



EUROPEAN
COMMISSION

Brussels, 13.7.2023
SWD(2023) 256 final

PART 1/4

COMMISSION STAFF WORKING DOCUMENT
IMPACT ASSESSMENT REPORT

Accompanying the document

Proposal for a Regulation of the European Parliament and of the Council on circularity requirements for vehicle design and on management of end-of-life vehicles, amending Regulations (EU) 2018/858 and 2019/1020 and repealing Directives 2000/53/EC and 2005/64/EC

{COM(2023) 451 final} - {SEC(2023) 292 final} - {SWD(2023) 255 final} -
{SWD(2023) 257 final}

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Glossary

Term or acronym	Meaning or definition
3R type-approval (3RTA) Directive	Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability
ASR	Automotive Shredder Residues
ATF	Authorised Treatment Facilities
BAT	Best available techniques
Batteries Regulation	Regulation of the European Parliament and the Council of [date] 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (OJ L [...]).
BCR	Benefit – Cost Ratio (a value > 1 indicates a positive return on investment)
BEV	Battery Electric Vehicle
CEAP	Circular Economy Action Plan
CoD	Certificate of Destruction
CPA	Circular Plastics Alliance
CRM	Critical Raw Material
EAF - DRI	Electric Arc Furnace – Direct Reduced Iron
EC	European Commission
ECHA	The European Chemicals Agency
EEE	Electrical and electronic equipment
EGD	European Green Deal
ELV	End-of-life vehicle
ELV Directive	Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles
EoL	End-of-life
EPR	Extended Producer Responsibility
ESPR	Proposal for a Regulation of the European Parliament and of the Council Ecodesign for Sustainable Products
ETS	Emissions Trading System (https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en)
EU	European Union
EV	Electric Vehicle
GHG	Green House Gas
HDV	Heavy Duty Vehicle (e.g., a bus (M2,M3), lorry (N2,N3) or trailer (O)) as defined in Regulation 2018/858
ICE	Internal Combustion Engine
IMDS	International Material Data System
ISG	Inter-service Steering Group
L3e-L7e-category/ 'motorcycles'	Two-wheel motorcycles (L3e), two-wheel motorcycles with sidecars (L4e), powered tricycles (L5e), light quadricycles (L6e) and heavy quadricycles (L7e), excluding L1e and L2e categories as defined in Regulation 2013/168
Li-ion batteries	Lithium-ion batteries
PHEV	Plug-in Hybrid Electric Vehicle
PRO	Producer Responsibility Organisation
PST	Post-Shredder Technologies
REACH	Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
REE	Rare Earth Element
RoHS	Directive 2011/65/EC on the restriction of the use of certain substances of concern in electrical and electronic equipment
SDG	Sustainable Development Goals
SME	Small and Medium-sized Enterprise
SUV	Sport Utility Vehicle
SVHC	Substance of Very High Concern
WEEE	Waste Electrical and Electronic Equipment
WEEE Directive	Directive 2012/19/EU on waste electrical and electronic equipment (WEEE)
WFD	Waste Framework Directive, Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste

1 INTRODUCTION

1.1 Political context

The European Green Deal (EGD) is Europe's growth strategy to ensure by 2050 a climate neutral, clean and circular economy, optimising resource management and minimising pollution. The Circular Economy Action Plan (CEAP)¹ and the New Industrial Strategy for Europe² lay out the roadmap for the European industry to meet the EGD objectives. The Circular Economy Action Plan contains a commitment to review the legislation on end-of-life vehicles (ELVs) with the aim to "promote more circular business models by linking design issues to end-of-life treatment, consider rules on mandatory recycled content for certain materials, and improve recycling efficiency". The EU Action Plan: "Towards Zero Pollution for Air, Water and Soil"³ also stressed the need for the Commission to propose new measures to address the EU's external environmental footprint linked to the export of ELVs and used vehicles. The European Council⁴ and the Parliament⁵ have both recognised the importance of this initiative.

In this light, the purpose of this impact assessment is to provide the evidence needed for the joint review of the Directive 2000/53/EC on end-of-life vehicles ("ELV Directive")⁶ and of Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability ("3R type-approval" Directive)⁷. The review of these Directives aims to boost the transition of the automotive sector to a circular economy, thereby reducing the environmental footprint linked to the production and end-of-life treatment of vehicles and strengthening the sustainability of the automotive and recycling industry in Europe.

The invasion of Ukraine by Russia in 2022 reiterated the importance for the EU industry to reduce the vulnerability of its supply chains, especially for critical raw materials (CRMs) essential for the EU's strategic autonomy and for the transition to a carbon-neutral economy. The EU heads of state or government have made the transition to a circular economy a priority in that respect, contributing to securing EU supply of critical raw materials⁸. This is also a key point in the Green Deal Industrial Plan for the Net-Zero Age⁹.

The automotive sector is a pillar of the EU economy and its transition to more circular models will have a considerable spill over effect on key related industries, especially the extraction and processing sectors. The automotive industry is embedded in complex and global supply chains and has recently faced production shutdowns, semiconductor shortages and problems sourcing skilled labour. This initiative comes at a time of supply chain challenges and intense competition which have put pressure on automotive manufacturers to reduce costs and improve efficiency. The shift towards electric vehicles, as the EU and other major automotive markets in the world seek to drastically reduce the carbon intensity of road transport, requires

¹ https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

² https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/industry-and-green-deal_en

³ https://eur-lex.europa.eu/resource.html?uri=cellar:a1c34a56-b314-11eb-8aca-01aa75ed71a1.0001.02/DOC_1&format=PDF

⁴ <https://data.consilium.europa.eu/doc/document/ST-13852-2020-INIT/en/pdf>

⁵ https://www.europarl.europa.eu/doceo/document/TA-9-2021-0040_EN.html

⁶ Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles

⁷ Directive 2005/64/EC of the European Parliament and of the Council of 26 October 2005 on the type-approval of motor vehicles with regard to their reusability, recyclability.

⁸ See the Versailles Declaration adopted in March 2022: <https://www.consilium.europa.eu/media/54773/20220311-versailles-declaration-en.pdf> and the Conclusion adopted by the European Council on 9 February 2023

⁹ [https://commission.europa.eu/system/files/2023-](https://commission.europa.eu/system/files/2023-02/COM_2023_62_2_EN_ACT_A%20Green%20Deal%20Industrial%20Plan%20for%20the%20Net-Zero%20Age.pdf)

[02/COM_2023_62_2_EN_ACT_A%20Green%20Deal%20Industrial%20Plan%20for%20the%20Net-Zero%20Age.pdf](https://commission.europa.eu/system/files/2023-02/COM_2023_62_2_EN_ACT_A%20Green%20Deal%20Industrial%20Plan%20for%20the%20Net-Zero%20Age.pdf)

a major transformation of the industry and heavy investments in new technologies such as battery production to stay competitive. In addition, the automotive sector is one of the largest users of CRMs in the EU industry and the electrification of the fleet will lead to a considerable increase in the demand for these materials. Increasing the recovery of CRMs used in the automotive sector is therefore an essential element of this review, and an important contribution to the overall EU strategy to improve the security of supply of such materials, as reflected in the Commission proposal for a CRM Act¹⁰.

The transition of the automotive sector to circularity is also key to reaching by 2050 the climate neutrality targets included in the European Green Deal, complementing the various initiatives under the “Fit for 55” package¹¹. The initiative is also consistent with other recently launched initiatives designed to improve the eco-design of products and ensure sustainable management of waste, especially the proposal for a new Regulation on batteries¹², the proposal for a Regulation laying down harmonised conditions for the marketing of construction products¹³, the proposal for a Regulation on Ecodesign for Sustainable Products (ESPR)¹⁴ and the proposal for a new Waste Shipment Regulation¹⁵. Finally, this initiative complements other recent legislative developments designed to transform the automotive industry, such as the proposed revised CO₂ standards for cars and vans¹⁶, the proposed Euro 7 standard on emissions from new motor vehicles¹⁷ and the ongoing revision of the three Directives of the “Roadworthiness Package”¹⁸. A more detailed description of the interaction between this initiative and other EU policies and legislation can be found in Annex 10. This initiative supports the implementation of the Sustainable development Goals (SDGs), in particular SDG 9 “Industry, innovation and infrastructure”, SDG 12 “Responsible consumption and production”, SDG13 “Climate action”.

¹⁰ COM(2023) 160 final

¹¹ More information on the package is available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_21_3541

¹² Regulation of the European Parliament and the Council of [date] 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (OJ L [...]). The proposal for a new Regulation on batteries addresses automotive batteries and contains a comprehensive new legal regime covering their whole life cycle, designed to address their environmental footprint. The revision of the ELV and 3R TA Directives will not contain provisions regulating the design, production and end-of-life of batteries. It will address vehicles as a whole as well as their parts and components, in a way which complements the proposal for a Batteries regulation and would ensure that the overall environmental footprint of vehicles is addressed.

¹³ COM(2022)144

¹⁴ Proposal for a Regulation of the European Parliament and of the Council establishing a framework for setting Ecodesign requirements for sustainable products and repealing Directive 2009/125/EC, COM(2022)142 final, 2022/0095 (COD). Requirements on the circular design and production of motor vehicles should build on the exiting legal framework applying to vehicles, which are set out and enforced through the “type-approval” process. This is therefore a separate legal framework than the one set out under the upcoming ESPR instrument. Consistency between the two legal instruments should nevertheless be ensured to ensure a high level of ambition for the transition of this sector to a circular economy. The ESPR also does not deal with the end-of-life phase of the vehicle, vehicle component or material used in the vehicle, which are subject to the ELV Directive.

¹⁵ Proposal for a Regulation of the European Parliament and of the Council on shipments of waste and amending Regulations (EU) No 1257/2013 and (EU) No 2020/1056, COM(2021) 709 final, 2021/0367(COD). On this point, the revision would in particular aim to ensure, in line with the proposal on waste shipments, that ELVs (which if untreated are hazardous waste) cannot be exported outside the OECD countries.

¹⁶ Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/631 (COM(2021) 556 final)

¹⁷ Proposal for a Regulation of the European Parliament and of the Council on type-approval of motor vehicles and engines and of systems, components and separate technical units intended for such vehicles, with respect to their emissions and battery durability (Euro 7)

¹⁸ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13132-Vehicle-safety-revising-the-EUs-roadworthiness-package_en

1.2 Legal context

The ELV Directive was adopted in 2000 and established for the first time a harmonised EU framework designed to ensure the environmentally sound treatment of vehicles reaching the end of their life and considered as waste¹⁹. To this end, the ELV Directive sets out measures which need to be implemented by the Member States and relate to:

1. The prevention of waste, especially measures to limit the presence of hazardous substances in vehicles and to encourage Member States to take account and facilitate the recycling and reuse of vehicles and their parts, in the design and production stage of new vehicles;
2. The collection of ELVs, notably through obligations for Member States to ensure that authorised treatment facilities (ATFs) are available within their territory, that ELVs are transferred to ATFs and that this transfer occurs without any costs for the last holder;
3. The environmentally sound treatment of ELVs, through requirements on depollution;
4. The setting of annual targets for the reuse and recycling (85%) as well as reuse and recovery (95%) of ELVs, based on the overall weight of vehicles;
5. The provision of information by producers on components and materials used in vehicles, to facilitate their identification for reuse and recovery.

This Directive contains 13 Articles and 2 Annexes. Except for the Annex II on hazardous substance restrictions, it has not been subject to any substantial amendments since its adoption in 2000. At the occasion of the revision of the Waste Framework Directive in 2018, the co-legislators agreed²⁰ that the *Commission “shall review [the ELV] Directive, by 31 December 2020, and to this end, shall submit a report to the European Parliament and the Council, accompanied, if appropriate, by a legislative proposal”*. It indicates that the ELV Directive revision should focus on the feasibility of setting recycling targets for specific materials and the problem of ‘unknown whereabouts’ of end-of-life vehicles.

The 3R type-approval Directive²¹, adopted in 2005, aims to improve the design of new vehicles with regard to their reusability, recyclability and recoverability. The need for this Directive was foreseen when the ELV Directive was adopted in 2000, in order to link the provisions of the ELV Directive (like the prohibition of certain hazardous substances, treatment of ELVs and the reuse, recycling and recovery targets) to ‘design’ provisions in the type-approval process. In particular, the Directive states that vehicles should be constructed so as to be 85% recyclable/reusable and 95% reusable/recoverable. The 3R type-approval Directive is part of the type-approval framework²², whereby new vehicle types are tested and granted type-approval before being placed on the EU market, provided they meet a set of technical requirements. It places obligations on national type-approval authorities to verify information provided by car manufacturers on reusability, recyclability and recoverability of new vehicle types.

¹⁹ The definition of ‘waste’ in the ELV Directive is in line with the general definition of waste used in EU legislation, whereby waste means “any substance or object which the holder discards or intends or is required to discard”. Old collection cars which are kept on the premises of individuals are not considered as ELVs as there is no intention to discard them from the side of their owner.

²⁰ See Article 10a of Directive 2018/849/EU, OJ L50, 30.5.2018, p. 93

²¹ Directive 2005/64/EC on the type-approval of motor vehicles regarding their reusability, recyclability and recoverability (“3R type-approval Directive”)

²² Regulation (EU) 2018/858 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles

2 PROBLEM DEFINITION

This impact assessment addresses the following four problems:

1. The design and production of new vehicles do not sufficiently contribute to the ambitions of the European Green Deal for a climate-neutral, clean and circular economy ('design and production' problem area);
2. The treatment of vehicles at the end of their life is suboptimal compared to its potential to contribute to a climate-neutral, clean and circular economy ('waste treatment' problem area);
3. An important share of vehicles subject to the ELV Directive are not collected to be treated under sound environmental conditions in the EU, contributing to pollution in third countries ('collection' problem area);
4. There is no EU level playing field for the design, production and end-of-life treatment of vehicles currently outside the scope of the ELV Directive, resulting in unexploited potential to the circular economy objectives of the European Green Deal ('scope' problem area).

These four problems were identified in the evaluations of the ELV Directive²³ and of the 3R type-approval Directive²⁴ as preventing the transition of the overall automotive supply chain to a circular economy.

These problems relate to all stages of the life cycle of the automotive sector beyond use (design, production, waste management). They have different features and affect different economic operators (vehicle manufacturers, dismantlers, recyclers, authorities). This impact assessment therefore provides in the first place an analysis of their specific drivers and of specific options designed to address each of the objectives corresponding to these problems separately. This allows for a thorough presentation of each problem and of the different possible options to address them, as well as of their respective impacts.

It is however also essential that these problems are addressed in a consistent and mutually supportive manner to improve circularity across the whole automotive supply chain. There are clear links and synergies between the problems, objectives and measures linked to design, production, waste collection and recycling. For example, improving the design and production of new vehicles is key to ensuring higher quantity and quality of recycling of ELV, and improving quality of recyclates from ELVs is also essential to allow them to be taken up as recycled materials in new vehicles. For that reason, after an analysis of options specific to each problem, this impact assessment provides, in section 8.1, a preferred package of options covering them all, which represents the most effective and efficient solution to meet the general objective of this initiative (improving circularity for the whole automotive supply chain). A more detailed presentation of these problems and their drivers are provided in Annex 6.

2.1 Problem area 1: Lack of integration of circularity in vehicle design and production

2.1.1 What is the problem?

The EU automotive sector is among the world's biggest, providing 13.8 million direct and indirect jobs, representing 6.1% of total EU employment. In 2021, 12 million motor vehicles (cars, vans, lorries, buses) were manufactured in the EU and 11.5 million were placed on the

²³ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1912-End-of-life-vehicles-evaluating-the-EU-rules_en

²⁴ See Annex 11 of this report

EU market²⁵. The production of vehicles is one of the most resource intensive industries and represents a significant impact in terms of use of raw materials. Europe's automotive sector is responsible for 19% of the demand of the EU's steel industry (over 7 million tons/year²⁶), 10% of the overall consumption of plastics (6 million tons/year²⁷), a significant share of the demand for aluminium (42% for all transport equipment, around 2 million tons/year²⁸), copper (6% for automotive parts²⁹), rubber (65% of the production of general rubber goods³⁰) and glass (1.5 million tons of flat glass produced in the EU³¹). The electrification of the automotive sector, combined with the increasing integration of electronics in vehicles, will lead to more copper and CRMs, including rare earth elements³² in vehicles, as well as more advanced and lightweight materials like high grade steels and rapidly growing demand for aluminium alloys. The market demand has also resulted in a steady rise in sales of Sport Utility Vehicles (SUVs). SUVs represented around 40% of annual car sales of vehicles in Europe in 2020, compared to 10% in 2010. SUVs are heavier than conventional cars and their production requires greater amounts of primary materials, which considerably increases their environmental footprint. This has compounded the trend for heavier vehicles.

The result is that the production of vehicles represents a considerable environmental footprint, primarily due to the GHG emissions linked to the energy required for the extraction and processing of primary materials such as coal and iron ore (for steel), bauxite (for aluminium), copper or oil (for plastics). The extraction and processing of metals represent about 10% of global greenhouse gas emissions globally. **The automotive industry is undergoing profound changes towards climate-neutrality through the electrification of the vehicle fleet.** As a result, the “production phase” in the vehicle lifecycle will have a higher environmental footprint than its “use phase”, notably due to the importance of raw materials for the manufacturing of EVs. In terms of shares of the production carbon footprint, aluminium will be contributing 35-50%³³, steel 15-25%, plastics 4-7%, compared to 10-20% for the battery raw materials³⁴.

The dependence on primary materials is also making the supply chain for the automotive industry more vulnerable, compounding the challenges observed recently with disruptions for semi-conductors or magnesium and the hike in energy prices that followed the start of the war in Ukraine.

The automotive sector is only recently starting to embrace the decarbonisation of their production process to enable a full transition to a circular economy. Due to quality requirements, the automotive industry relies heavily on the supply of primary raw materials

²⁵ <https://www.acea.auto/figure/key-figures-eu-auto-industry/>

²⁶ More information available at: <https://www.eurofer.eu/publications/economic-market-outlook/economic-and-steel-market-outlook-2022-2023-third-quarter/>

²⁷ Based on JRC study report on recycled content of plastics in the vehicles.

²⁸ [CRM 2020 Factsheets critical Final.pdf \(europa.eu\)](#)

²⁹ [CRM 2020 Factsheets non-critical Final.pdf \(europa.eu\)](#)

³⁰ More information available at: <https://www.etrma.org/rubber-goods/>

³¹ More information available at: <https://glassforeurope.com/the-sector/key-data/>

³² Rare earth elements (REEs) are mainly used for permanent magnets in EVs (average weight of 1-2 kg of permanent magnets per EV); platinum group metals (PGMs) are used for catalytic converters (77% share in automotive catalysts) and printed circuit boards; gallium is used for lighting equipment and integrated circuits; magnesium (50% share in automotive sector) and niobium (23% share in automotive steel) are used for metal alloys; and natural rubber for production of tyres. Electric and electronic systems in vehicles also contain additional precious metals, PGMs, gallium, tantalum, and REE.

³³ R.G. Billy, D.B. Muller, Aluminium use in passenger cars poses systemic challenges for recycling and GHG emissions, Resources, Conservation & Recycling 190 (2023), <https://doi.org/10.1016/j.resconrec.2022.106827>

³⁴ Conzade, Julian, et al., 2021. Why the future automotive future is electric. McKinsey Center for Future Mobility. <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/why-the-automotive-future-is-electric>

and uses very little recycled materials. This is the case especially for plastics, steel³⁵ and aluminium³⁶. Notwithstanding the recent advances made by EU automotive industry frontrunners, the current level of integration of circular models in the design, production and end-of-life stages of the vehicle lifecycle remains insufficient to attain the objectives of the Circular Economy Action Plan to “*promote more circular business models by linking design issues to end-of-life treatment, consider rules on mandatory recycled content for certain materials, and improve recycling efficiency*”.

2.1.2 What are the problem drivers?

The **drivers** for this problem are a combination of market and regulatory failures which result in a lack of integration of circularity in the design and production phase of vehicles.

Market failure

Prices of primary materials do not factor in environmental externalities of extraction and processing and are generally lower than secondary materials due to economies of scale. The lack of market demand for secondary materials has in turn not encouraged the recycling sector to invest and increase supply and quality of recyclates suitable for the automotive sector.

Regulatory failures

Regulatory requirements designed to ensure that the automotive sector reaches climate-neutrality have focused on the use phase of vehicles (rather than on the circularity in the production and end-of-life stages). This has encouraged the incorporation of lightweight and composite materials in new vehicles, which are particularly challenging and costly to recycle. The growing use of new techniques to assemble parts (typically gluing elements instead of using screws) in vehicles has further hampered easy dismantling and high-quality recycling of ELVs.

The provisions in the ELV Directive³⁷ on the design of cars to facilitate dismantling, re-use, remanufacturing and recycling, as well as the use of recycled content, are too generic. The provisions in the 3R type-approval Directive lack specificity, for example for the verification that (i) the reusability, recyclability and recoverability targets are met and for (ii) incentivising a more sustainable vehicle design and production. The verification of how vehicle manufacturers meet their obligations on recyclability and recoverability is largely built on the ISO 22628 standard from 2002³⁸ that does not take into account the degree of development in recycling technologies and allows for a wide interpretation as to what materials can be considered as “recyclable”. In addition, there is no reporting obligation for Member States and the Commission on the implementation of the 3R type-approval Directive and no regular monitoring has been carried out at this point. Moreover, **there are no legal incentives for manufacturers to increase the amount of recycled content in new vehicles or to use materials and parts which can be easily repaired, dismantled, re-used,**

³⁵ For steel, with significant ongoing decarbonisation investments in electric arc furnaces (EAF), ELV steel scraps typically contain too much copper hindering scrap utilisation rates. Combined with increasing demand of flat products with even lower copper tolerances by the automotive industry, this is a hindrance to higher recycled content rates leading to use of primary units to dilute and to significant loss of economic value (see also Material Economics (2020), Preserving value in EU industrial materials - A value perspective on the use of steel, plastics, and aluminium, EIT – Climate KIC).

³⁶ Increasing secondary raw materials is hindered by the switch from cast to wrought alloys. In the case of aluminium, the transition to EVs requires lower alloying levels for wrought aluminium alloys than currently available in (ELV) aluminium scraps, posing a real and significant risk of mixed aluminium scrap surpluses especially for high EV deployment scenarios, whereby high energy intensity materials cannot be recycled to their full potential.

³⁷ Article 4(1)(b) and (c) of the ELV Directive.

³⁸ <https://www.iso.org/standard/35061.html>

remanufactured or recycled³⁹. Lack of clarity in definitions for secondary raw materials makes it difficult to distinguish between primary and secondary raw materials and between post-consumer scrap and pre-consumer scrap.

2.2 Problem area 2: Lack of quality and quantity in reuse and recycling

2.2.1 What is the problem?

Vehicles reaching their end of life currently are not managed in optimal conditions. About 6.1 million ELVs are collected every year in the EU, representing 6.9 million tons of waste⁴⁰, with 66% (4 million tons) of ferrous metals, 11% (0.7 million tons) of non-ferrous metals, 2% (0.1 million tons) of glass and 14% (1 million tons⁴¹) of mixed plastics⁴². **While substantial progress has been made since 2000 to reach the 85% recycling/re-use target set out in ELV Directive, a large share of materials, in particular Automotive Shredder Residues (ASR) is sent to landfills or incinerated.** The share of plastics in the composition of vehicles has considerably increased, and today ranges from 14 to 18% of the total weight of new passenger cars. **Only 19% of plastics or 0.2 million tons per year from ELVs is currently going to recycling and 0.1 million tons are effectively recycled, while around 0.8 million tons of plastic waste per year either ends up in landfills (40%) or is sent to waste-to-energy facilities (41%).**

The increased use of certain materials in new vehicles since the introduction of the ELV Directive poses challenges, in particular the integration of carbon-fibre- and, most of all, glass-fibre-reinforced plastics as lightweight materials that cannot currently be recycled easily. The widespread use of electronics in new vehicles creates additional difficulties. They contain important concentrations of **CRMs, including REEs, which are currently not recycled at the end-of-life**⁴³. Finally, while the recycling rates of metals like steel (88%) or aluminium (95%) from ELVs are high, the **quality of the scrap is often too low**, notably due to contamination with other materials during the shredding process. For steel this is typically due to high levels of copper content in ELV scrap and for aluminium due to insufficient sorting of alloys respectively containing zinc, copper, silicon and magnesium alloying elements accumulating in cast aluminium. This prevents higher scrap utilisation rates in the production of new high-grade products and the scrap is downcycled for other purposes.

The share of parts and components from ELVs which are re-used or remanufactured remains low. The suboptimal management of waste from ELVs represents a loss of resources for the industry in the EU, either because waste is not recycled back into the economy (especially for plastics or glass) or because the quality of the scrap is often too low (especially for steel and aluminium) for direct use by the industry in the EU.

2.2.2 What are the problem drivers?

The potential for higher quantity and quality of materials from ELVs to be re-used, remanufactured and recycled remains underexploited, due to the following regulatory and market failures:

Market failures

³⁹ Such incentives are being established at the EU level for batteries and packaging, based on the provisions of the Waste Framework Directive (Article 8a) on the “modulation of fees” foreseen for “extended producer responsibility schemes”, in line with the polluter pays principle set out in Article 191(2) of the Treaty on the Functioning of the European Union (TFEU).

⁴⁰ In 2019, the average weight of an ELV was estimated at 1137 kg (based on reports by Member States).

⁴¹ Collected at the authorized treatment facilities (ATFs).

⁴² These figures exclude tyres, battery casings and the plastic sheathing of wiring harnesses.

⁴³ This is also the case of other CRM (e.g., niobium or magnesium) that are integrated as alloying elements in basic metals (steel or copper) and are currently not targeted in the recycling processes.

It is currently not profitable to recycle from ELVs materials such as plastics and glass or precious metals from electronic components. Economies of scale and incentives to promote better quality of scrap are lacking. Authorised Treatment Facilities (ATFs) are mostly SMEs which make their business in the commercialisation of the most valuable spare parts removed from ELVs and the sale of depolluted ELVs to shredders. The market for other spare parts⁴⁴ remains limited, as the cost for their dismantling is high and many ATFs are not equipped to reach out to a wider range of customers for instance on digital marketplaces. After ATFs, ELVs are transferred to shredders where, in most Member States, there is no sophisticated technology in place to sort, separate and recover various materials contained in ELVs into clean fractions, notably high-quality steel and aluminium scraps and plastics suitable for mechanical recycling. Investments in “post shredding technologies” (PST) are capital intensive and they remain underdeveloped across the EU.

Regulatory failure

The definition of “recycling” in the ELV Directive includes “backfilling”⁴⁵ and is broader than other definitions applied to other waste streams, pursuant to the Waste Framework Directive. As a result, in some Member States, considerable amounts of wastes from ELVs, especially inert materials, glass particles, mixed plastics, rubbers, fibres and textiles are backfilled and accounted as recycled. **The methodology to calculate that the recycling/re-use targets are met is not sufficient to provide clear evidence** that only waste which enters recycling is counted towards the achievement of the targets⁴⁶. **The ELV and 3R type-approval Directives do not sufficiently incentivise vehicle manufacturers to provide dismantling information on components and materials that would facilitate ATFs, garages and repair shops to identify, locate and dismantle valuable spare parts and components.** As an example, the lack of sufficient information on CRMs contained in vehicles do not ease their early-stage disassembly and sorting in the authorised treatment facilities. The provisions on this point in Article 8 of the ELV Directive, and their implementation by the vehicle manufacturers, are often seen by the dismantling sector as too limited, notably as the information might not be free of charge and not user-friendly. There is **no incentive either in the current legal framework for economic operators to increase the re-use and remanufacturing rates of parts from used vehicles or ELVs.**

Regarding financial responsibility, **the ELV Directive does not specify that car manufacturers should contribute financially to the costs linked to the dismantling, re-use, remanufacturing and recycling of materials and components from ELVs.** This contrasts with other sectors, such as batteries, electric and electronic equipment and packaging, where “extended producer responsibility” (EPR) schemes explicitly include the financing by producers of the waste management phase of their products. In March 2022, the Commission carried out inspections at the premises of automotive companies and associations of such companies, based on concerns that several of them may have violated antitrust rules

⁴⁴ Such as bumpers, dashboards and windshields.

⁴⁵ The Waste Framework Directive defines backfilling as “any recovery operation where suitable non-hazardous waste is used for purposes of reclamation in excavated areas or for engineering purposes in landscaping. Waste used for backfilling must substitute non-waste materials, be suitable for the aforementioned purposes, and be limited to the amount strictly necessary to achieve those purposes”.

⁴⁶ This is firstly due to shortcomings in the reporting foreseen in Commission Decision 2005/293/EC of 1 April 2005 laying down detailed rules on the monitoring of the reuse/recovery and reuse/recycling targets set out in Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles. In addition, this methodology has not been adapted to reflect the improvements introduced at the EU level for other waste streams, as laid down in Article 11a of the Waste Framework Directive for municipal waste, and in Article 6a of Directive 94/62/EC on packaging and packaging waste.

and colluded to agree not to provide any financial support to the dismantling and recycling sector. The investigations on this case are ongoing⁴⁷.

2.3 Problem area 3: ‘Missing vehicles’ cause environmental impacts

2.3.1 What is the problem?

While around 6.1 million ELVs are reported to be treated according to the ELV Directive every year, **it is estimated that around 32% of de-registered vehicles, i.e., approximately 3.4 million units per year, are of unknown whereabouts (so-called “missing vehicles”) and 1 million units (10%) are exported as used vehicles.** Despite numerous studies on this problem⁴⁸, it remains challenging to estimate the proportion of these vehicles gone missing due to administrative failures, illegal dismantling in the EU or illegal export outside the EU. In any case, the treatment of ELVs and the recovery of materials from these ELVs is not in accordance with the requirements and causes environmental damages, such as oil spillage, unsound treatment of refrigerants or improper removal of hazardous substances and of components for higher quality of recycling. This represents unfair competition and economic losses for authorised treatment facilities, which have to abide by EU rules. It further means a loss of secondary resources which are important for reducing industry’s environmental footprint through the use of recyclates instead of primary resources. Illegal dismantling and export of ELVs are also feeding criminal networks.

The export of used vehicles also raises important environmental and public health challenges. While the export of ELVs from the EU to non-OECD countries are considered as hazardous waste and thus banned, this is not the case for used vehicles that have not (clearly) reached the waste stage. Although these vehicles are not formally waste, they are exported to third countries are often close to end of service stage, meaning that they cannot be used for the primary purpose they were conceived, in a fully safe manner. The EU is the biggest exporter of used vehicles worldwide. In 2020, the number of used vehicles exported from the EU to third countries amounted to **870,000 vehicles at a value of € 3.85 billion.** The most important destinations are Africa, Eastern Europe, Central Asia and the Middle East. Used vehicles exported from the EU contribute to affordable access to mobility in third countries, where they are used longer than in the EU. However, as documented in a recent study⁴⁹ on the quality of used vehicles carried out by the Dutch Ministry of Infrastructure and Water Management, a significant part (more than 60%) of used vehicles exported to African countries do not meet Euro 4/IV emissions standard, are older than 15 years and do not have a valid roadworthiness certificate. The roadworthiness status proves that the vehicle is in a technically and environmentally sound condition to use it⁵⁰. Therefore, it is an essential factor determining the appropriateness and full functionality of a vehicle to be safely exploited during its service phase. According to the Correspondents Guidelines No 9 “Shipments of Waste Vehicles”⁵¹, failure to pass a periodic roadworthiness test for more than 2 years may be considered as one of the indicators to suspect that the vehicle is not functional anymore, it is technically irreparable, and thus should be considered as an end-of-

⁴⁷ See: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1765

⁴⁸ Umweltbundesamt,(2022), Illegal treatment of end-of-life vehicles - Assessment of the environmental, micro- and macroeconomic effects, texte 130/20 22

⁴⁹ <https://www.ilent.nl/documenten/rapporten/2020/10/26/rapport--used-vehicles-exported-to-africa>

⁵⁰ As it is explained in Recital 3 of Directive 2014/45/EU, the roadworthiness testing is a part of a wider regime designed to ensure that vehicles are kept in a safe and environmentally acceptable condition during their use; Recital 6: Vehicles with malfunctioning technical systems have an impact on road safety and may contribute to road crashes involving injuries or fatalities. Moreover, as it is further explained in Recital 22, Roadworthiness tests cover all items relevant to the specific design, construction and equipment of the tested vehicle. Compatibility between parts and components, such as between wheels and wheel hubs, should be treated as a critical safety item and should be checked during roadworthiness testing.

⁵¹ https://ec.europa.eu/environment/pdf/waste/shipments/correspondents_guidelines9_en.pdf

life vehicle. There are also indications that a considerable portion of exported vehicles undergo illegal alterations, like the removal of air bags and exhaust filters. They present a serious risk of polluting the environment and for road safety. According to WHO, road accidents cause the death of 1.25 million people and injure 20-50 million people annually. Despite having only 54% of the global vehicle fleet, low and middle-income countries account for 90% of these fatalities. The African continent, which is the main destination of used vehicles exported from the EU, has the highest road traffic fatality rates, with 246,000 deaths annually, and this figure is expected to rise to 514,000 in 2030, representing an increase of 112%. In order to address these problems, and as documented by the UN Environmental Programme⁵², a growing number of countries and regional organisations⁵³ committed to restrict the import of used vehicles, based on their age, compliance with air pollutant emission limits (Euro standards) or roadworthiness criteria.

2.3.2 What are the problem drivers?

The **drivers** for this problem are a mix of regulatory and market failures resulting in (i) a lack of traceability (ii) insufficient enforcement and (iii) the absence of considerations linked to roadworthiness and environmental protection when used vehicles are exported from the EU.

Market failures

There are **economic incentives for insurance companies, dealers and private owners of ELVs to sell them on online market places or directly to non-authorised treatment facilities or export them in contravention of EU rules: they will obtain higher prices than if they have to deliver them to authorised treatment facilities, which have to abide by the requirements of the ELV Directive** for the treatment of these vehicles and are subject to social security, employment and other fiscal charges (unlike the informal sector).

The steady demand in developing countries is an important driver for the export of used vehicles outside the EU, associated with the high prices that exporters of such vehicles can obtain compared to what they could gain with selling them in the EU. There are also factors that can make it difficult to sell certain types of used vehicles in the EU, such as emission taxes and restrictions on access to urban centres. This can make it more attractive for exporters to sell these vehicles in developing countries where such restrictions might not exist. Overall, the demand for used vehicles in developing countries is a significant factor in the global trade in used vehicles and is likely to remain so in the future. The global fleet of LDVs is set to at least double by 2050. Some 90% of this growth will take place in non-OECD countries which import a large number of used vehicles.

Regulatory failures

The ELV Directive and the EU legislation on registration documents and roadworthiness do not contain sufficient provisions to track a vehicle until it reaches the end-of-life. Especially, the obligation to record and report ELVs, upon issuance of a certificate of destruction (COD), is not clearly attributed to stakeholders and public authorities. **The difficulty in exchanging information on the registration and de-registration of vehicles** contained in the vehicle registers of the different Member States is a key obstacle to the problem of unknown whereabouts.

The absence of clear and legally binding criteria on the distinction between used vehicles and ELVs also makes enforcement of the requirements of the ELV Directive very

⁵² <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

⁵³ The Economic Community of West African States (ECOWAS⁸) adopted on 5 September 2020 a Directive limiting the import of used vehicles to a minimum Euro 4/IV emission standard. The age limit for importing vehicles into the region is five years for light-duty vehicles, two-wheel motor vehicles, tricycles and quadricycles and 10 years for heavy-duty vehicles.

challenging. Specific guidelines⁵⁴ were developed to assist enforcement and customs officials in implementing the rules on the export of ELVs, and especially to distinguish between ELVs and used cars. These guidelines are however non-binding and are combined with a lack of enforcement capacity. The illegal sector widely exploits this grey area, notably to export illegally ELVs, which are waste and shall be subject to treatment under the EU waste legislation, however they are presented as used vehicles, for which no trade restrictions apply. Even economic actors in the formal sector⁵⁵ regularly auction total loss vehicles without checking their final destinations.

Moreover, the absence of a requirement to **export from the EU only roadworthy vehicles** allows exports of used vehicles even for those not authorised to be driven on EU roads due to lack of compliance with safety or environmental rules. The enforcement of the mandatory roadworthiness status of a vehicle is an essential part of the EU regime designed to ensure that vehicles are kept in a safe and environmentally acceptable condition during their use. Directive 2014/45/EU⁵⁶ contains a long list of minimum elements which have to be tested, in order for a vehicle to obtain a roadworthiness certificate. Every vehicle that is at least 4 years old circulating on EU roads has to have a valid roadworthiness certificate. As per Article 5 of Directive 2014/45/EU, cars and vans must be tested at least every two years after the age of 4, while heavy-duty vehicles, including their trailers must undergo inspections every year. In accordance with the EU legislation, each Member State shall recognise the roadworthiness certificate issued by tother Member State. While these requirements are a condition for a vehicle to be used on EU roads, they are currently not relevant when used vehicles are exported from the EU to third countries. In addition, there are also no requirements that exporters of used vehicles and competent authorities of EU Member States check that used vehicles comply with the conditions set out by importing countries for the import of such vehicles.

There are no specific provisions in the ELV Directive requiring the Member States to carry out **inspections or take enforcement actions** to ensure that its provisions are properly implemented, or to establish penalties against breaches of the requirements set out in the Directive.

2.4 Problem area 4: Lack of EU level playing field to improve circularity in the design, production and end-of-life treatment of lorries, buses and motorbikes

2.4.1 What is the problem?

The ELV and 3R type-approval Directives apply to passenger vehicles (M1), as well as to light commercial vehicles (N1)⁵⁷. **Around 85 % of 323 million vehicles registered in the EU fall within the scope of ELV Directive⁵⁸. 15% of registered vehicles are therefore not covered, representing around 52 million vehicles (motorcycles (L3e-L7e), lorries and buses)⁵⁹.** By mass, this represents 33% of registered vehicles, or 191 million tons. The average sum of materials from motorcycles), busses and lorries that became waste in 2019 can be estimated to amount to more than 4.13 million tons⁶⁰. L1 and L2 including e-bikes and

⁵⁴ https://ec.europa.eu/environment/pdf/waste/shipments/correspondents_guidelines9_en.pdf

⁵⁵ for example, insurance companies which own a large share of accidented vehicles

⁵⁶ Directive 2014/45/EU of the European Parliament and of the Council of 3 April 2014 on periodic roadworthiness tests for motor vehicles and their trailers and repealing Directive 2009/40/EC

⁵⁷ Motor vehicles used for the carriage of goods and with a maximum mass not exceeding 3,5 tonnes (vans).

⁵⁸ 76 % passenger cars (M1 type) and 9 % lorries (N1 type).

⁵⁹ It should be noted that this impact assessment does not address the situation of e-bikes, ships, planes, trains, agricultural and non-road mobile machinery, and vehicles used for military purposes and space. These vehicles are non-road vehicles, with the exception of non-type approved (electric) bicycles. These are subject to specific regulations.

⁶⁰ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

mopeds, although included in the LMT definition under the Battery Regulation, are not considered for the scope extension here⁶¹. The reason is that they are smaller than motorcycles, are not included in the vehicle registrations in certain member states and are typically collected via bicycle and scooter dealers compared to large motorcycles.

There is no comprehensive information on the treatment of end-of-life motorcycles, lorries and buses. The information gathered for this impact assessment shows that there is an important market for used spare parts dismantled from end-of-life motorcycles and lorries, and that the treatment of the vehicles outside the scope of the current legislation also has specific features:

- End-of-Life motorcycles are often treated by small operators in the EU;
- End-of-life lorries have a longer lifetime than M1-N1 vehicles, are exported in large number (up to 75%) outside the EU when reaching a certain age and, when dismantled in the EU, are usually treated in facilities which are either specialised in their treatment, or also treat end-of-life passenger cars;
- A non-negligible share of used busses (around 33%) are exported outside the EU, and their dismantling raises specific challenges due to a lower share of metals and higher share of textile and glass compared to other vehicles.

The vehicles excluded from the ELV and 3R type-approval Directives are currently not subject to any specific requirement when it comes to eco-design and their waste phase. The consequences of this exclusion are the following:

1. No guarantee on the environmentally sound management of the waste stemming from end-of-life vehicles outside the scope of the legislation;
2. No legal incentive for the re-use or recycling of large volume of parts, components and materials (steel, iron, aluminium, copper, CRMs, plastics, glass...) stemming from such waste;
3. No legal incentive to increase the design for circularity of the vehicles in question;
4. Risk of a fragmentation of the EU market as individual Member States take individual measures to address the end-of-life stage of the vehicles concerned.

The data collected for this impact assessment shows that **at least seven Member States have adopted various types of legal provisions governing the end-of-life stage of lorries, buses or motorbikes**. Many of them have especially established a requirement that these vehicles should be delivered to an ATF at end-of-life and require that their dismantling complies with specific obligations, especially on depollution. This poses the risk of fragmenting the EU market, as economic actors willing to escape national rules could decide to get their vehicles dismantled in another EU Member State with lower or no requirements.

Overall, the integration of circularity in the business model of producers of vehicles outside the scope of the ELV and 3R type-approval Directives largely relies on voluntary actions.

2.4.2 Problem drivers

Regulatory failures

The main driver for the problem outlined above is the exclusion of powered two- and three wheelers, lorries and buses from the scope of the ELV and 3R type-approval Directives. More than twenty years after adoption of the ELV Directive, this has led to a situation where there is no transparency on the degree of circularity of the sectors concerned and that they are not

⁶¹ See page 17 in Huisman, J., Bobba, S., “Available for Collection” study on alternative collection targets for waste portable and light means of transport batteries, EUR 30746 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-39442-6, doi:10.2760/163961, JRC125615.

incentivised to go beyond a “business as usual” scenario. The fact that a few Member States have started to set out national regulations covering the end-of-life stage of vehicles not in the scope of the EU legislation is a sign that the current limited scope is considered as sub-optimal.

2.5 Overview of problems and drivers

Figure 1 below presents an overview of the main problems this initiative aims to address, their drivers and consequences, in line with what is presented in Sections 2.1 to 2.4.

Figure 1 - Problems, drivers and consequences

Problems	Drivers	Consequences
Lack of integration of circularity in design and production	Market failures: - Externalities of primary raw materials not priced in at design. - Use of new and difficult to recycle materials - Limited availability of secondary raw materials of sufficient quality to meet modern standards - Lack of financial incentives to increase recycled content Legislative failures: - Imprecise formulation of ELV requirements - Imprecise and theoretical 3RTA requirements - Lack of adequate dismantling information - Inconsistent and outdated hazardous substance restrictions	Increased dependency on primary raw materials and limited decarbonisation potential in supply chains
Lack of quality and quantity in reuse and recycling at end-of-life treatment	Market failure: - High costs for dismantling and economies of scale - Costly PST treatment of automotive shredder residues - Lack of quality of ELV scraps like steel and aluminium - Lack of incentive to provide targeted dismantling information Regulatory failure: - Too ‘broad’ ELV definition of recycling allowing backfilling - Lack of reuse incentives	Insufficient reuse and recycling and loss of valuable resources Damage to the environment and human health from unsound treatment
‘Missing vehicles’ cause environmental impacts	Market failure: - Higher revenues from informal and illegal treatment activities - Higher revenues export used vehicles than EU recycling Regulatory failure: - Lack of traceability ELVs - No systemic exchange of registration information - Insufficient monitoring and enforcement - Guidelines used vs. waste vehicles non-legally binding	35% of vehicles are “missing” causing loss of resources and pollution in third countries.
No EU level playing field to improve circularity for trucks, buses + motor-cycles	Market failure: No economic incentives to improve design Regulatory failure: Lack of clarity on responsibilities Market failure: Information availability Regulatory failure: motorcycles, buses, lorries, trailers ‘not in scope’	Restrained circularity potential of vehicles currently out of scope

2.6 Who is affected and how?

The stakeholders which are primarily affected by the problems described in this section are those involved in the whole supply chain for the design, production and waste management of vehicles. This includes vehicle manufacturers, importers, suppliers of spare parts for the automotive industry, dismantlers (which are mostly SMEs), shredding/recycling companies, industries relying on scraps as feedstock for their production (notably in the steel, aluminium, copper and plastics sectors), exporters of used vehicles, insurance companies (who own and sell a large share of ELVs), workers, consumers, non-EU stakeholders like third-country producers exporting vehicles to the EU and importers of used vehicles from the EU, competent authorities in charge of the implementation of the ELV and type-approval legislation. More information on how these stakeholders are affected by the initiative can be found in Annex 3.

3 WHY SHOULD THE EU ACT?

3.1 Legal basis

The legislative proposal is based on Article 114 of the Treaty on the Functioning of the European Union (TFEU), which is to be used for measures that aim to establish or ensure the functioning of the internal market. This is essential as the proposal is designed to set out requirements which govern the placing on the EU market of motor vehicles.

The proposal tackles a number of key problems related to the single market. These include: i) an uneven playing field for vehicles placed on the market; ii) barriers to the functioning of recycling markets and improvement in economies of scale; iii) uneven implementation of the ELV Directive, since applicable rules are subject to interpretation; iv) lack of attention to quality and value retention in reuse and recycling; v) the persistent problem of ‘missing vehicles’ and lack of clarity to distinguish ELVs from used vehicles in the case of export and (vi) the need for a stable and fully harmonised regulatory framework, in particular related to uneven implementation of the polluter pays principle across Member States.

Harmonised rules are necessary to ensure that all goods placed on the EU market comply with similar conditions. Article 114 TFEU is the legal basis of the overall regulatory framework on type-approval of motor vehicles, including the 3R type-approval Directive, whereas the ELV Directive has an environmental legal basis (Article 192 TFEU). At the time of adoption of the ELV Directive, the choice of an environmental legal basis was justified as the Directive did not place any direct obligations on any economic operators, in particular no obligations linked to the placing on the market of vehicles, and as it essentially set out measures to be adopted by the Member States, targeting the end-of-life stage of a vehicle.

The policy options will lead to further harmonisation of: product requirements for vehicles placed on the Union market, in particular related to i) harmonised requirements for the inclusion of recycled content for plastics, steel and CRMs; ii) harmonised and improved materials declarations on the presence and locations of hazardous substances, the levels of recycled content for a range of materials including CRMS, and iii) improved requirement on information exchanges facilitating reuse and recycling. The proposal will also set requirements for ensuring a well-functioning market for secondary raw materials while preventing and reducing the environmental impacts from the production and recycling of vehicles.

The new legislation will modernise the existing requirements relating to the placing on the market of vehicles on the EU market, which currently are included in the 3R type-approval Directive, and those requirements will be merged with the rules applicable to the end-of-life stage of the vehicle. The new legislation will furthermore include a number of new provisions aimed at closing the material loop in products. With this in mind, it is appropriate that the new legislation is based on Article 114 TFEU, thus allowing for both ensuring a smooth functioning of the internal market and a high level of environmental protection.

The choice of Article 114 of the TFEU as a legal basis allows to build environmental-related requirements as the core elements of conditions on the type-approval and thereby the placing on the EU market of vehicles. It follows other examples of legislative proposals tabled by the Commission recently, aiming at covering in one single instrument sustainability/circularity requirements applying to the whole lifecycle of products, such as the proposal for a Batteries Regulation⁶², the proposal for a Regulation on Eco-design for Sustainable Products⁶³ and the proposal for a Regulation on Packaging and Packaging Waste⁶⁴.

3.2 Nature of the legal instrument

The evaluation of the ELV Directive and 3R type-approval Directive identified the generic nature of their provisions as one of their main shortcomings. Many of these provisions were

⁶² Regulation of the European Parliament and the Council of [date] 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (OJ L [...]).

⁶³ Proposal for a Regulation of the European Parliament and of the Council establishing a framework for setting ecodesign requirements for sustainable products and repealing Directive 2009/125/EC.

⁶⁴ Proposal for a Regulation of the European Parliament and of the Council on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904, and repealing Directive 94/62/EC.

found to be too general, not setting sufficiently clear requirements and not measurable. This led to diverging interpretation among the Member States (for example on the calculation of recycling targets), to a lack of progress (for example on design for recycling) or could not be properly monitored (for example the provisions in the 3R type-approval on the verification by Member States that vehicle producers adequately demonstrate that new vehicle types comply with the requirements on re-usability, recyclability and recoverability). This is hampering the functioning of the EU single market and not resulting in a better protection of the environment.

In addition, the co-existence of two separate legal acts (ELV Directive and 3R type-approval Directive) brings with it the risk that their respective provisions are not synchronised. The provisions of both Directives are intrinsically linked, as the 3R type-approval Directive needs to mirror the provisions of the ELV Directive. The merger of the two existing Directives into a single Regulation represents the most efficient solution to ensure this synchronisation. It will provide the necessary legal certainty, simplify the current regulatory landscape by gathering all requirements into a single act and contribute to a stronger EU market integration. A Regulation will ensure that the obligations are implemented at the same time and in the same manner in all 27 EU Member States in a harmonised way. Compared to a Directive, the choice of Regulation also reduces the administrative costs linked to the transposition process into national legislation and allows new EU requirements to apply earlier. The choice of a Regulation is consistent with the rest of the type-approval regulatory framework, where Directives have been turned into Regulations as part of the measures adopted at the EU level in the aftermath of the “Dieselgate” emissions scandal.

3.3 Subsidiarity: necessity and added value of EU action

To ensure a harmonised and well-functioning internal market across all EU Member States and enable a smooth transition of the automotive sector to the circular economy, in line with the ambition of the European Green Deal, it is essential to put in place a common set of rules at the EU level, with clear requirements and obligations addressed to both Member States and economic operators. Otherwise, the risk is to fragment the EU market and make progress on circular economy dependent on voluntary actions by economic actors or individual Member States. EU action is necessary to meet all the objectives of this initiative.

The EU automotive sector benefits greatly from the internal market. As indicated above, type-approval rules streamline the conditions linked to the placing on the EU market as adopted at EU level. Without active EU level regulatory intervention, only small-scale and local incentives to design and produce vehicles in a way which limits the use of primary materials and increase the use of secondary materials are expected, as there are no legally binding provisions on the design for circularity of such vehicles today.

Harmonisation of requirements would facilitate the development of modern and environmentally sound infrastructure for the treatment for all vehicles in the EU, support innovation and address the implementation problems related to the different interpretations of existing legislation. It would also allow setting a clear reporting and monitoring mechanism, resulting in transparency and data comparability across the sector.

The difficulties related to the “missing vehicles” are common to all Member States. The cross-border dimension of the problem is one of its main features and requires an EU response. There were different attempts by some Member States to address the problem, which have not proven effective. The difficulty in exchanging information on the registration of vehicles between vehicle registers of the different Member States requires a harmonised solution. The same goes for the export of used vehicles from the EU, which can only be governed at the EU level in view of the EU common rules on customs and external trade.

Finally, the treatment of vehicles not covered by the ELV Directive has been regulated differently by the Member States. The study supporting the evaluation of the EU rules on end-of-life vehicles⁶⁵ revealed that only few Member States have established a consistent legal framework for the treatment of these vehicles at the end-of-life, whereas in others it is not clear how they are treated and what consequences to the environment are caused when the treatment is carried under sub-optimal conditions. Maintaining nationally fragmented regulatory frameworks in the EU would leave more than 45 million vehicles currently on EU roads at higher risk of encountering illegal dismantling activities, environmentally unsound treatment causing an uneven playing field between economic operators and significant potential loss of valuable secondary raw materials from the ELVs.

The objectives of the revision of the EU rules on end-of-life vehicles cannot be sufficiently achieved by the Member States acting individually but can rather, by reason of the scale and effects of the measures, be better achieved at Union level.

4 OBJECTIVES: WHAT IS TO BE ACHIEVED?

4.1 General objectives

The overall objective of this initiative is to improve the functioning of the EU internal market by reducing the negative environmental impacts linked to the design, production, service life and end-of-life treatment of vehicles and contributing to the sustainability of the automotive and recycling sectors.

4.2 Specific objectives

In order to address the problems described in section 2, the initiative seeks to address the following five specific objectives:

1. **‘Design circular’**: Improve circularity at the design phase of vehicles, to facilitate and increase the removal, reuse, remanufacturing and recycling of materials, parts and components contained in vehicles, so that vehicle producers use more materials and technologies which do not hamper the removal of re-usable parts and components, use more materials which are easy to recycle and dismantlers are provided with information allowing them to increase and improve the removal, re-use and recycling of parts, components and materials from ELVs.
2. **‘Use recycled content’**: Significantly increase the use of recycled materials (especially plastics, steel, aluminium and CRMs) in the production of vehicles, thereby incentivising recycling, reducing strategic dependencies of raw materials for the automotive industry and supporting the decarbonisation of the EU industry.
3. **‘Treat better’**: Significantly increase the quantity and quality of materials (especially plastics, steel, aluminium and CRMs) re-used, remanufactured and recycled from ELVs, thereby reducing the environmental footprint linked to the management of the waste generated by the automotive industry, supporting the creation of a dynamic market for secondary materials in the EU and facilitating the incorporation of more reusable parts into used vehicles extending their lifespan at moderate costs for end-users.
4. **‘Collect more’**: Significantly increase the collection of ELVs in the EU and ensure roadworthiness of used vehicles exported from the EU, so that the number of “missing vehicles” and the EU external pollution footprint and road safety risks associated with the export of non-roadworthy used vehicles outside the EU are reduced.

⁶⁵ SWD(2021)60

5. **‘Cover more vehicles’:** Increase circularity in the design, production and end-of-life treatment of vehicles (lorries, buses, trailers⁶⁶ and L3e-L7e category vehicles⁶⁷) which are currently outside the scope of the ELV and 3R type-approval legislation and ensure that they are treated properly.

5 WHAT ARE THE AVAILABLE POLICY OPTIONS?

5.1 What is the baseline from which options are assessed?

The automotive sector is currently undergoing a massive transformation in its design and production patterns, triggered by the shift to (heavier) electric vehicles, increasing use of advanced and lightweight materials and the growing number of electronic components in vehicles. The main share of the environmental footprint of the automotive sector will shift from the use phase to the materials production and end-of-life phase. Electrification will increase the mass in vehicles in general and of non-ferrous metals in particular. The trend to put on the market larger and heavier vehicles (like SUVs) is expected to continue, which translates into an increasing use of primary materials and its associated carbon footprint, which can offset the environmental gains linked to the phasing out of combustion engine. For aluminium for instance, current ELVs contain around 100 kg of predominantly cast alloys, whereas average new vehicles contain 180 kg and BEVs more than 320 kg of aluminium per vehicle, predominantly wrought alloys⁶⁸. For global production, a four-fold increase in aluminium demand is expected⁶⁹ towards 2050. The limitations inherent to both the ELV and the 3R type-approval Directives (generic provisions, limited monitoring and enforcement) would remain, and prevent real changes towards making the design and production of all vehicles placed on the EU market more circular.

Novel components, advanced materials and more complex (and lighter) vehicle designs will further increase the reliance of the sector on CRMs. Electric drivetrains will significantly increase the share of electric drive motors in the EU fleet, either being induction motors or permanent magnet motors⁷⁰ containing rare earth elements such as neodymium and dysprosium for their construction⁷¹. Dysprosium demand will double by 2030 to six times higher by 2050; praseodymium will increase by 50% in 2030 and double by 2050⁷²; for neodymium an eleven-fold increase by 2032 is expected⁷³. Increasing numbers of electronic components shifts the presence of platinum-group metals from catalysts to multiple parts distributed over the vehicles. The use share of magnesium, another CRM used for lightweight parts and in aluminium alloys, is expected to increase significantly, with an annual growth of 9.5% from 2020 to 2025⁷⁴.

⁶⁶ Also referred to as Heavy Duty Vehicles (HDV), categories as defined in Regulation 2018/858

⁶⁷ L-category vehicles include light 2-wheel powered vehicles (category L1), three-wheel mopeds (L2), two-wheel motorcycles (L3), two-wheel motorcycles with sidecars (L4), powered tricycles (L5), light quadricycles (L6) and heavy quadricycles (L7) as defined in Regulation 2013/168. The scope considered here excludes L1 and L2.

⁶⁸ DuckerFrontier, Aluminium content in European Passenger Cars, prepared for European Aluminium, public summary 10.10.2019.

⁶⁹ R.G. Billy, D.B. Muller, Aluminium use in passenger cars poses systemic challenges for recycling and GHG emissions, Resources Conservation and Recycling 190 (September):106827, March 2023, DOI: 10.1016/j.resconrec.2022.106827.

⁷⁰ A detailed list of electric traction motor types is available in (JRC, 2023). N. Tazi, M. Orefice, C. Marmy, Y. Baron, M. Ljunggren, P. Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821

⁷¹ EU Science hub, JRC Raw Materials Information System, <https://rmis.jrc.ec.europa.eu/apps/veh/#/v/materials>

⁷² “European Commission, Critical materials for strategic technologies and sectors in the EU - a foresight study, 2020”.

⁷³ <https://www.idtechex.com/en/research-article/rare-earths-in-evs-problems-solutions-and-what-is-actually-happening/25071>

⁷⁴ Source: JRC 2023 ongoing CRM project: <https://www.intlmag.org/page/3d-demonstrator-2020>

The uptake of recycled materials like plastics, steel and aluminium would be largely left to voluntary initiatives by individual economic actors. Plastics materials in vehicles is expected to represent around 200 kg on average per light-duty vehicle (13% of the total weight of an average EV). Currently, the level of (post-consumer) recycled plastics in cars is limited to 2.5% and little progress on this is expected without regulatory intervention in the next years, so that the automotive sector would remain a major user of virgin plastics across the EU industries⁷⁵.

The problems linked to the waste stage of the life cycle of vehicles will remain. Under a baseline scenario, **around 10 million passenger cars and vans would become ELVs in 2035**, containing 7.6 million tons of steel (and cast iron), 1.3 million tons of aluminium, 175 thousand tons of copper and brass, 250 thousand tons of glass and 1.6 million tons of plastics. The dismantling and recycling sector would continue to focus on materials and parts which are profitable, and, in the absence of incentives or regulatory requirements, the quantity of recyclates from materials which are difficult to remove or recycle (especially plastics, glass, CRMs, textiles, composite materials) will not increase. Without incentives, the quality of recyclates would not improve either, hampering their uptake in new production and ultimately preventing the design and production of vehicles to become more circular. Electric vehicles are expected to represent up to 35 % of ELVs by 2035⁷⁶. The costs per vehicle for dismantling batteries and e-drive motors are high and require sizeable investments in new skills and equipment (e.g., handling and storage of batteries). Most CRMs in EVs risk therefore to continue to be lost during the recycling processes or downcycled due to lack of economies of scale and lack of recycling and further refining capacity. This is likely to be the case for rare earths magnet materials diluted in the ferrous ELV stream or for other CRMs like magnesium or silicon to be found in mixed unsorted ELV steel and aluminium fractions.

A lack of new policy intervention would result in considerable losses of resources, including of CRMs, with significant impacts on the environment and the EU economy and a missed opportunity to put the automotive sector on a path to circularity, at a moment where the shift to electrification is driving profound changes in its business and production models.

Finally, a side effect to the shift to EVs might be the development of the market for second-hand vehicles, which are more affordable than new EVs. This could in turn boost the demand for used spare parts and provide incentives for the whole automotive supply chain to increase re-use and remanufacturing.

The problem of missing vehicles was identified in 2010 and has not been successfully addressed since then, despite a series of soft law initiatives and individual measures taken by some Member States. **Without policy intervention addressing the drivers of this problem, it is anticipated that the problems with illegal and informal activities and loss of resources will continue at similar levels.** Despite efforts by some Member States, it is expected that the number of missing vehicles will amount to approximately 3.2 million in 2035. By 2035, it is estimated that over one million of old, used, non-roadworthy vehicles would be exported annually from the EU to third countries, mostly in Africa, non-EU central Europe and central Asia, exposing populations in destination countries to air pollution and road safety problems. It could be that the implementation of new import requirements by

⁷⁵ The automotive sector is the third consumer of virgin plastics in the EU, representing ca. 10% of the consumption, after packaging (34%) and building and construction (24%), see Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008.

⁷⁶ Estimates are based on data Aeris Europe 2021 and ACEA 2021.

receiving countries leads to a reduction in the volume of exported used vehicles from the EU; in the absence of international harmonised standards on this point and in view of limited enforcement capacities in importing countries to control shipments of used vehicles, this reduction is expected to be of a small magnitude.

Finally, keeping a large amount of road **vehicles outside the scope of the ELV and 3R type-approval legislation** would mean that the design, production and end-of-life treatment of these vehicles would continue to operate on a ‘business as usual’ scenario with limited integration of circularity considerations, no guarantee that the vehicles are managed in a sustainable manner when they reach the end of their life, and losses of resources not re-used or recycled. In 2030, the number of end-of-life motorcycles would amount to approximately 1.6 million units, the number of end-of-life lorries to approximately 265,000 units and the number of end-of-life buses to approximately 30,000 units⁷⁷. This represents 5 million tons of materials by 2030. These vehicles (especially lorries and buses) will use a growing quantity of CRMs, in order to comply with the latest CO₂ emission performance⁷⁸ and air emission standards (requiring for example technologies for exhaust gas control, leading to more copper, platinum and palladium), but also due to the electrification or hybridisation of some models (requiring lithium batteries and the use of permanent magnets containing rare earth elements in e-drive motors) and the shift of other models to hydrogen-powered technologies (with the associated use of fuel cells for which platinum plays an essential role as a catalyst element)⁷⁹. Voluntary actions by some economic operators might slightly increase the contribution of these sectors to the circular economy, but there would be no leverage at the EU level to use this potential to its full extent. It is likely that Member States would increasingly adopt different measures applying to these vehicles⁸⁰, posing a risk of fragmentation in the internal market.

The export of used lorries and buses to third countries could decrease as a result of the implementation of the Euro VI standard⁸¹ which necessitates that heavy-duty vehicles put on the EU market after 2013 are equipped with advanced aftertreatment technologies which require the use of high-quality fuels and reagents, especially for diesel-powered vehicles (i.e. diesel exhaust fluid or AdBlue) which may not be widely available in a number of importing countries. If it materialises, this decrease would lead to a corresponding increase in the number of vehicles becoming waste in the EU, but would still not guarantee that the exported used vehicles are roadworthy upon export. It should be noted that the impact of the implementation of Euro VI norms in the EU on the level of export of used vehicles is likely to be much higher for lorries than for M1-N1 vehicles: the practical totality used lorries exported from the EU are diesel vehicles which, when equipped to comply with Euro VI norms, may not function properly in countries which do not have the same the fuel standards and cannot supply these lorries with the required technologies and urea. The impact is less clear on the export of used M1-N1 vehicles as they can continue to be driven with lower fuel quality (albeit being much more pollutant than compliant vehicles).

Overall, the problems described in section 2 will increase in severity in the future. Without simultaneous regulatory intervention in all above areas at the same time, the automotive sector will increasingly depend on supply of primary raw materials,

⁷⁷ Source: study supporting the impact assessment report

⁷⁸ Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 setting CO₂ emission performance standards for new heavy-duty vehicles

⁷⁹ See Annex 15 for more information on this point

⁸⁰ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023.

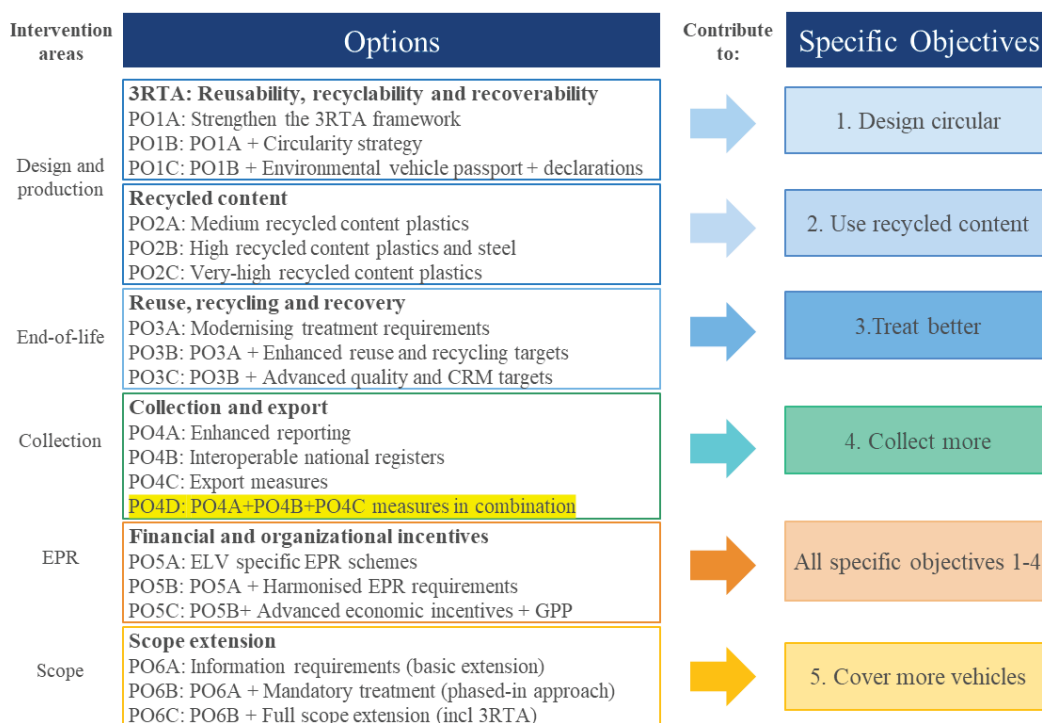
⁸¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02009R0595-20200901>

including CRMs, with a significant environmental footprint at extraction and processing stages.

5.2 Description of the policy options

As displayed in Figure 2, this impact assessment presents and analyses policy options designed to attain each of the five specific objectives described in Section 4.2. For each of these specific objectives, the impact assessment analyses three policy options (A, B and C), which are specifically addressing the objective in question, except for Policy options 5A to 5C which contain supporting measures for the attainment of different objectives and therefore serve to attain several of them⁸².

Figure 2 - Policy options and specific objectives



1. Policy options 1A, 1B and 1C are designed to meet specific objective 1 - '**Design circular**';
2. Policy options 2A, 2B and 2C are designed to meet specific objective 2 - '**Use recycled content**' and include requirements for car manufacturers to incorporate minimum amounts of recycled materials in new vehicles;
3. Policy options 3A, 3B and 3C are designed to meet specific objective 3 - '**Treat better**' and aim to improve the management of waste from ELVs and to support the market for re-used and remanufactured parts;
4. Policy options 4A, 4B and 4C are designed to meet specific objective 4 - '**Collect more**' and aim at higher collection rates of ELVs;
5. Policy options 5A, 5B and 5C provide appropriate **financial and organisational incentives** to support the implementation of the other policy options;
6. Policy options 6A, 6B and 6C are designed to meet specific objective 5 '**Cover more vehicles**' and improve circularity for the vehicles currently outside the scope of the ELV and 3R type-approval legislation.

⁸² In Annex 4.2.2 the structuring of the options is further explained, including a two-step approach where the effect of policy options 5 to the other options is computed first, before determination of total joint impacts. This approach to prevent 'circular calculations' thus complies with the BRG tool #16, Figure 1b.

The options are based on a comprehensive list of 52 potential policy measures listed in Table 1, which are extracted from the evaluations of the existing legislation, and input from Member States and stakeholders as described in more detail in Annex 2. They also take account of the suggestions provided in the Fit for Future Platform (F4F) opinion, which can be found in Annex 5⁸³. A detailed description of each measure presented below can be found in Annex 7.2 for selected measures and Annex 7.3 for discarded measures, as well as references to the underlying information in the supporting study. Table 1 includes discarded measures (marked with an X) for which the reasoning is provided in Section 5.3, planned entry-into-force dates in the second last columns and whether measures are included in the final preferred option as well be substantiated later in Section 8.1 to avoid repetition of the same table.

Table 1 Overview of all measures considered

Policy Options	#	Measures (all implementing dates are specified as +x yrs from entry-into-force)	EIF *	Pref. *
PO1 – <i>Design Circular</i>	1A	M1 - Ensure that new 3RTA rules provide for a proper implementation of circularity requirements for new vehicle types	+1	Y
		M2 - Empowerment for the Commission to develop a refined methodology to determine compliance with 3R-requirements	+3	Y
		M3 - Provision of basic dismantling information to ELV treatment operators	+3	Y
		M4a - Declaration on substances of concern verified by 3R type-approval authorities	+3	N
		M5a - Restrictions of substances under the revised ELV Directive (<i>analysed separately in Annex 9</i>)	+1	N
	1B	<i>Includes measures M1,M2,M3 of PO1A.</i>		
		M4b - Mandatory declaration on recycled content of plastics, steel, aluminium	+5	Y
		M5b - Restrictions of substances under REACH and other existing legislation (<i>analysed separately in Annex 9</i>)	+8	N
		M6 - Obligation for vehicle manufacturers to develop circularity strategies	+3	Y
		M7 - Design requirements for new vehicles to facilitate the removal of components	+6	Y
	1C	<i>Includes measures M1-M3, M6,M7 of PO1A and PO1B.</i>		
		M4c - Mandatory declaration on recycled content for materials, other than plastics, including CRMs, steel, aluminium	+5	Y
		M5c - Hybrid approach: maintenance of current restrictions under ELV with new restrictions under REACH (<i>analysed separately in Annex 9</i>)	+8	Y
		M8 - Establishment of a digital Circularity Vehicle Passport	+7	Y
Discarded PO1		M34 - Voluntary pledges campaign to increase circularity		X
		M35 - Preparation of non-binding guidelines to improve circularity		X
		M36 - Obligatory due diligence requirements for materials used in vehicles		X
PO2- <i>Use Recycled Content</i>	2A	M9a - Mandatory recycled content targets for plastic used in vehicles - 6% recycled plastics content by 2031, 10% by 2035 at fleet-level, of which 25% of recycled material from closed loop production, calculation and verification rules at +2 yrs	+6	N
		M10a – Empower the Commission to set a mandatory recycled content target for steel, including calculation and verification rules at +3 yrs, based on a dedicated feasibility study, application to newly type approved vehicles at +7 yrs	+7	Y
	2B	M9b - Recycled plastics content: 25% in 2031 for newly type-approved vehicles only, of which 25% from closed loop production, calculation and verification rules	+6	Y
		M10b - Steel recycled content: 20% in newly type-approved vehicles, calculation and verification rules	+7	N
	2C	M9c - Recycled plastics content: 30% in 2031 for newly type-approved vehicle only, of which 25% from closed loop production, calculation and verification rules	+6	N
		M10c - Steel recycled content: 30% in newly type-approved vehicles, of which 15% from closed loop, calculation and verification rules	+7	N
		M11- Empower the Commission to set a mandatory recycled content targets for other materials (aluminium alloys, CRM), feasibility study +3 yrs, target levels, calculation and verification rules +5 yrs, application to newly type approved vehicles >7 yrs	>7	Y

⁸³ <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

Discarded PO2	M37 - Higher than 30% of recycled content target for plastic of in 2031			X
	M38 - Recycled content targets for copper			X
	M39 - Recycled content targets for glass			X
	M40 - Recycled content targets for rubber/ tyres			X
PO3- <i>Treat Better</i>	3A	M12- Aligning the definition of recycling (at EIF) and aligning the calculation methodology for recycling rates (+3 yrs) with other waste legislation	+3	Y
		M13a - Mandatory removal of certain parts/components prior to shredding to encourage their recycling or re-use, 'list A'	+3	Y
		M14a - New definition of 'remanufacturing' (at EIF) and new monitoring requirements (+3 yrs) for (preparing for) re-use/ remanufacturing	+3	Y
		M16a - Ban on the landfilling of automotive waste residues from shredding operations	+3	Y
	3B	<i>Includes all measures of PO3A (cumulative)</i>		
		M13b - Mandatory removal of longer list of components, including those that contain a high concentration of valuable metals or CRMs, 'list B'	+3	Y
		M14b – Market support for the use of spare parts	+3	Y
		M15b – Recycling targets for plastics – 30% at 5 yrs EIF. Calc rules +2 yrs EIF	+5	Y
		M16b – Ban on mixed shredding of ELVs with WEEE and packaging waste	+3	Y
	3C	<i>Includes all measures of PO3A and PO3B (cumulative)</i>		
		M13c – Mandatory removal of additional components, 'list C'	+5	N
		M15c – Glass – 70% recycling as container glass quality or equivalent.	+5	N
		M16c – Setting requirements on Post Shredder Technologies (PST) to improve the quantity and quality of metal scrap recovered from ELVs	+5	N
Discarded PO3	M41 – setting specific recycling targets for metals			X
	M42 – setting specific recycling targets for non-metal materials			X
PO4 – <i>Collect More</i>	4A	M17a – Reporting by Member States on “missing vehicles”, vehicle registrations, the import and export of used vehicles, incentives to encourage delivery to an ATF and penalties	+3	N
		M18 - Obligations for dismantlers /recyclers to check and report on ELVs/ CoDs	+3	Y
		M19a - Setting minimum requirements for sector inspections and enforcement action (including non-binding Correspondents Guidelines No9)	+1	Y
	4B	M17b - Setting fines for the ELV sector if an ELV is sold to illegal dismantlers and for dealers (and electronic platforms) dealing with dismantled (used) spare parts from non-authorised facilities.	+3	Y
		M19b - Clearer definition of ELVs to ensure that there is a better distinction between used vehicles and ELVs (binding CG9)	EIF	Y
		M20 - Improving the information contained in national vehicle registries and making them interoperable	+5	Y
	4C	M19c - Provide or making available information on vehicle identification and roadworthiness to customs authorities (VIN)	+4	Y
		M21 - Export requirements for used vehicles linked to roadworthiness	+7	Y
Discarded PO4	4D	Includes measures M17b,M18,M19a-c,M20,M21of PO4A, PO4B and PO4C (cumulative)	+3	Y
		M43 - Establish a mandatory collection target of ELVs based on the reporting obligations on the national vehicle market		X
		M44 - Voluntary campaigns on export of ELVs incl. waste shipment correspondents' guidelines No9 on distinction ELVs and second-hand vehicles		X
		M45 – Establishing a central EU vehicle registration database		X
		M46 - Exchange of Member States on the implementation of incentives supporting effectiveness of the Certificate of Destruction (CoD)		X
		M47 - Support / software interfaces to international notification system		X
		M47a – Setting threshold for age and emission for the export of all used vehicles from the EU to third countries		X
PO5 – <i>EPR</i>	5A	M22 - Requirement for the Member States to establish collective or individual EPR schemes, incl. monitoring compliance costs and minimum financial obligations	+3	Y
		M23 - Reporting obligations for producers	+3	Y
	5B	<i>Includes measures M22, M23 of PO5A (cumulative)</i>		
		M24 - Harmonised modulation of EPR fees	+5	Y
		M25 - Transfer of the EPR fees/ guarantees (cross-border EPR)	+3	Y
	5C	<i>Includes measures M22-M25 of PO5A and PO5B (cumulative)</i>		
		M26 – Setting up national deposit refund schemes	+5	N
Discarded PO5	M27 - Harmonised GPP criteria (voluntary)		+5	N

Discarded PO5	M48 - Establishment of an EU wide EPR scheme			X
	M49 - European-wide deposit refund scheme supervised by a single European body			X
	M50 - Collection of vehicles at holder's premises and abandoned vehicles free of charge for the last holder			X
PO6 – Cover more vehicles	6A	M28 - Provision of information to dismantlers and recyclers	+5	Y
	6B	<i>Includes measure M28 of PO6A (cumulative)</i>		
		M30a - Mandatory treatment of end-of-life L3e-L7e-category vehicles, lorries (N2,N3) and buses (M2,M3) and trailers (O) at ATFs + CoD	+5	Y
		M30b - Export requirements for used vehicles linked to roadworthiness for lorries (N2,N3) and buses (M2,M3) and trailers (O)	+5	Y
		M31b - Minimum EPR requirements for end-of-life L3e-L7e category, lorries (N2,N3) and buses (M2,M3) and trailers (O)	+5	Y
		M32 - Review clause on the regulatory extension of 3RTA scope to new vehicles	+8	Y
	6C	<i>Includes measures M28,M30a-b,M31b of PO6A and PO6B (cumulative)</i>		
Discarded PO6		M31c - Full application of EPR and advanced economic incentives	>7	N
		M33 - Full scope application of the new 3RTA and end-of-life treatment requirements to additional vehicle categories	>7	N
Discarded PO6	M51 - Extension of new requirements to special purpose, multistage vehicles and vehicles produced in small series			X
	M52 - A full regulatory 3RTA scope extension to all vehicle categories			X

* Entry-into-force of the Regulation; Pref. is preferred option, see Section 8.1

** Included in the preferred option, Y = YES, N = NO, See Section 8.1, X = Discarded, See Section 5.3

5.2.1 Policy Options 1A, 1B and 1C (related to specific objective 1 'design circular')

PO1A, PO1B and PO1C are designed to meet the specific objective 1 '**Design Circular**', with an increasing level of ambition. These options are cumulative (i.e., PO1B = PO1A + additional measures; PO1C = PO1B + additional measures).

"PO1A - Better compliance verification" includes first the adaptation of 3R type-approval process to the new Framework Regulation on type approval and market surveillance⁸⁴, including the possibility to perform conformity of production and market surveillance tests. It includes the possibility to recall vehicles, withdraw type-approval certificates and sanction manufacturers in case of non-compliance (M1). It includes an empowerment for the Commission, within 3 years, to review the calculation methodology on how vehicles manufacturers should demonstrate compliance with their obligations on recyclability and re-usability of new vehicles. This could be done through supporting a change to the current ISO standard on this point, or through the development of standards at EU level, and would be preceded by an impact assessment. (M2). **PO1A also requires manufacturers to provide treatment operators and consumers, through existing platforms, with detailed and user-friendly repair, reuse and safe dismantling instructions (M3) and the location of the parts/components in their vehicles containing CRMs⁸⁵.** See Annex 7.2.1 for more details.

"PO1B – Circularity strategy" contains the measures in PO1A, with additional requirements for vehicle manufacturers to develop a specific circularity strategy for each new vehicle which is type-approved ("type-specific strategy"). The strategy would foster cooperation between vehicle manufacturers and actors in the dismantling and recycling sectors. The objective of this "type-specific strategy" would be for vehicle manufacturers to demonstrate how they will follow-up on their obligations to ensure that the requirements on re-usability, recyclability and recoverability for this vehicle are met, with a particular focus on

⁸⁴ Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (OJ L 151, 14.6.2018, p. 1–218.)

⁸⁵ with a specific focus on declaration of indicative weights, locations, fastening and coating techniques as well of labelling of CRMs such as Neodymium and Dysprosium in e-drive motors

materials such as CRMs, for which no recycling technology is currently available at commercial scale or that need to be removed prior to shredding. The findings from the strategy should be used to inform the recycling/dismantling sector, as well as by the vehicle manufacturer to improve the circular design of future vehicles. This strategy should contain a nontechnical summary which should be publicly available. To provide transparency and allow for monitoring of the progress made by the sector toward circularity, the Commission will establish regular reports on circularity in the automotive sector, drawing notably from these strategies (M6). In addition to these measures, **PO1B** includes provisions on **design for dismantling and recycling**, especially a requirement that batteries, electric drive motors from EVs and other CRM-containing parts/components are designed in such a way that professional dismantlers can remove them safely without excessive costs (M7). This also includes an empowerment for the Commission to develop standards or specific requirements on the design for dismantling and recycling of selected parts or components from vehicles, especially those made of plastics or containing CRMs, to be adopted within 6 years after the adoption of the new legislation. Additionally, **vehicle manufacturers are requested to provide evidence of the share of recycled content (plastics and steel, but also aluminium and copper) used in each vehicle type as relevant and necessary for the attainment of the objectives of the future legislation**⁸⁶ (M4b). Finally, **PO1B** clarifies that all new restrictions of substances in vehicles, due to reasons related primarily to their chemical safety, will be carried out under REACH⁸⁷ or, for the specific case of substances in batteries used in vehicles, under the new Batteries Regulation⁸⁸. It addresses the call to ensure a legal coherence, as highlighted in F4F opinion⁸⁹. Under this policy option the existing restrictions on lead, mercury, hexavalent chromium and cadmium in vehicles, as well as their specific exceptions in Annex II, remain with enhanced provisions⁹⁰ under the new ELV Regulation with a planned reassessment, at 8 years, of their potential full take-up by REACH (M5). See Annex 7.2.1 for more details.

PO1C: Circularity Vehicle Passport for circular vehicles: **PO1C** builds on **PO1B** and includes in addition the requirement that each vehicle needs to be accompanied by a digital **Circularity Vehicle Passport** (M8), containing information provided by the manufacturer on the composition of vehicles and its components, relevant for repair, maintenance, dismantling, re-use, remanufacturing and recycling as a single entry for consumers and treatment operators. This development responds to the suggestion of the F4F opinion and is fully consistent with the corresponding provisions that are included in the proposal for Battery Regulation (battery passport)⁹¹, the ESPR proposal (product passport⁹²) and the proposal for the Euro 7 standard (Environmental Vehicle Passport⁹³). As part of the digital information, recycled content levels for all should be declared allowing for verification of manufacturer's claims (M4c) to monitor actual decarbonisation results as explained in 5.2.2 and Annex 7.2.2

⁸⁶ Including the shares of post-consumer, pre-consumer and closed loop percentages derived from ELV treatment on a mass-balance basis.

⁸⁷ Or, for substances identified as Persistent Organic Pollutants, these would be covered under the Regulation on Persistent Organic Pollutants.

⁸⁸ Based on the results of provisional 1st reading agreement 9 December 2022:

<https://www.europarl.europa.eu/news/en/press-room/20221205IPR60614/batteries-deal-on-new-eu-rules-for-design-production-and-waste-treatment>

⁸⁹ For more information see Suggestion 6 at <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>;

⁹⁰ Allowing an in depth assessment of alternatives and of their socio-economic impacts, similar to that carried out under REACH.

⁹¹ Regulation of the European Parliament and the Council of [date] 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (OJ L [...]).

⁹² COM(2022) 142 final

⁹³ COM(2022) 586 final

in more detail. The Commission would be tasked to develop the technical features of this passport within 7 years from entry into force of the new legislation, ensuring further consistency with other similar initiatives under development in the ESPR framework and the Euro7 regulation. See Annex 7.2.1 for more details.

5.2.2 Policy Options 2A, 2B and 2C (related to specific objective 2 ‘use recycled content’)

PO2A, PO2B and PO2C target the specific objective 2 ‘**use recycled content**’, with an increasing level of ambition. These options are alternative and not cumulative.

In view of the low recycling and recycled rates of plastics from ELVs, these options would have a focus on recycled content for plastics, but also address recycled content for metals (steel, aluminium, CRMs). Only recyclates from post-consumer waste⁹⁴ would be eligible to be accounted for the targets presented below. Increasing pre-consumer (or post-industrial) recycled content does not contribute as much to decarbonisation and scrap quality improvement as post-consumer recycled content. Due to lower costs and higher quality of pre-consumer content, the likelihood it is recycled is much higher than for post-consumer and basically part of the baseline as manufacturers are increasingly incorporating more. The proposed targets would only apply to new M1 and N1 vehicle types⁹⁵ entering the EU market and excluding L3e-L7e category vehicles, lorries, buses and trailers not covered by the current ELV Directive. A specific methodology for the calculation and verification of recycled content for plastics would also be established, similar to what is implemented or in development in other legislative proposals⁹⁶. This is especially relevant to distinguish the differences in average carbon footprint of post- versus pre-consumer waste and to establish a harmonised and consistent mass-balance approach for fair accounting of recycled content volumes. In the case of plastics, this is required to address future developments in chemical recycling⁹⁷. This does not jeopardise setting a target level as it incentivises mechanical treatment first. With chemical recycling maturing, there is possibly upwards potential in the future when chemical recycling is more mature to deal more polluted and mechanically difficult to recycle plastics as specified in the JRC study. See Annex 7.2.1 for more details.

PO2A includes a requirement for **recycled content targets for plastics⁹⁸ in new vehicles of at least 6% of the overall plastics contained in the vehicle fleet by 2031, and 10% by 2035 (M9a)⁹⁹, of which 25% of recyclates originates from closed loop recycling from ELVs. PO2A includes an empowerment allowing the Commission to lay down a future target for recycled content for steel for newly type approved vehicles 3 years after entry into force of the Regulation, based on a dedicated feasibility study particularly focusing on the determining an appropriate target level. The study will investigate i) the current and forecasted availability of steel recycled from post-consumer sources of steel waste; ii) the current share of post-consumer waste in various steel semi-products and intermediates used in vehicles; iii) the potential uptake of post-consumer recycled steel by manufacturers in vehicles to be type-approved in the future; and iv) the relative demand of the automotive**

⁹⁴ CPA. (2021). *Guidance on Waste Definitions* (Issue September).

<https://ec.europa.eu/docsroom/documents/46954/attachments/8/translations/en/renditions/native>

⁹⁵Type approval means the procedure whereby a Member State certifies that a type of vehicle, system, component or separate technical unit satisfies the relevant administrative provisions and technical requirements; (art.3, Directive 2007/46/EC).

⁹⁶ See the proposals for a Regulation on packaging and packaging waste, the Single Use Plastics Directive, the proposed Ecodesign for Sustainable Products Regulation and the Battery Regulation.

⁹⁷ See Section 4.2.3 of the JRC supporting study: Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008.

⁹⁸ Thermoplastics (e.g., polyolefins, styrenics, polyamides) as well as polyurethane foams.

⁹⁹ This corresponds with scenario JRC3a in the respective study (JRC129008).

sector in comparison to the demand for post-consumer steel waste of other sectors. The necessary calculation and verification rules should be laid down at the same time. **Actual targets would start to apply 7 years** after entry into force of the Regulation (M10a). Under **PO2A**, no other mandatory recycled content targets for other materials would be set, but a mandatory declaration regarding the share of recycled materials embedded in new vehicle types at type-approval stage (see M4b for the declaration to this point).

PO2B includes mandatory recycled content targets for plastics in newly type-approved vehicles of 25%, of which 25% from closed loop (M9b). This would represent an annual growth of 30% until 2031 compared to the average baseline in 2022¹⁰⁰. The target for plastic would apply from 6 years after entry into force of the Regulation. **PO2B would set a mandatory recycled content target for steel at 20% for newly type approved vehicles** in the Regulation with the target to be achieved 7 years after entry into force. A review clause is foreseen in case supply and demand of steel is rapidly increasing or decreasing as material choices may be subject to change (M10b).

PO2C includes mandatory recycled content targets for plastics in newly type-approved vehicles of 30% of recycled content of which 25% from closed loop¹⁰¹(M9c). **PO2C** would further include a **recycled content target for steel of 30% for newly type approved vehicles, including a 15% closed loop percentage** (M10c). In addition, the Commission would be (i) tasked to **assess the desirability, feasibility and impacts of setting out recycled content targets in new vehicles for other materials, especially aluminium alloys, copper and CRMs such as rare earth elements or magnesium** (M11), and (ii), based on a feasibility study, empowered to set out recycled content targets for the materials in question. The study shall investigate both technical limitations in supply and demand similar to the feasibility study for steel and focus additionally at the wider economic viability, technical and scientific progress, including changes in the availability of recycling technologies concerning the type of materials recycled; their material specific recycling rates and investigate the risk of disproportionate negative impacts on the affordability of vehicles containing these other materials derived from post-consumer recycled content. This feasibility study is planned 3 years after entry into force.

5.2.3 Policy Options 3A, 3B and 3C (related to specific objective 3 ‘treat better’)

PO3A, PO3B and PO3C target the specific objective 3 ‘**Treat better**’, with increasing levels of ambition. These options are cumulative.

PO3A modernises the current provisions of the ELV Directive to improve clarity and enhance the quality of the treatment of waste. The first element is aligning the ELV Directive with the more recent and **stricter definition of recycling used in other sectoral waste legislation** (M12) which explicitly excludes backfilling¹⁰². A clearer methodology for the calculation of recycling rates would also be established, similar to what is implemented or in development in EU law and ensuring that what is accounted as “recycled” only includes materials which are effectively recycled and not just collected for recycling. As a supporting element, a ban on the landfilling of the residues from shredding operations (“automotive shredder residue” or ASR) would be included (M16a)¹⁰³ to ensure increased metal and plastics recovery and use of remaining non-inert materials for energy recovery. The option would also clarify the obligation (currently unclear in the ELV Directive) that some parts and

¹⁰⁰ This corresponds with the scenario JRC4b in the Annex of the study (JRC129008).

¹⁰¹ This corresponds with the scenario JRC4c in the Annex of the study (JRC129008).

¹⁰² Backfilling is a recovery operation where suitable waste is used for reclamation purposes in excavated areas or for engineering purposes in landscaping and where the waste is a substitute for non-waste materials

¹⁰³ Currently, 4 Member States already ban the disposal in landfills of fractions from post-shredder treatment.

components¹⁰⁴ are to be removed prior to the shredding phase, as to facilitate high quality recycling or re-use (M13a). Finally, to support reuse and remanufacturing of spare parts, a definition of remanufacturing (including conditions for warranty) would be introduced in the new legislation, as well as clearer instructions for reporting **on the level of re-use and remanufacturing** from ELVs (M14a). All these measures follow the suggestions provided in the F4F opinion focussing on retrieving higher volume and quality of secondary materials from the automotive sector¹⁰⁵. See Annex 7.2.3 for more details.

PO3B: This Policy Option contains the measures in **PO3A** and, in addition, **new enhanced measures** to promote the re-use and recycling of relevant metals, plastics and certain CRMs. The list of parts/components to be **removed prior to shredding** (mentioned in **PO3A**) **would be extended with parts and components with high concentrations of valuable materials or CRMs** (M13b)¹⁰⁶. A derogation to this removal requirement would apply if evidence can be provided by the dismantlers that the materials/parts/components will be separated with the same efficiency as manual dismantling/ semi-automated disassembly by post shredding technologies (PST). For monitoring purposes, Member States are to report on established and used capacities of PST plants. The option also foresees that incentives should be put in place to support the market for re-used and remanufactured parts, building on legislation and best practices in some Member States¹⁰⁷(M14b). To improve warranty conditions of used spare parts, information on their origin should be made mandatory as a condition for their sales (i.e., through the provision of the VIN number of the ELV the parts come from).

To boost plastic recycling and ensure a sufficient supply of recyclates to meet the demand for recycled plastics in vehicles (see PO2), a **specific plastic recycling target**¹⁰⁸ of 30% by 2031 would be established (M15b). To ensure improved quality of steel and aluminium scraps from ELVs, a ban on the mixing of ELV scraps with WEEE scraps (such as white goods and refrigerators) and packaging waste (such as aluminium cans) would be established for shredders (M16b), reducing (copper) impurities and improving traceability notably for the closed loop share of automotive plastics recycling¹⁰⁹. See Annex 7.2.3 for more details.

PO3C contains the measures in **PO3B** and, in addition, specifically targets **higher quality of recycling for specific materials**. Additional components **and novel lightweight materials** would be added to the list of parts/components to be removed prior to shredding (M13c)¹¹⁰. For glass, a material specific recycling target of 70% would be set, accompanied with quality criteria to ensure that only recyclates to container glass or equivalent quality are accounted towards the recycling target (M15c). The Commission would be required within 5 years to develop specific and additional requirements to improve the efficiency of post-shredder treatment (PST) operations by setting minimum quality standards (M16c). This may be

¹⁰⁴ The current ELV Directive lists in Annex I (4) batteries, large metal components (such as engines and gear boxes), large plastic components (bumpers, dashboard, fluid containers), catalysts, glass (including windshields, rear and side windows).

¹⁰⁵ For more information see Suggestion 7 at <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

¹⁰⁶ The additional parts would include e.g., main wiring harness (copper), electric and electronic components (such as printed circuit boards with a surface area > 10 cm², photovoltaic panels with a surface area > 0.2 m², controllers, engine motors), mono-material aluminium components with a weight > 10 kg, requiring the separate collection and treatment of cast and wrought aluminium, e.g., bumpers, wheels, heat exchangers, NdFeB permanent magnets, electric steel and copper from EV drive train in case not destined for (preparation for) reuse/remanufacturing.

¹⁰⁷ See for example the measure established in France that requires garage and repair shops to provide offers for used spare parts together with new spare parts to their customers (see Article L224-67 of the “Code de la Consommation”, available at https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000032226565/2018-01-19).

¹⁰⁸ Applying to ELV thermoplastics and polyurethanes.

¹⁰⁹ The WEEE Directive Art 5 requires separate collection for such products and Art 8/ Annex VII specifies selective treatment requirements.

¹¹⁰ This would include difficult to recycle lightweight materials such as glass and carbon fibre reinforced plastics, as well as smaller copper and EEE parts, small motors, inverters, etc.

needed in case novel sorting technologies for aluminium, magnesium or CRMs are insufficient. See Annex 7.2.3 for more details.

5.2.4 *Policy Options 4A, 4B, 4C and 4D (related to specific objective 4 ‘collect more’)*

PO4A, PO4B and PO4C target the specific objective 4 ‘Collect more’, with different policy strategies and scope. **PO4D** is a cumulative combination of both the collection and export measures under **PO4A, PO4B and PO4C**. See Annex 7.2.4 for more details.

PO4A focuses on **enhanced reporting and enforcement of existing rules**. Member States are required to keep better track of their national vehicle fleets and ELVs by **mandatory annual reporting on the number vehicles registered, de-registered, treated as ELVs and shipped outside the Member State of registration** (M17a)¹¹¹. To facilitate better traceability, a new obligation would be established for **dismantlers to issue a certificate of destruction (CoD) for each ELV treated and report it digitally** to the competent authorities of their Member State, and for **shredders to only accept ELVs with a corresponding CoD** and then to notify final destruction to the same competent authorities (M18). This is in line with the suggestions from the F4F platform which stressed that the delivery and registration of CoD need to be improved¹¹². Member States are encouraged to exchange best practices on the use of incentives to achieve higher ELV collection numbers¹¹³. To strengthen enforcement, there is a definition of **minimum requirements for sector inspections** and enforcement actions (M19a). Finally, reporting on sanctions applied by the Member States with respect to violations of the rules set out in the future legislation is added to the national reporting requirements (M17a).

PO4B provides new measures designed **to improve exchange of information between Member States on missing vehicles and to foster harmonised enforcement**. With regard to the exchange of information between Member States, PO4B consists in provisions to ensure that Member States (i) **provide additional information in their national vehicles registers** on elements which are necessary to track de-registered vehicles and ELVs¹¹⁴ and (ii) **provide access through digital means to their national registers to all other Member State competent authorities** to improve traceability (M20)¹¹⁵. This would allow for better control of the vehicle status and strengthen the ability of enforcement authorities to carry out more stringent checks on compliance, as stressed in the F4F opinion¹¹⁶. These provisions could be added either in Directive 1999/37/EC on the registration documents for vehicles or in the new legislation on 3R type-approval and ELV. For the **export of vehicles, the definition of ELVs will be clarified by introducing mandatory criteria which will make it easier to distinguish waste vehicles from used vehicles** (M19b) and hence avoid that ELVs are exported as used vehicles. It corresponds with the suggestion of the F4F opinion, acknowledging the illegal export of vehicles outside of the EU being one of the major issues with regard to the implementation of the ELV Directive¹¹⁷. Finally, **Member States would be**

¹¹¹ Complementing Commission Decision 2005/293/EC.

¹¹² RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022: <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

¹¹³ Notably through deposit return schemes whereby financial support is provided to the last owner of a vehicle upon its delivery to an ATF. Such schemes are in place in a number of EU Member States already.

¹¹⁴ This should include information on the motives for which vehicles are permanently removed from the register (treatment as an ELV in an ATF, export, theft, etc.), as well as a requirement for the owner of a vehicle which is “temporarily de-registered” to report changes on the ownership of the vehicle in question to the registration authority.

¹¹⁵ For example through the use of the European Vehicle and Driving Licence Information System (Eucaris).

¹¹⁶ For more information see Suggestion 3, <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

¹¹⁷ For more information see Suggestion 2, <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

required to establish appropriate sanctions for breaches of the legislation, in case of selling ELVs to illegal dismantlers, illegal export, illegal sales of used spare parts (M17b).

PO4C: Under this option, new provisions would be established with regard to the export of used vehicles outside the EU. First, exporters would be required to make available to customs the **vehicle identification number (VIN)** and the information on the validity of the roadworthiness status of used vehicles (M19c). Secondly, only those used vehicles which are verified to be roadworthy **would be authorised to be exported to non-EU countries**. In addition, the future legislation would foresee development of a complementary control mechanism to check how the EU vehicles comply with the rules on imports of used vehicles imposed by third countries¹¹⁸ regarding the environment and road safety. (M21).

PO4D: Under this option, **all** measures (M17 to M21, see Table 1) from PO4A, PO4B and PO4C are combined to most effectively achieve the objective **‘Collect more’**. The combination thus includes incentives and / or penalties to make use of CoDs, improvement of registration and deregistration procedures, better statistics / monitoring on vehicle stock and import / export and the fight against illegal export of ELVs and environment, health and safety problems in the receiving countries.

5.2.5 Policy Options 5A, 5B and 5C (related to specific objectives 1 to 4)

PO5A, PO5B and PO5C aim at establishing economic incentives and organisational arrangements contributing to meeting the first four specific objectives of the initiative to ensure proper implementation. They are cumulative.

PO5A requires Member States to establish specific Extended Producer Responsibility (EPR) schemes for vehicles¹¹⁹, aligned with the minimum requirements applicable to other sectoral waste streams, as specified in the Waste Framework Directive¹²⁰. This means that Member States would require vehicles manufacturers to bear financial and organisational responsibility for the management of the waste stage of the vehicle life cycle, including sorting and treatment operations, in addition to cost coverage which is already part of the requirements of the current ELV Directive. The F4F opinion particularly recommended to focus on proper implementation of polluter pays principle through addressing the mandatory treatment operations that are not economically viable¹²¹. Member States would have to establish such schemes, or extend the scope of existing ones, to ensure that vehicle manufacturers provide for advanced measures to guarantee that legal requirements for collection and treatment of ELVs are achieved (M22). When it comes to collection of ELVs, this would include **digitalisation of reporting of ELVs collected and treated in ATFs and shredders**, and **dedicated awareness-raising campaigns** designed to improving the collection of ELVs. When it comes to treatment, **vehicle manufacturers will be made responsible for the costs** related to the difference between revenues generated by the sale of parts/components/materials resulting from the dismantling/recycling processes and the costs linked to their **mandatory dismantling and recycling** and other treatment requirements that are net cost negative (M23). Producer responsibility may be organised collectively or individually, while setting uniform conditions for the modulation of the financial contributions to avoid distortion of the internal market and to limit administrative burden, where necessary. See Annex 7.2.5 for more details.

¹¹⁸ For example on limitations of imports linked to the age or compliance with emission standards of used vehicles

¹¹⁹ There are already provisions on cost coverage of delivery/take-back of an ELV by producers (Article 5(4) ELVD).

Although not a fully-fledged EPR scheme, the basics of cost coverage already exist and are explicitly referred to in the WFD (article 8a(4)). This means that PO5 would not necessarily entail starting up completely new EPR schemes

¹²⁰ See Articles 8 and 8a of the Waste Framework Directive (Directive (EU) 2018/851).

¹²¹ For more information see Suggestion 7 at <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>;

PO5B: Policy option 5B complements the obligation for Member States to establish EPR schemes for ELV with harmonised requirements designed to ensure a uniform and fair implementation across the EU single market. To avoid that Member States apply diverging methodologies relating to the responsibilities of the vehicle manufacturers, **harmonised criteria for the modulation of fees to be paid by vehicle manufacturers would be set, based on circularity features**, such as the weight of a vehicle, the dismantling time for key parts/components like batteries, the expected level of recyclability/re-usability, the share of materials preventing high-quality recycling process and the level of recycled content (for metal, plastics and CRM) (M24). These elements comply with the recommendations of the F4F recalling that including recyclability and durability criteria in vehicle design can facilitate dismantling and lift implementation burden from ATFs¹²². Taking into account the large volume of used cars shipped within the EU and the need for fair cost allocation between economic actors in different Member States, **specific requirements are put in place to make sure that vehicle manufacturers contribute to the costs of dismantling and recycling of vehicles which become ELVs in a Member State different from the Member State where it was first registered (“cross-border EPR”)** (M25). See Annex 7.2.5 for more details.

PO5C includes **advanced economic incentives** to increase the collection of ELVs and promote the market for vehicles manufactured in a circular manner. It gives the discretion for the Member States to establish **“deposit return schemes”** based on the common EU wide criteria, whereby a lump sum of money is given to the last owner of an ELV upon its delivery to an ATFs (M26). This measure reflects the suggestion of F4F platform¹²³. The second component of this option is the possibility to establish harmonised **Green Public Procurement (GPP) criteria for the purchase of all vehicles**, based on circularity criteria described for PO5B, and consistent with the Clean Vehicles Directive¹²⁴(M27). See Annex 7.2.5 for more details.

5.2.6 *Policy Options 6A, 6B and 6C (related to specific objective 5 ‘cover more vehicles’)*

PO6A, PO6B and PO6C target the specific objective 6 ‘Cover more vehicles’ with an increasing level of ambition. These options are cumulative.

PO6A includes a **limited extension of the scope** of the new legislation to additional categories of vehicles including L3e-L7e-category vehicles, buses (M2,M3), lorries (N2,N3) and trailers (O)¹²⁵. The manufacturers of these vehicles would be required to **provide information to dismantlers and recyclers**, through existing or new platforms, **to facilitate depollution, dismantling and recycling** of these vehicles (M28). This shall include at the minimum information on the location of substances of concern, of CRMs as well as instructions on dismantling. These requirements **would not be applicable to special purpose vehicles, multistage and vehicles produced in small series**. See Annex 7.2.6 for more details.

PO6B consists of a **broad extension of the scope of the new legislation**. In addition to the requirements set out in PO6A, it includes a **mandatory requirement that end-of-life L3e-L7e category vehicles (which includes motorcycles), lorries, buses and trailers are treated in an ATF**, with their dismantling accompanied by a CoD similar to PO4A (M30a). To complement this measure and ensure traceability of used vehicles, used **lorries and buses**

¹²² Ibid.

¹²³ For more information see Suggestion 5 at <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>; RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022;

¹²⁴ [Directive \(EU\) 2019/1161](#) of the European Parliament and of the Council of 20 June 2019 amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles (OJ L 188, 12.7.2019, p. 116–130). A review of this Directive is foreseen by the end of 2027.

¹²⁵ Vehicles of categories L3-L7, M2, M3, N2, N3 and O.

should be subject to similar requirements as for passenger cars **with regard to export related requirements based on roadworthiness** (M30b). **Manufacturers of lorries and buses should also be requested to assume the responsibility for the collection and reporting obligations set for these vehicles (basic EPR scheme)** (M31). Finally, a review clause for a phased-in future scope extension is included when more information is available (M32). See Annex 7.2.6 for more details.

PO6C: Policy sub-Option 6C includes a full scope extension, with all requirements for M1 and N1 vehicles equally applying to the additional vehicles categories as well in the medium term. This implies full application of the modernised 3R type approval procedure and requirements on reusability, recyclability and recoverability as specified in PO1A-C, the recycled content requirements of PO2A-C, the advanced waste treatment requirements of PO3A-C (M33) and finally, the **establishment of EPR schemes**, including compliance cost offsetting and the other minimum EPR requirements as under PO5A-C, for L3e-L7e category vehicles, lorries, buses and trailers (M34). See Annex 7.2.6 for more details.

5.3 Measures discarded at an early stage

These measures were screened to identify those that should be retained for further analysis. Annex 7.3 provides a detailed list of individual discarded measures and the rationale behind their screening out from further consideration. A short summary of discarded measures per intervention area and the reasons for discarding are presented here:

Design circular (specific objective 1): A range of voluntary measures, non-binding guidelines and pledges by manufacturers to increase circularity are discarded due to low effectiveness and higher results expected from the circularity strategy measure under PO1B. Setting obligatory **due diligence** requirements for materials used in vehicles is discarded as being covered under the Corporate Sustainability Due Diligence Directive (CSDD)¹²⁶. Setting overall carbon footprint requirements for the entire vehicle is not included, but this problem is addressed through direct measures in Policy Option 2. See Annex 7.3.1 for more details.

Use recycled content (specific objective 2): Setting levels of plastics recycled content above 30% in 2031 is discarded as they are not attainable without serious supply – demand misbalances and disproportionate costs. Setting at this point in time recycled content targets for glass, rubber, CRMs and other metals (such as copper and aluminium) is also discarded, in view of other measures under PO3. However, the possibility to set such targets at a later stage is foreseen in case market failures would not be sufficiently addressed (M11). See Annex 7.3.2 for more details.

Treat better (specific objective 3): Setting material-specific recycling rates for steel, aluminium or copper was discarded since the recycling rates are already high (steel, aluminium) and the main concerns are related more to scrap qualities. Here, other measures such as mandatory removal of parts and improving sorting and waste treatment are more effective and indirectly improve copper recycling rates. The same counts for other materials like glass, plastics and specific components such as electronics. Setting recycling targets for CRM was also discarded at this stage, but recycling should be considerably enhanced through other measures, especially relating to the design of new vehicles (obligation to declare location and dismantling information for CRM), improved waste treatment (obligation to remove parts and components containing CRM to ensure their recovery) and EPR schemes (fee modulation taking into consideration amount of CRM and recycled CRM in new vehicles). See Annex 7.3.3 for more details.

¹²⁶ Proposal for a Directive of the European Parliament and of the Council on Corporate Sustainability Due Diligence and amending Directive (EU) 2019/1937 (COM/2022/71 final)

Collect more (specific objective 4): A range of voluntary measures are discarded due to low expectations on their effectiveness, important feasibility challenges, subsidiarity reasons or legal obstacles, including the setting of an EU-wide Deposit Refund Scheme (DRS), which would require strict rules for registration and deregistration and be sensitive to fraud. Setting collection targets at Member State level is discarded as other measures are expected to be more directly effective. As an alternative to the requirement for the exporters to non-EU countries to provide the information on the roadworthiness status of the used vehicles, another measure was considered, according to which a maximum age of the vehicle or a minimum EU emission standard would be established for the export of all used vehicles from the EU to third countries. However, such regulatory approach was not followed, as it could have a disproportionate effect of banning all the export of used vehicles, in manner which would not allow to take into account the specific import requirements for the used vehicles, when these are officially applied by the import countries. Instead, it was decided to base the export of used vehicles on the requirement to have a valid ‘roadworthiness’ status in accordance with Directive 2014/45/EU. The assessment showed that this approach is the most effective as it allows to prove whether these vehicles comply with the EU stringent environmental and safety standards. Moreover, such approach would ensure that the vehicles which are exported with the aim to continue their service in third countries, are not of lower quality than those which are authorised to be on the EU public roads See Annex 7.3.4 for more details.

Provide appropriate financial and organisational incentives (specific objectives 1-4): Mandatory collection of vehicles at holder’s premises and collection of abandoned vehicles free of charge are discarded as cost-ineffective and not stimulating vehicle owners to hand in vehicles at designated facilities. The option that vehicle manufacturers could set up EU-wide EPR schemes (rather than at national level) was discarded due to (i) subsidiarity constraints, as the organisation of the waste management systems, the relations between waste operators, the vehicle registers and the management of EPR schemes are currently operated at national level (ii) concerns that it would not be politically acceptable by Member States and (iii) lack of EU staff and funds available to set up the required EU instance to manage such a scheme. For more information see the description of this discarded measure M48 in Annex 7.3.5. However, vehicle manufacturers would still have the option to set up individual schemes within the national schemes put in place by Member States (M22). In addition, the Member States would need to make sure that the “cross-border” dimension of the problem (i.e. large number of vehicles dismantled in a Member State different from the one where they were put on the market for the first time) is properly addressed (M25). This would make it easier for vehicle manufacturers to develop an EU-wide approach for their extended responsibility, even when this is based on national EPR schemes. See Annex 7.3.5 for more details.

Cover more vehicles (specific objective 5): Extension of the vehicle category scope to special purpose vehicles, multistage vehicles and vehicles produced in small series is discarded as, on the basis of available information the measure appears disproportionate. See Annex 7.3.6 for more details.

6 WHAT ARE THE IMPACTS OF THE POLICY OPTIONS?

6.1 Methodological considerations

The quantification of the impacts of the policy options relies on studies and quantitative models complemented with qualitative assessments for those cases where data is scarce. The information sources include in particular a study by Oeko-Institut¹²⁷ which includes a custom-

¹²⁷ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

made impact assessment model for the purpose of this revision, a dedicated report by the JRC on recycled plastic in vehicles¹²⁸ and a JRC study on CRMs in vehicles¹²⁹. Data on the number and types of vehicles placed on the market are the same as in the Euro 7 impact assessment, complemented by an assessment of the number of vehicles becoming waste, collected and exported annually¹³⁰. The model computes a variety of policy options individually and the effect of combinations of them for the preferred options proportional to the mass flows involved. Detailed information can be found in Annex 4. To improve robustness of the analysis, the estimated impacts and their underlying assumptions were presented in stakeholder workshops and verified by independent experts, the JRC and concerned stakeholders. In the following sections, the individual tables summarise the main environmental and economic impacts for each of the policy options. The impacts presented are for the year 2035¹³¹.

For the environmental impacts, avoided greenhouse gas emissions and the amount of materials recovered (at higher quality compared to the baseline) are chosen as the main categories to summarise results. Some of the measures target an improvement in the quality of materials recycled from vehicles and not just an increase in quantity. These different recycling qualities have a financial significance which is captured in the calculation of revenues from recycled material as well environmental benefits which are quantified as far as possible. Data for other years, broken down per vehicle, are available in Annex 8.

For economic impacts and how stakeholders are affected, cost and revenue redistributions between operators are taken into account. The main ‘reallocation’ elements are the future value of plastic recyclates from the plastics recycled content, the value of cleaner steel scraps and the revenues derived from dismantled materials at ATFs. The reduced value of dismantled ‘hulks’ is accounted for by reduced payments of shredders to ATFs. Another significant effect relates to the value of vehicles not exported anymore. The impact assessment takes account the effect on prices of vehicles, as additional costs on vehicle manufacturers and other economic operators are ultimately passed on (partially or in full) to consumers.

In the tables below, when referring to monetary impacts, the minus (-) symbol is used when referring to a cost (a negative monetary impact) and a plus (+) in case of a revenue (a positive monetary impact). All values are presented as net present values. Economic data presented reflects how costs and revenues are expected to be allocated to various stakeholder, including underlying assumptions and sensitivities.

6.2 Environmental impacts

6.2.1 *Design circular: Improve reusability, recyclability and recoverability, 3R type-approval*

The strength of the 3R type-approval approach is that a vehicle type cannot be placed on the EU market unless it complies with all type approval requirements. The actual benefits of measures to improve recyclability, reusability and recoverability of vehicles are of a mid- or

¹²⁸ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

¹²⁹ N. Tazi, M. Orefice, C. Marmy, Y. Baron, M Ljunggren, P Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821.

¹³⁰ Commission Staff Working Document accompanying the Regulation of the European Parliament and of the Council on type-approval of motor vehicles and of engines and of systems, component and separate technical units intended for such vehicles, with respect to their emission and battery durability (Euro 7)

¹³¹ More information on the projections used in the SWD are explained in Annex 4.

long-term prevention nature when vehicles become waste many years later. It is therefore difficult to quantify the exact environmental benefits and values in the future. Nonetheless, the value of the measures can be compared qualitatively against the current baseline, since past vehicle design choices frequently hinder current recycling possibilities.

The general reusability and recyclability of vehicles placed on the market following the **PO1A - improved 3R type-approval compliance verification** requirements are expected to improve the level of reuse and recycling by about 5% in the long term. **PO1B - Circularity Strategy** (incl. PO1A measures) will have more immediate effect. The design for dismantling requirements and increased cooperation with recyclers will enhance recycling of increasing shares of lightweight, difficult-to-recycle materials in the medium-term. **PO1C – Circularity Vehicle Passport** (incl. PO1A and PO1B measures) ensures that necessary reuse and dismantling information to address existing information gaps to match supply and demand is delivered using digital technology. Reuse and recycling rates will increase further in the long term due to repairability requirements on the use of digital keys and interchangeable components. The additional **mandatory declaration on the use of recycled content** for all materials provides better substantiation of related claims to the consumer, supporting greener vehicle purchase decisions and providing an incentive for further decarbonisation achievements in the supply chains. For substance restrictions, the ‘transfer to REACH’ and the ‘hybrid approach’ will have effectively similar impacts given either ELV, under REACH or in a hybrid approach a comprehensive approach to restrict these substances is introduced. More detailed information can be found in Annex 8.1.1.

6.2.2 Use recycled content: increase recycling and decarbonise production for selected materials

PO2A – plastic recycled content targets¹³² of 10% in 2035 based on the **fleet level** create a final demand for recyclates in the automotive industry of 240 ktons in 2035¹³³. **PO2B – targets** of 25%¹³⁴ starting in 2031 **for newly type-approved** vehicles correspond to an additional demand of recyclates of 713 ktons for 2035. This should boost the recycling of plastics from ELVs, as this means that 53% of ELV plastics recyclates would have to be reintroduced in the automotive sector. **PO2C – targets** of 30% in 2035 correspond to a demand of recyclates of 872 ktons in 2035¹³⁵. The target would represent an effective recycling rate of available ELV plastics of 64% which poses a supply – demand imbalance risk. The GHG savings linked to **PO2B** would be 314 ktons of CO₂-eq, and 376 ktons of CO₂-eq for **PO2C**.

For steel, a recycled content target under **PO2B** and **PO2C** provide an additional push to integrate higher quality scrap into new vehicles, assuming such scrap becomes available, with roughly 585 ktons of GHG savings in comparison to the baseline for 2035 and 900 ktons towards 2040 for **PO2B**. Compared to **PO2A**, **PO2B** and **PO2C** would reduce the demand for natural gas, coal and iron ore and increase the demand for electricity by 2035 as displayed in Table 2. The summary of the main environmental impacts for the PO1 and PO2 affecting the design and production stages are visualised in Table 1. For more information see Annex 8.1.2.

Table 2 Environmental impacts of Recycled Content targets for plastics and steel, 2035

Environmental impacts	PO2	PO2A	PO2B	PO2C

¹³² Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

¹³³ Corresponds with the scenario JRC3a of the JRC study (JRC129008).

¹³⁴ Corresponds with the scenario JRC4b in the Annex of the study (JRC129008).

¹³⁵ Corresponds with the scenario JRC4c in the Annex of the study (JRC129008).

(in 2035, annual compared to baseline)				
Vehicles placed on market (units)		15,025,000		
Recycled content plastics (JRC study)	PO2 plastics	10% in 'fleet' in 2035	25% of newly TA from 2030	30% of newly TA from 2030
Design and production	Baseline	(values in addition to baseline)		
Recycled content plastics (kton)	123	+240	+713	+873
CO ₂ savings (kton CO ₂ -eq., plastics RC)	46	+90	+314	+376
Reduced deace incidence PM	2	+4	+13	+16
Energy savings (GWh)	1,161	+2,264	+7,283	+8,740
BOE (million Barrel of Oil equivalent saved)	1	+1.4	+4.5	+5.4
Contribution to the CPA targets	1%	3%	8%	9%
Recycled content steel	PO2 steel	PO2A	PO2B	PO2C
Recycled content steel (kton)	1,515	0	+505	+1,212
CO ₂ savings (kton CO ₂ -eq., steel RC)	1,754	0	+585	+1,404
Reduction in Electricity use (GWh)	-776	0	-259	-621
Natural gas savings (million m ³)	45	0	+15	+36
Hydrogen savings (ton H ₂)	9,185	0	+3,062	+7,348
Coal savings (kton)	500	0	+167	+400
Iron ore savings (kton)	1,808	0	+603	+1,446

6.2.3 Treat better: Improve treatment quality and quantity

All three options under **PO3** bring significant environmental benefits from higher quantities and qualities of recycling. For **PO3A**, the effect of better implementation of the current Annex I of the ELV Directive has a significant positive effect of about 1 million tons of materials recovered at higher quality, corresponding with 1.5 million tons of CO₂ savings compared to the baseline. In order of magnitude of GHG savings, improved aluminium and steel recycling contributes the most, followed by the environmental benefits of improved plastics recycling¹³⁶. **PO3B** (incl. PO3A) and **PO3C** (incl. PO3B measures) bring even higher benefits. The increased separation of (cast) aluminium components provides significant gains for **PO3B** of around 3.7 million tons of CO₂-eq saved, primarily due to reuse and corresponding aluminium production avoided. Initial assessment for the e-drive motors mandatory removal prior to shredding shows that circa 1 million ELV in 2030 and 5 million ELVs in 2040 will be affected by this provision¹³⁷, respectively, compared to baseline scenario. Copper recovery from e-drive motors would increase by 97% and would decrease contamination of secondary base metals, hence increasing quality. The mandatory removal and separate recycling of e-drive motors would also thrive the permanent magnet recycling value chain and generate new flows of CRMs for further recycling. It is estimated circa 4.2 kton of permanent magnets, including 1.5 kton of REEs, to be available in 2040 for high quality recycling from future EU ELVs. For **PO3C**, the advanced quality targets provide savings equivalent to 2.9 million tons of CO₂-eq.

The update of the recycling, reuse and remanufacturing definitions proposed in the revision would exclude some recycling processes that yield very-low quality recyclates. A more consistent definition of recycling in particular provides an incentive for the improved recycling of plastics and glass contributing to 600 kton and 200 kton of annual GHG savings respectively. The results are excluding the effect of increased collection from PO4 but already

¹³⁶ Recycling quality improvements of PO3 are not overlapping with the allocation of plastics recycling benefits of PO2 to avoid double counting.

¹³⁷ N. Tazi, M. Orefice, C. Marmy, Y. Baron, M Ljunggren, P Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821.

includes the PO5 effect of EPR measures in the last column of Table 3. See Annex 8.1.3 for a detailed assessment per material and other years.

Table 3 Environmental impacts of improved treatment quantity and quality, 2035

Environmental impacts (in 2035, annual compared to baseline)	PO3	PO3A	PO3B	PO3C	Amplification (+ EPR)
ELVs treated EU (units, legal & illegal)			9,621,000		+2,107,000
Recycling stage (kton of material)	Baseline	(values in addition to baseline)			
Steel (reused and recycled pre-shredder)	719	+812	+1,188	+1,457	+273
Aluminium (reused and recycled pre-shredder)	133	+99	+365	+204	+84
Copper (reused and recycled pre-shredder)	11	+27	+79	+54	+18
Glass (recycled pre-shredder, high quality)	22	+4	+131	+131	+30
Plastics (reused and recycled pre-shredder)	84	0	+125	+138	+29
CRMs (permanent magnet materials)		+0.35	+0.35	+0.35	0
Improved quality (kton of material)	161	+381	+1,217	+1,313	+280
Recycling stage - GHG savings (kton CO ₂ -eq)	Baseline	(values in addition to baseline)			
Steel	6,662	+597	+641	+672	+147
Aluminium	14,270	+693	+1,994	+1,309	+459
Copper	318	+69	+143	+76	+33
Glass	13	+4	+126	+126	+29
Plastics recycling (allocated to PO3)	929	0	+758	+661	+174
EEE (inventor only)	139	+15	+26	+36	+6
GHG savings (kton CO ₂ -eq.)		+1,378	+3,688	+2,880	+848

6.2.4 Collect more: Improve collection quality and quantity

Under policy options **PO4A** to **PO4C**, improved collection of ELVs increases the number vehicles treated at ATFs and reduces extra-EU exports, leading to more higher quality recycling the EU. The cumulative **PO4D**, which combines all measures from **PO4A** to **PO4C**, is the most effective as it generates synergies from this combination, which are higher than a simple addition. The resulting summary of environmental impacts shows significant additional material recovery and corresponding GHG savings. **PO4B**, with improved enforcement and harmonised national registers, significantly reduces the number of vehicles of unknown whereabouts and improves the quality of treatment at ATFs, resulting in 1.5 million tons of CO₂-eq from recycling plus 0.1 million tons CO₂-eq. from better recovery of air conditioning refrigerants. **PO4C**, which focusses on export regulatory measures, is expected to save up to 3.2 million tons of CO₂-eq from recycling plus 0.2 million tons CO₂-eq. from better recovery of air conditioning refrigerants. The CO₂ savings take account of the fact that the CO₂ emissions generated by the dismantling of old vehicles as waste in the EU and the production of new cars to replace them are offset by the reduction of CO₂ emissions achieved when taking into consideration the emissions generated, during their use phase, by newly produced vehicles, compared to much older ones. The highest impacts are achieved with **PO4D**, a combination of all measures, with savings of 5.6 million tons of CO₂-eq. In addition to GHG savings, eliminating the export of non-roadworthy used vehicles from the EU to third countries will decrease the external environmental and health related costs associated with air pollution¹³⁸ as well as with the informal dismantling of vehicles (linked for example to improper treatment of waste oil, tyres, refrigerants from air-conditioning systems and lead-acid batteries, which is a significant source of lead pollution in developing

¹³⁸ For the assessment of magnitude of possible external costs associated with the export of used non-roadworthy vehicles from the EU to third countries, see the Handbook on the External Costs of Transport: European Commission, Directorate-General for Mobility and Transport, Essen, H., Fiorello, D., El Beyrouthy, K., et al., Handbook on the external costs of transport: version 2019 – 1.1, Publications Office, 2020, <https://data.europa.eu/doi/10.2832/51388>

countries¹³⁹) in the receiving countries. The measure is likely to lead to changes in the overall vehicle fleet imported in receiving countries: the replacement of old used vehicles with more modern ones would lead reduced air pollution and increase road safety. In addition, as the lifetime of modern vehicles is longer than the lifetime of old ones, there would less vehicles becoming waste in the recipient countries¹⁴⁰. This would therefore reduce the pollution caused by the unsound treatment of ELVs in the countries concerned¹⁴¹. This will reduce the EU external pollution footprint and support the development of policies and actions supporting a more sustainable, safer and efficient transport system in these countries. More information is available in Annex 7.2.4 under M21.

Table 4 Environmental impacts of improved collection, 2035

Environmental impacts (in 2035, annual compared to baseline)	PO4	PO4A	PO4B	PO4C	PO4D	Amplification (+EPR)
Collection stage (units)	Baseline	(values in addition to baseline)				
ELVs treated in the EU (legal & illegal)	9,620,640	+115,624	+501,037	+1,079,156	+1,721,511	+321,177
to ATFs and CoD (reported)	7,630,563	+218,401	+796,520	+1,374,639	+2,916,291	+385,413
treated in the EU (non-reported)	1,990,077	-102,777	-295,483	-295,483	-1,194,780	-359,719
Export of used vehicles and ELVs	3,226,456	-115,624	-501,037	-1,079,156	-1,721,511	-385,413
Used vehicles + ELV export reduction	0.0%	3.6%	16%	33%	53%	+12%
Materials recovered (ktons)	8,568	+103	+446	+961	+1,533	+284
Steel/ cast iron	7,084	+85	+369	+795	+1,268	+43
Aluminium	1,074	+13	+56	+121	+192	+6
Copper/Brass	142	+2	+7	+16	+25	+11
Average Plastic	268	+3	+14	+30	+48	+1
Platinum	30	+0	+2	+3	+5	+0.3
GHG savings recycling (kton CO ₂ -eq.)	27,850	+353	+1,513	+3,222	+5,218	+1,132
GHG savings refrigerants (kton CO ₂ -eq)	969	+30	+113	+207	+408	+56

6.2.5 Provide appropriate financial and organisational incentives to improve collection and waste treatment

The assessment of the EPR and economic incentives related measures, described in **PO5A**, **PO5B** (incl. PO5A) and **PO5C** (incl. PO5B), is based on their amplifying effect on the measures for recycling (under **PO3A** - **PO3C**) and on collection (under **PO4A** to **PO4C**), and previously displayed in the Tables 3 and 4. The amplifying effect of EPR on the compliance level for collection and recycling is calculated and shows an additional 12% reduction in export of non-roadworthy used vehicles and ELVs, or 385,000 fewer vehicles exported, plus an extra 320,000 units brought to ATFs in the EU at end of life. The combined effect is an additional 284 kton of materials and 1.1 million tons of CO₂-eq, which includes 56 kton of equivalent CO₂ savings from improved refrigerant recovery. More details are available in Annex 8.1.4 and 8.1.5.

¹³⁹ <https://apps.who.int/iris/rest/bitstreams/1091390/retrieve>

¹⁴⁰ If the vehicle is imported at an age of 5 years, it will possibly last another 25 years in the country of destination before becoming an ELV. An imported vehicle with an age of 18 years might last another 12 years in the receiving country before becoming waste. Thus, the waste generated for the same service is twice as much when old vehicles are imported.

¹⁴¹ For more information on these aspects, see section 6.12 in Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

6.2.6 Cover more vehicles: Extend the vehicle category scope

The main indicator used to assess the environmental and economic impacts of **PO6A**, **PO6B** (incl. PO6A) and **PO6C** (incl. PO6A and PO6B measures) is the number of additional vehicles which would be treated in ATFs in the EU compared to the baseline, as well as the corresponding materials which would be recovered. For the environmental impact assessment, the GHG savings linked to such recovery is then calculated for L3e-L7e category vehicles, buses (M2, M3) and lorries (N2,N3), but not for trailers due to lack of information. For **PO6C**, the export reduction effect of a full EPR system (M31c) can be determined as well, however, the full scope extension to 3RTA, recycled content targets cannot be quantified (M33). On that basis, the assessment shows that the environmental benefits of **PO6A** are modest, as it would result in a limited number of additional lorries, buses and L3e-L7e category vehicles dismantled in ATFs compared to the baseline, and of the corresponding materials recycled or re-used. **PO6B** would provide higher environmental benefits, including 510 ktons (PO6B) and 660 ktons (PO6C) of material reused or recycled at higher quality. This corresponds with 1,1 million respectively 1.4 million tonnes of CO_{2eq} as GHG savings. This is the result from:

- (i) the obligation to treat all lorries, buses and L3e-L7e category vehicles in ATFs, which would reduce increase the number of vehicles treated by ATFs by 39% and reduce those treated by the informal sector in the EU under less environmentally efficient conditions (M30a). This measure would particularly affect L3e-L7e category vehicles;
- (ii) the new requirements on the export of used lorries and busses, which could lead to a drop in export in non-roadworthy vehicles of up to 19% and subsequent treatment of these vehicles in ATFs in the EU (M30b);
- (iii) the basic requirements for manufacturers of lorries, buses and L3e-L7e category vehicles to facilitate collection and reporting on end-of-life vehicles (M31).

The environmental benefits of **PO6C** are expected to be larger than for **PO6B**, as **PO6C** would entail a much broader range of measures affecting the design, type-approval and treatment of lorries, buses and L3e-L7e category vehicles. However, there is insufficient information on parameters (for example on the feasibility to set up recyclability target under the type-approval framework, as well as an overall recycling target for the whole vehicle at end-of-life stage; on current rate and possible increase in the use of recycled materials; on the feasibility to require that a list of “difficult-to-recycle materials” are removed prior to shredding) which are key to calculate the environmental benefits of the measures under **PO6C**. It is therefore not possible to quantify the additional impacts of M33.

Table 5 Environmental impacts of the scope extension, 2035

Environmental impacts (2035, compared to baseline)	PO6	PO6A	PO6B	PO6C*
Scope extension (values in million units)	Baseline	(values in addition to baseline)		
ELVs (L3e-L7e-category vehicles)	1,624,242			
ELVs (buses, M2,M3)	32,972			
ELVs (lorries and trailers, N2,N3,O)	289,992			
ELVs to ATFs (L3e-L7e-category vehicles)	0	Not assessed	+487,273	+633,454
ELVs to ATFs (M2,M3)	21,762		+2,119	+2,754
ELVs to ATFs (N2,N3,O)	75,398		+35,408	+46,030
ELVs non-reported to ATFs (L3e-L7e)	0	Not assessed	30%	39%
ELV+ used export reduction (M2,M3)	11,211		19%	25%
ELV+ used export reduction (N2,N3,O)	214,594		17%	21%
Materials recovered (ktons of materials)		(values in addition to baseline)		
Additional reuse (L3e-L7e, ktons)	301	Not assessed		
Additional reuse (M2, M3, ktons)	104		+31	+40
Additional reuse (N2, N3,O, ktons)	553		+166	+216

Additional recycling (L3e-L7e, ktons)	191	Not assessed	+57	+75
Additional recycling (M2, M3, ktons)	127		+38	+49
Additional recycling (N2, N3,O, ktons)	720		+216	+281
Total materials recovered (ktons)	1,995		+508	+661
GHG savings (ktons of CO2eq.) (values in addition to baseline)				
GHG savings (L3e-L7e, ktons CO2eq.)	2,639	Not assessed	+126	+164
GHG savings (M2, M3, ktons CO2eq.)	1,235		+152	+178
GHG savings (N2, N3,O, ktons CO2eq.)	2,055		+841	+1,094
Total GHG savings (ktons of CO2eq.)	5,929		+1,120	+1,436

*Excluding impacts for the full scope extension of M33. Only impacts of measure M31c (EPR and collection) are assessed.

6.3 Economic impacts

6.3.1 Design circular: Improve reusability, recyclability and recoverability

The estimated operational costs for modernising the 3R type-approval framework of **PO1A**, excluding administrative costs, are rather limited and assessed qualitatively. The revisions to the 3R-type-approval calculation will make the process somewhat more complex for OEMs and type-approval authorities. Possible sanctions for non-compliance are not included in these estimates. The expected increase in the rate of reuse of certain components means suppliers of new replacement part see a loss of business, while ATFs and remanufacturers will see an increase. Vehicle owners shall benefit from increased supply of spare parts from improved digital marketplaces and less digital keys hampering repair. With a large number of different parts and values, these revenues are not quantified. The costs of improving recyclability of difficult-to-recycle materials and R&D related to the circularity strategies in **PO1B** (incl. PO1A) are not assessed in detail, but the envisaged cooperation between recyclers and manufacturers is an important improvement, frequently mentioned by a range of stakeholders. Costs for developing the digital Circularity Vehicle Passport are determined at 2 million EUR annually and thus relatively limited under **PO1C** (incl. PO1A and PO1B measures). It overlaps with existing and new digital platforms that manufacturers are further expanding. Thus, development costs are already assumed for the baseline. For substances, the ‘restriction under REACH and other existing legislation’ and the ‘hybrid approach’ will have overall similar impacts, with a slightly higher impact in terms of administrative burden given the need for automotive operators to familiarise with REACH and its restriction procedures. They hybrid approach is assessed to be that resulting in the highest ease of implementation. More information can be found in Annex 8.1.1. Administrative costs are presented in Section 6.4 and Annex 8.3.

6.3.2 Use recycled content: increasing recycling and decarbonising production for selected materials

The costs and revenues for the plastics and steel recycled content targets are summarised in Table 6¹⁴². It is assumed the quality of produced recyclates comply with the technical specifications of manufacturers. This requires investments in recycling technology. The total sum of costs and revenues range approximately from 15 to 49 EUR/vehicle in 2035, depending on the sub-options as well as on expected new price setting of recyclates. Costs are relatively high in the short term as manufacturers and suppliers will adapt production, carry out the necessary R&D, testing and validation of the new blends and securing supply from recyclers. For the targets of **PO2B**¹⁴³ and **PO2C**¹⁴⁴, in 2035, the measures would cost 740

¹⁴² Based on the JRC study, see Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

¹⁴³ Corresponds with scenario 4b in the JRC study.

¹⁴⁴ Corresponds with scenario 4c in the JRC study.

respectively 1,170 million EUR but generate a net profit for recyclers of 600 respectively 70 million EUR at the same time thus providing an important incentive for secondary markets for raw materials.

Table 6 Economic impacts of recycled content targets for plastics and steel, 2035

Economic impacts (in 2035, annual compared to baseline, excl. admin costs)	PO1	PO1A	PO1B	PO1C
Vehicles placed on market (units)	Baseline	15,025,000		
Design stage		(values in addition to baseline)		
Operational costs 3RTA (qualitative)		(-)	(--)	(--)
Hazardous substance declaration (qualitative)		(o)	(o)	(o)
Production: Recycled content plastics (JRC study)	PO2 Plastics	PO2A (PoM 6-10%)	PO2B (TA 2030 25%)	PO2C (TA 2030 30%)
Recycled content plastics (kton)	95	+240	+713	+873
Manufacturer and supplier costs	0	-205	-392	-739
Recycler investments	-4	-20	-69	-83
Plastics (processing costs)	-53	-101	-284	-349
Plastics (revenues recyclers)	112	+216	+602	+739
Production Recycled content steel	PO2 Steel	PO2A	PO2B (20% in 2035)	PO2C (30% in 2035)
Recycled content quality steel (kton)	1,515		+505	+1,212
Shredder and sampling costs (HQ steel, M EUR)			-4	-10
Steel industry (cost HQ scrap, M EUR)			-33	-80
Manufacturers (premium RC steel, M EUR)			-33	-80
Shredders (revenues HQ scrap, M EUR)			+33	+80
Steel industry (reduced processing costs, M EUR)			+33	+80
Total costs plastics + steel (all stakeholders)	-58	-326	-816	-1,340
Total revenues plastics + steel (all stakeholders)	112	+216	+668	+899

For the recycled content target for steel, the necessary shredder costs for improving ELV steel scrap sampling to ensure quality requirements are estimated at 4 million EUR for **PO2B** and 10 million EUR for **PO2C**. Further costs for improving quality of treatment, including a ban on mixed treatment and the removal obligations of components are allocated to **PO3**. On the costs side, the cost potential is estimated at 66 million EUR, assumed to be split between the steel industry and automotive manufacturers. These (avoided) costs do present an increasing purchasing price for steel producers, which could be covered by lower ETS¹⁴⁵ costs, estimated conservatively at 132 EUR resp. 156 EUR/ton CO_{2eq} according to the low scenario of the DG MOVE handbook¹⁴⁶. The corresponding GHG reduction is presented in Section 6.2.2. See Annex 8.1.2 for more details and assumptions.

6.3.3 Treat better: Improve treatment quality and quantity

The results of the impact assessment for **PO3** are displayed below. The majority of the costs are for the dismantlers and linked to the requirements on removal of parts prior to shredding in **PO3A** and **PO3B** (around 350 million EUR), partially compensated by additional revenues from removed materials. Similarly, the recycling definition improvement and ban on the landfilling of the residues from shredding operations of **PO3A** come with a cost. The costs for removal of CRM relevant components under **PO3A** are estimated at 65 million EUR by the

¹⁴⁵ https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

¹⁴⁶ European Commission, Directorate-General for Mobility and Transport, Essen, H., Fiorello, D., El Beyrouthy, K., et al., Handbook on the external costs of transport: version 2019 – 1.1, Publications Office, 2020

JRC and further discussed in Annex 15.2¹⁴⁷. The cost-effectiveness of dismantling smaller components under **PO3C** (including PO3A and PO3B measures) is much lower compared to **PO3A** and **PO3B**. The ban on mixed treatment of ELV with other scrap types (**PO3B**) at the same time reduces shredder capacity flexibility leading to extra costs, at the same time, it improves quality of recycling and noticeably the value of ELV steel and aluminium fractions in return. Since this is difficult to quantify and very shredder and Member State specific, the net result is assumed to be cost neutral. It should be noted that the modelling approach focused on manual dismantling¹⁴⁸ **does not allow to quantitatively assess the less costly mechanical recycling** scenario, for the **PO3B** and **PO3C** in those countries that have sufficient PST capacity. The **PO3C** costs are to be regarded ‘worst-case’.

There is a substantial shift in costs and revenues between stakeholders for all three policy options. The value of removed materials minus dismantling costs will not be a direct net profit to the ATFs, as shredder companies will pay less for dismantled hulks where significant material value is already removed and subsequent lower treatment costs due to for instance the prior removal of glass. In Section 8.2 and in Annex 8.2.3, these ‘propagations’ of reduced costs and revenues are made explicit per stakeholder, material, component and for other years.

Table 7 Economic impacts of improved treatment quantity and quality, 2035

Economic impacts (in 2035, annual compared to baseline)	PO3A	PO3B	PO3C	Amplification (+EPR)
Treatment (in million EUR, - =cost, + =revenue)				(values in addition to baseline)
ATFs				
ATF dismantling costs	-173	-412	-401	-80
ATF additional revenues	+34	+100	+70	+21
Shredders/PST operators (excl. RC)				
Shredder costs	-347	-998	-686	-230
Shredder additional revenues	+309	+902	+634	+187
Recycling/ End-processing				
Recyclers costs	-140	-82	-132	-1
Recyclers additional revenues	+68	+152	+146	19
Total costs (all stakeholders)	-660	-1,492	-1,219	-310
Total revenues (all stakeholders)	+412	+1,153	+851	+227

ATFs and shredders are commonly SME's, recyclers are regarded large enterprises including plastic recyclers, steel mills and non-ferrous smelters that produce secondary raw materials as ‘commodities’

6.3.4 Collect more: Improve collection quality and quantity

Under policy options **PO4A** to **PO4C** and the cumulative **PO4D**, ATFs will benefit from more ELVs diverted to them from illegal operators in the EU and from the limitations regarding the export of used unroadworthy vehicles. Detailed trade and economic information is available in Annex 8.1.4. Car dealers, in particular those specialised in exports outside the EU, would incur lost profits (up to 414 million EUR for **PO4D**), as the prices for exporting used vehicles are higher than for selling old used vehicles or ELVs in the EU. ATFs would incur net profits of respectively 24, 82, 125 and 308 million EUR, for **PO4A** to **PO4D**. Shredders and recyclers will also have additional turnover and profits from more ELVs treated, however as the profit per ton of depolluted and dismantled vehicle is limited, the net effect is low. With a substantial shift in costs and revenues between stakeholders, again the

¹⁴⁷ N. Tazi, M. Orefice, C. Marmy, Y. Baron, M Ljunggren, P Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821.

¹⁴⁸ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

‘propagations’ of reduced costs and revenues are made explicit for each stakeholder, material, component and other years in Annex 8.2.4 and summarised per vehicle in Section 8.2.

Table 8 Economic impacts of improved collection, 2035

Economic impacts (in 2035, annual compared to baseline)	PO4A	PO4B	PO4C	PO4D	Amplification (+EPR)
Collection (in million EUR, - =cost, + =revenue)	(values in addition to baseline)				
Consumers	0	0	-134	-142	-17
Car dealers (export requirements)	-27	-123	-282	-414	-241
ATF profits	+24	+82	+125	+308	+203
Shredder profits	+2	+7	+15	+24	+14
Total costs	-27	-123	-416	-556	-257
Total additional revenues	+26	+89	+140	+332	+217

6.3.5 Provide appropriate financial and organisational incentives to improve collection and waste treatment

The economic and governance elements of ELV-specific EPR schemes under **PO5A-C** will support better cooperation between manufacturers and recyclers to jointly improve both design and treatment of vehicles. The impact of the EPR and economic incentives related measures is presented as an **amplifying** effect on the measures to meet the specific objectives 1, 3 and 4. The **PO5B** (incl. PO5B measures) results are already visualised in previous Tables 2 to 4 and 6 to 8 and clearly show the additional benefits of improved governance and financial incentives. Dependent on the choice of new collection and recycling requirements and their additional costs, EPR schemes and producers (and subsequently consumers) will be required to compensate ATFs and shredders for the additional costs incurred to improve recycling quality and compliance. Compared to the baseline, the estimated **additional** compliance cost offset per ELV ranges between 3 and 33 EUR per ELV in 2035, dependent on the combination of policy options and member state specific price-setting elements that can affect the economic performances of the ATFs, shredders and recyclers. For more details see Annex 8.2.5.

6.3.6 Cover more vehicles: Extend the vehicle category scope

The information provisions of **PO6A** would generate moderate costs for manufacturers which would have to provide a set of information to dismantlers and recyclers on the composition of their vehicles and their dismantling. The related administrative costs are specified in Section 7.1. Lorry manufacturers are already used to doing this, so the costs would take form a limited administrative burden, which could be a bit higher for manufacturers of buses and L categories vehicles. This information should on the other hand facilitate and speed up the activities by dismantlers, so reduce their overall costs, although this is difficult to quantify.

PO6B (incl. PO6A measures) main economic impacts would be linked to the measures on the export of lorries and buses, with decrease in revenues for (specialised) exporters, but more vehicles to be treated by ATFs in the EU, generating additional turnover for this sector. The requirements to treat lorries, buses and L3e-L7e category vehicles in ATFs would represent extra economic activities for the dismantling sector operating under advanced environmental standards. The costs would take the form of investments to upgrade facilities which currently do not meet the standards to be authorised as a treatment facility. Overall, this impact will more important for operators treating end-of-life L3e-L7e category vehicles, for which the informal sector is more prevalent than for the other types of vehicles. For manufacturers, **PO6B** would generate limited costs under the form of administrative burden linked to their basic obligations as producers in terms of collection and reporting (Section 7.1).

PO6C (incl. PO6A and PO6B measures) would generate important costs for the whole supply chain, in view of the wide changes that it would require for each actor along the supply chains (manufacturers having to ensure at type-approval stage that their vehicles are 85% recyclable and to incorporate recycled plastics; dismantlers having to modernise their practices to ensure removal of parts and materials for re-use and recycling; recyclers having to improve treatment of waste from lorries, buses and L3e-L7e category vehicles (M33)). They cannot fully be quantified however, and only a partial calculation corresponding to measures on EPR and collection is presented below. **PO6C** would also generate revenues from higher volume and quality of used spare parts and materials sent for recycling. This part of the quantification (M31c) is displayed in Table 9.

Table 9 Economic impacts of the scope extension, 2035

Economic impacts (2035, compared to baseline)	PO6A	PO6B	PO6C*
Scope extension (million units)			
Lost revenues exporters (M EUR)	(values in addition to baseline)		
Costs (lost revenue L3e-L7e; M EUR)			
Costs (lost revenue M2,M3; M EUR)	not assessed	-2.5	-4.4
Costs (lost revenue N2,N3,O; M EUR)		-48	-84
ATFs (M EUR)	(values in addition to baseline)		
Costs	not assessed	-39	-53
Revenues		+42	+55
Recyclers (M EUR)	(values in addition to baseline)		
Revenues	not assessed	+39	+50
Net value scope extension		-9	-36

*Excluding impacts for the full scope extension of M33. Only impacts of measure M31c (EPR and collection) are assessed.

6.4 Administrative burden

Administrative burden per policy option is included in Section 7.1 in the comparison of options in Tables 10-14. A detailed overview of the administrative burden for all years is provided in Annex 3 per stakeholder affected as well as per measure and split in recurrent and one-off costs and summarised in Annex 8.3 per individual policy option and operator. For **PO1C**, the 3R calculation and required declaration generally follows existing procedures, with some one-off transition costs totalling 2.57 million EUR. The total recurring administrative burden for the information provision of **PO1C** is assessed at 5.68 million EUR; including the adaptations for the Circularity Vehicle Passport. For plastics recycled content, the certification costs are estimated to be limited to 0.24 million EUR in 2035 for **PO2B** and thus marginal compared to processing costs. A similar value is expected for the steel recycled content target, following the same approach. The highest costs of roughly 32 million EUR are related to for **PO3B** and **PO3C** where ATFs are required to improve reporting over depollution and mandatory removal (roughly 3 EUR/ELV). The recurring costs related to **PO4** for collection including EPR in setting up PROs in **PO5** range between 35 and 54 million EUR (4 to 6 EUR/ ELV) with an additional one-off cost of 1.35 million EUR. In total, including some administrative costs for the scope extension of **PO6**, the **total recurring administrative costs range between 72 and 106 million EUR** (5 and 7 EUR per new vehicle sold) **plus 1.4 to 4.0 million of one-off costs**.

6.5 Social impacts

6.5.1 Job creation

An overview of the social impacts is provided in in Section 7.1 in the comparison of options in Tables 9-13. The main impact category is the creation of total jobs, with significant impacts related to the recycled content options with respectively 600, 1,200 and 1,800 jobs for the options **PO2A-PO2C** for both manufacturers and shredder/PST operators. Second in

contribution are the additional jobs related to mandatory removal of components, ranging for 930 jobs for **PO3A** to over 6,500 jobs for **PO3C** (including PO3A and PO3B measures) due to long dismantling times of smaller components in case a manual definition of ‘removal’ would be selected. For the collection options **PO4A** with 330 jobs, **PO4B** with 1,200 jobs, **PO4C** with 2,000 jobs and the cumulative **PO4D** with 4,400 jobs are expected for SMEs. The scope extension implies 700 extra jobs for **PO6B** (incl. PO6A) versus 830 for **PO6C** (incl. PO6A and PO6B measures). Other social and health effects relate to the export restrictions. Limiting the export of non-roadworthy vehicles may have a significant effect on local air pollution and increased road safety in developing countries. See Annex 8.4.1 for more details including job creation per policy option and economic operator.

6.5.2 *Impacts on SMEs*

The measures proposed in this impact assessment are likely to have substantial impacts on a number of SMEs, which are dominating the waste management sector, creating both opportunities and challenges. The economic viability of SMEs in the **dismantling sector** is already fragile and they will anyway have to face, under the baseline scenario, important challenges linked to the dismantling of EVs (notably for the training of staff and investments and adaptations so as to properly dismantle and store batteries and other EV components). For SMEs in the dismantling sector, measures consisting in increasing the number of parts and components to be removed prior to the shredding phase will generate important extra costs. These costs would be partly offset by additional revenues, notably linked to the sales of used spare parts, which will be considerably encouraged through measures designed to improve the market for such parts, as well as of valuable components (plastics, aluminium, CRMs) for high quality recycling. Taking advantage of the digitalisation process will be critical in empowering the smaller and often family-run companies to reach out to new market players by connecting to online platforms and distant marketplaces at both local and international levels. In addition, the ‘pull-effect’ from the mandatory targets on recycled content for plastics and (in the future) for steel are expected to boost the competitiveness of dismantlers, as they would become the primary supply spots of the wanted high-quality secondary materials. The measures designed to address the problems of “missing vehicles” will also have an important effect for the dismantling sector, as this will result in an important extra volume of ELVs delivered to ATFs, and thereby an increase in their turnover. For the extra costs linked to the proposed measures which cannot be offset through market conditions, the measures proposed on EPR will be key to ensure that vehicle manufacturers provide the necessary financial support to dismantlers so that they maintain their competitiveness and compete with illegal actors.

For SMEs involved in the **sorting, shredding and recycling** of ELV waste, the most impactful measures are those (i) on recycled content, which should ensure an increased market share for recycled plastics and steel and boost their competitiveness, as well as (ii) those designed to increase the quality of recyclates and improve the treatment of waste, especially the removal of parts prior to shredding and the requirements on shredding and post-shredding technologies. These measures would require investments, notably for the companies which are currently not operating modern shredding and post shredding technologies. In that case again, the measures proposed on EPR are due to ensure that extra-costs which cannot be offset under normal market conditions should be borne by vehicle manufacturers to support the recycling sector.

Overall, the proposed measures should support the competitiveness of SMEs in the dismantling and recycling sector through new market opportunities. It is likely though that a number of SMEs might not be able or willing to adapt their business models or invest in the technologies necessary to meet the new requirements, leading them to focus on activities such as repairs or sales of second-hand cars, rather than on the treatment of ELVs. In addition, the

measures proposed on the design/production of vehicles, as well as those on EPR, could also encourage vehicle manufacturers to take a greater role in management of ELV waste. This could take the form of contractual arrangements with existing actors in the waste management, or of a more direct intervention through direct investments in this field. As a result, it is likely that the proposed measures could lead to a concentration of actors in the dismantling and recycling sectors and a reduction in the number of SMEs in this field.

SMEs exporting used vehicles to third countries would be directly affected by the measures on export foreseen under this initiative. They would incur costs linked to the obligation for them to carry out roadworthiness tests for vehicles which are currently exported after the certificate has expired. In addition, they are likely to see a decrease in revenues linked to a reduction in the export of used vehicles which do not meet the roadworthiness requirement estimated at 51 million EUR (**PO6B**) respectively 88 million EUR (**PO6C**). They would then have to sell these vehicles as ELVs to ATFs in the EU, at a lower price than what they could have obtained for exporting them.

Operators from the informal sector repairing and treating L3e-L7e category vehicles would also be affected as they would have to upgrade their standards and facilities to become officially authorised to treat these vehicles at end-of-life. This would require investments and possibly represent a loss of activities for those which are not able or willing to become an authorised treatment facility. More information on the impacts of proposed measures on SMEs can be found in Annex 13.

6.5.3 Contribution to SDGs

Figure 3 visualises the contribution of the policy options to the SDGs. On the left-hand 'design and production' side of the diagram, policy options **PO1** and **PO2** contribute mostly to sustainable innovations (SDG9), responsible consumption and production with a lower environmental footprint (SDG12) and climate action (SDG13). The collection and recycling options **PO3** and **PO4** contribute to the same SDGs and to less pollution water and air pollution (SDG14 and SDG15) to a lesser extent. **PO5** improves partnerships for the goals (SDG17). See Annex 3.3 for more details.

Figure 3 Contribution of the Regulation to the SDGs



7. HOW DO THE OPTIONS COMPARE?

7.1 Summary of impacts and costs/ benefits

Table 10 provides a qualitative overview of the main environmental benefits¹⁴⁹ and administrative costs for the 3RTA policy options for **PO1**. As indicated in Section 6, the environmental impacts of the options do materialise many years later at end-of-life and are thus not quantified but evaluated qualitatively. A growing incorporation of circularity requirements in the design and production of new vehicles is regarded important to achieve the long-term circularity objectives in the automotive sector, at relatively limited administrative costs as presented below, even for the most comprehensive **PO1C** (incl. PO1A and PO1B measures). The qualitative evaluation on the reduction of substances of concern is available in Annex 7.1, here the hybrid approach of **PO1C** offers the best cost – benefit balance.

Table 10 Comparison and summary of impacts, PO1 - Design Circular, 2035.

PO1 Costs and benefits (in 2035, compared to baseline, excl. admin)		PO1A	PO1B	PO1C
Environmental benefits (qualitative)		(values in addition to baseline)		
1	3RTA - Circularity at design	(+)	(++)	(+++)
1	Reduction substances of concern	(0)	(0/+)	(+)
Admin burden (3RTA in Million EUR)		(values in addition to baseline)		
1	Manufacturers, authorities (recurrent)	-0.8	-3.8	-5.6
1	Manufacturers, EC (one-off)			-2.6
Job creation (in FTE)		(values in addition to baseline)		
1	Manufacturers 3RTA	+5	+5	+5

Since materials production is particularly energy intensive, the related environmental benefits of using recycled content, improving collection and recycling are expressed in GHG savings as the primary environmental impact category for comparison for **PO2-PO6**¹⁵⁰. Table 11 provides an overview of the main environmental benefits and related costs to the recycled content targets for plastics and steel for **PO2**. For plastics recycled content, the additional costs for **PO2C** in comparison with **PO2B** are high against marginal environmental benefits. The steel recycled content target of **PO2B** provides significant GHG savings against limited additional costs.

Table 11 Comparison and summary of impacts, PO2 - Recycled content, 2035.

PO2 Costs and benefits (in 2035, compared to baseline, excl. admin)		PO2A	PO2B	PO2C
Environmental benefits (in kton of materials)		(values in addition to baseline)		
2	Materials recycled (steel RC)	0	+505	+1,212
2	Materials recycled (plastics RC)	+240	+713	+873
GHG savings (kton of CO ₂ -eq)		(values in addition to baseline)		
2	GHG savings production (steel RC)	0	+585	+1,404
2	GHG savings production (plastics RC)	+90	+314	+376

¹⁴⁹ Except for the recycled content related GHG savings of PO2 and its financial relevancy for the future functioning of ETS / CBAM, the other GHG savings cannot be attributed unambiguously to individual economic operators and thus not be directly capitalised using available financial instruments. Therefore ‘monetised GHG savings’ is used in below tables except in the case of PO2 where ‘avoided CO₂ taxation under ETS’ is used to illustrate its attribution potential. This approach is in line with quantifying non-market benefits as described in Tool 14 of the Better Regulation Guidance and Tool 23 related to monetising environmental impacts for the purpose of Cost Benefit Analysis and the BCR as determined in Section 7.1

¹⁵⁰ European Commission, Directorate-General for Mobility and Transport, Essen, H., Fiorello, D., El Beyrouty, K., et al., Handbook on the external costs of transport: version 2019 – 1.1, Publications Office, 2020, <https://data.europa.eu/doi/10.2832/51388>

Costs (M EUR, excl. admin)		(values in addition to baseline)		
2	Costs production (steel RC)	0	-71	-170
2	Costs production (plastics RC)	-326	-745	-1,171
Revenues (M EUR, excl. admin)		(values in addition to baseline)		
2	Revenues production (steel RC)	0	+67	+160
2	Revenues production (plastics RC)	+216	+602	+739
Monetised GHG savings (M EUR)		(values in addition to baseline)		
2	Avoided CO ₂ taxation ETS (steel RC)	0	+133	+318
2	Avoided CO ₂ taxation ETS (plastics RC)	+20	+71	+85
Admin burden (3RTA in Million EUR)		(values in addition to baseline)		
2	Manufacturers, TA authorities (recurrent)	-0.24	-0.24	-0.33
Job creation (in FTE)		(values in addition to baseline)		
2	Manufacturers	+1,642	+3,264	+6,529
2	SMEs: ATFs+shredders	+598	+1,196	+1,794

For **PO3**, Table 12 shows the additional amounts recycled at higher quality are comparable for **PO3B** (incl. PO3A) and **PO3C** (incl. PO3A and PO3B measures), but the GHG savings are higher for **PO3B** due to improved aluminium separation as the main factor. The costs for the recycling option **PO3A** are much lower compared to the environmentally more effective options **PO3B** (see Annex 8.3 for details). Removal obligation prior to shredding of e-drive motor is estimated to contribute around 100 and 500 jobs in 2030 and 2040, generating specific additional costs at professional dismantler's level but also generating higher revenues at the value chain level by 2040¹⁵¹.

Table 12 Comparison and summary of impacts, PO3 - Treat Better, 2035.

PO3 Costs and benefits (in 2035, compared to baseline, excl. admin)		PO3A	PO3B	PO3C
Environmental benefits (in kton of materials)		(values in addition to baseline)		
3	Materials at higher quality (recycling)	+942	+1,888	+1,984
GHG savings (kttons of CO ₂ -eq)		(values in addition to baseline)		
3	GHG savings recycling (N1,M1)	+1,378	+3,688	+2,880
Costs (M EUR, excl. admin)		(values in addition to baseline)		
3	Costs recycling (N1,M1)	-660	-1,492	-1,219
Revenues (M EUR, excl. admin)		(values in addition to baseline)		
3	Revenues higher quality (recycling)	+412	+1,153	+851
Monetised GHG savings (M EUR)		(values in addition to baseline)		
3	Monetised GHG savings at higher quality (recycling)	+312	+836	+653
Admin burden (3RTA in Million EUR)		(values in addition to baseline)		
3,5	SMEs, authorities, PROs (recurrent)	-31.7	-31.7	-31.8
Job creation (in FTE)		(values in addition to baseline)		
3	SMEs: ATFs+shredders	+934	+6,224	+6,504

For collection **PO4**, Table 13 shows the additional amounts collected and recycled and the GHG savings for the four different Policy Options, where **PO4D** is including cumulatively all measures under **PO4A** to **PO4C**. **PO4D** has the highest GHG savings with higher costs and revenues as well. This result is without the amplifying effect of the implementation of EPR, which adds another significant +2 million tons of GHG savings, +400 million EUR in revenues, +470 million EUR of monetised monetised GHG savings and -750 million EUR additional costs as presented in section 6.2.4. Detailed results are presented in Annex 8.4 and 8.5 for other years, per individual policy option and per stakeholder.

¹⁵¹ N. Tazi, M. Orefice, C. Marmy, Y. Baron, M Ljunggren, P Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821.

Table 13 Comparison and summary of impacts, PO4 – Collect More, 2035.

PO4* Costs and benefits (in 2035, compared to baseline, excl. admin)		PO4A	PO4B	PO4C	PO4D
Environmental benefits (in kton of materials)		(values in addition to baseline)			
4	Materials recovered (collection + export)	+103	+446	+961	+1,533
4	Vehicles collected and treated more	+116,000	+500,000	+1,100,000	+1,700,000
GHG savings (ktons of CO ₂ -eq)		(values in addition to baseline)			
4	GHG savings collection + export	+353	+1,513	+3,222	+5,218
Costs (M EUR, excl. admin)		(values in addition to baseline)			
4	Costs collection + export	-27	-123	-416	-556
Revenues (M EUR, excl. admin)		(values in addition to baseline)			
4	Revenues collected + export	+26	+89	+140	+332
Monetised GHG savings (M EUR)		(values in addition to baseline)			
4	Monetised GHG savings collected extra (incl. export)	+80	+343	+731	+1,183
Admin burden (3RTA in Million EUR)		(values in addition to baseline)			
4,5*	SMEs, authorities, manufacturers (recurrent)	-35	-54	-54	-54
4,5*	Authorities (one-off)	-1.35	-1.35	-1.35	-1.35
Job creation (in FTE)		(values in addition to baseline)			
4	SMEs: ATFs and shredders	+328	+1,195	+2,062	+4,374
5*	Manufacturers, PROs	+512	+512	+512	+512

* Some administrative burden and job creation include the impacts of EPR elements from PO5.

Table 14 shows the results for **PO6**. For **PO6C** (incl. PO6A and PO6B measures), the costs and revenues can only be partly quantified due to lack of sufficient data on the impact of measures on design, production and recycled content. The data mentioned below are only indicative and not covering all costs and revenues. **PO6B** (incl. PO6A) has relatively high environmental benefits due to increased reported collection and treatment of new vehicles at ATFs (see Annex 8.6 for more details), with limited costs/revenue losses for (i) exporters, linked to the requirements to provide the information on the roadworthiness status for the export of lorries and busses, and for (ii) waste treatment operators, linked to the upgrade of facilities dealing with the treatment of end-of-life L3e-L7e category vehicles.

Table 14 Comparison and summary of impacts, PO6 - Cover more vehicles, 2035.

PO6 Costs and benefits (2035, compared to baseline, excl. admin)		PO6A	PO6B	PO6C*
Environmental benefits (in kton of materials)		(values in addition to baseline)		
6	Materials arriving at EoL (scope extension)	n.a	+508	+661
GHG savings (ktons of CO ₂ -eq)		(values in addition to baseline)		
6	GHG savings scope extension (L+HDV)	n.a	+1,120	+1,436
Costs (M EUR, excl. admin)		(values in addition to baseline)		
6	Costs scope extension (M2,M3,N2,N3)	n.a	-90	-141
Revenues (M EUR, excl. admin)		(values in addition to baseline)		
6	Revenues scope extension	n.a	+81	+105
Monetised GHG savings (M EUR)		(values in addition to baseline)		
6	Monetised GHG savings (scope extension)	n.a	+254	+326
Admin burden (3RTA in Million EUR)		(values in addition to baseline)		
6	Manufacturers, authorities, vehicle owners (recurrent)	-4.6	-13.6	-13.7
6	Manufacturers (one-off)	-0.082	-0.082	-0.082
Job creation (in FTE)		(values in addition to baseline)		
6	Manufacturers (qualitative)	n.a	701	829

* Only impacts of measure M31c (EPR and collection) are assessed.

7.2 Cost benefit analysis, cost efficiency, effectiveness, coherence and proportionality

Cost benefit analysis

Based on the quantitative information available for most policy options (see section 7.1), a presentation and comparison of the benefit - cost ratios (BCR) of the different options is presented in Table 15. A BCR ratio above 1 identifies those options where the benefits outweigh the costs. The higher the ratio, the higher the 'return on investment'.

For these ratios, all quantifiable costs and revenues for the policy options, including recurring administrative burden, are taken into consideration. The benefits include revenues linked to additional material recovery as well as the environmental benefits in the forms of GHG savings which could be monetised. The costs include all treatment costs (including investment costs) and lost revenue potential in the case of export reduction. Due to their different nature or insufficient data, other external environmental costs or revenues, like health benefits, reduced air pollution (in developing countries due to higher quality exported vehicles), or the externalities related to reduced energy consumption, fossil fuel and raw material dependencies are not monetised. Therefore, the values of Table 15 are to be regarded as conservative estimates for the full societal benefits.

All detailed costs and benefit breakdown are presented in Tables 8.28 – 8.32 of Annex 8.5.2. This also includes a description of the key assumptions and allocations in the case of policy options 2 and 3 that are closely related. Here, specific allocations are applied to enable a fairer and more comparable benchmark for the steel and plastics recycled content targets, based on **direct** costs and benefits for the combined effect of the recycling efforts for these materials (PO3) that simultaneously enable the uptake of recycled content (PO2). See Annex 8.5.2 for the details and specific assumptions applied.

Table 15 Benefit – costs ratios (BCR) per policy option, 2035

Benefit / Cost ratios (2035, compared to baseline, including recurrent administrative costs)	Policy options			Preferred (individually)	Preferred (combined + EPR)
EUR per ton of CO ₂ reduction	(values in addition to baseline)				
PO1 3RTA	PO1A	PO1B	PO1C		
B/C ratio 3RTA	Not assessed quantitatively				
PO2 + PO3 Steel recycled content	PO2A	PO2B	PO2C		
B/C ratio design + production, steel RC *1	N.A.	1.69	2.38	N.A.	N.A.
PO2 + PO3 Plastics recycled content	PO2A	PO2B	PO2C		
B/C ratio design + production, plastics RC *2	0.96	1.21	0.94	1.21	1.21
PO3 Recycling	PO3A	PO3B	PO3C		
B/C ratio recycling *3	0.99	1.22	1.03	1.22	1.24
PO4 Collection	PO4A	PO4B	PO4C	PO4D	
B/C ratio collection (incl. export)	3.97	3.51	2.09	2.73	2.67
PO6 Scope extension	PO6A	PO6B	PO6C		
B/C ratio scope extension	Not assessed	3.72	Not fully assessed	3.72	3.72
Benefit / costs ratio				1.57	1.58

*1 This includes the costs for removal of steel parts at ATFs originally allocated to PO3, *2 This includes the avoided emissions from plastics incineration originally allocated to PO3 for the plastics recycled under PO2, *3 This excludes the costs and avoided emissions allocated to PO2 (see Annex 8.5.2 for details and assumptions)

For **PO2B** and **PO2C** for the steel recycled content, the potential BCR lies significantly above 1 indicating important monetised CO₂ savings compared to the related costs for dismantling, sampling and sorting. It must be noted however that there is significant uncertainty on a number of important factors which are critical to set out directly in the future

legislation an adequate level for a recycled content target for steel in new vehicles (see below for more elements on this).

For plastics, the BCR is lower, with relatively speaking higher investments to realise the monetised CO₂ credits in this case. Only **PO2B** has an acceptable BCR of 1.21. In the case of **PO2A**, the BCR slightly below 1 is due to relatively high investment costs for a smaller volume of plastics. For **PO2C**, a more constrained supply-demand balance and higher quality constraints to meet the closed loop share results in higher estimated costs of recyclates compared to the more optimal balance for **PO2B**. It should be noted that besides the economic revenues of material and energy savings, there are non-monetised environmental benefits like the external costs of fossil-fuel savings of 1.4, 4.5 and 5.4 billion Barrels of Oil equivalent for respectively **PO2A**, **PO2B** and **PO2C**, reduced plastic waste volume and health benefits as specified in Section 6.2.3.

For the recycling policy options, **PO3B** (incl. PO3A measures) shows the most attractive benefit/ costs ratio where the material revenues from improved separation (1.15 billion EUR) plus monetised CO₂ savings (0.84 billion EUR plus 0.2 billion from avoided incineration) together outweigh the significant costs (1.50 billion EUR and 0.05 billion EUR removal costs) to achieve the improved treatment quality.

All collection options have a high BCR ranging from above 7 for **PO4A** to above 2 for **PO4C** and the cumulative option **PO4D**. Here, it should be noted that in absolute terms, the GHG savings are increasingly significant with **PO4D** having more than a tenfold value of +5.2 million tons of CO_{2eq} compared to +0.4 and +1.5 million tons for respectively **PO4A** and **PO4B**. **PO4D** is thus by far the **most effective** option with a net monetised result of +1,1 million EUR. Moreover, the higher collection volume further amplifies the recycling results of PO3 in particular and improve the availability of materials for the recycled content targets of PO2 (see Section 8.2).

PO6B (including PO6A measures) has a comparable BCR to the PO4 options of 3.7, reflecting the relatively high environmental benefits and increased revenues vs limited costs, linked to the additional treatment of lorries, buses and L3e-L7e category vehicles.

Cost – efficiency: cost per ton of CO₂ avoided

To further compare the costs of the reduced GHG savings as a key decarbonisation objective of the proposal, Table 16 shows the costs per ton of CO_{2eq} avoided for the different options. It shows that the cumulative **PO4D** collection measures and particularly the roadworthiness requirement upon export in combination with all other measures has the lowest cost of only 43 EUR per ton of CO₂ reduction due to more recycling in the EU. This is followed by the **PO2B** recycled steel. Here the assessment is based on the combination of impacts including the costs for the **PO3B** (including PO3A measures) recycling improvement options, consistent with the same allocations as for the benefit - cost ratios highlighted under Table 15 above. The results for steel are thus indicative as the costs of creating higher purity scrap allocated to **PO3B** are related to both the removal of steel parts (allocated to PO2) as well as copper parts from the steel fraction (allocated to PO3 as a separate target material). For the steel recycled content, the costs of **PO2B** and **PO2C** are respectively 88 EUR and 29 EUR per ton.

Similarly for plastics, again based on the same allocations as for the benefit - cost ratios highlighted under Table 15 above, **PO2B** for plastics has a cost of 109 EUR per ton of CO₂ avoided and is more efficient compared **PO2A** with relatively high investment costs for a relatively low amount of plastics, resulting in over 200 EUR per ton of CO_{2eq}. For the higher volumes of **PO2C**, high prices of recyclates lead to a cost of 270 EUR per ton of CO_{2eq}.

Table 16 Cost per ton of GHG reduction for the various policy options, 2035

Costs per ton of CO _{2eq} avoided (2035, compared to baseline, including recurrent administrative costs)	Policy options			Preferred (individually)	Preferred (combined + EPR)
EUR per ton of CO ₂ reduction	(values in addition to baseline)				
PO1 3RTA	PO1A	PO1B	PO1C		
Production (3RTA)	Not assessed quantitatively				
PO2 Steel recycled content	PO2A	PO2B	PO2C		
Production + recycling (steel RC) *1	N.A.	€ 88	€ 29	N.A.	N.A.
PO2 Plastics recycled content	PO2A	PO2B	PO2C		
Production + recycling (plastics RC) *2	€ 257	€ 109	€ 270	€ 109	€ 109
PO3 Recycling	PO3A	PO3B	PO3C		
Recycling (excl. costs plastics/steel) *3	€ 231	€ 108	€ 203	€ 108	€ 103
PO4 Collection	PO4A	PO4B	PO4C	PO4D	
EUR/ton CO ₂ , collection + export	< 0	€ 23	€ 86	€ 43	€ 50
PO6 Scope extension	PO6A	PO6B	PO6C		
EUR/ton CO ₂ , scope extension (L+HDV)	n.a.	€ 8	n.a.	€ 8	€ 8
				€ 69	€ 72

*1 This includes the costs for removal of steel parts at ATFs originally allocated to PO3, *2 This includes the avoided emissions from plastics incineration originally allocated to PO3 for the plastics recycled under PO2, *3 This excludes the costs and avoided emissions allocated to PO2 (see Annex 8.5.2 for more details)

Efficiency, effectiveness, coherence and proportionality

Below Table 17 provides a summary of the comparison of the options based on the two key criteria that are quantified regarding ‘effectiveness’, for which the absolute GHG savings are used as the primary parameter and ‘efficiency’, from the previous Table. For PO1 and PO6 a more qualitative comparison is performed, as well as for the criteria of ‘coherence’ and ‘proportionality’ are provided. A more detailed description and the reference to all the individual instances in the supporting study are provided in Annex 8.5.2

Table 17 Comparison of options compared to the general objectives, effectiveness, efficiency, coherence and proportionality

PO1. Design Circular	PO1A	PO1B	PO1C
Effectiveness	(++)	(++)	(+++)
Efficiency	(++)	(++)	(+++)
Coherence	(+)	(++)	(+++)
Proportionality	(++)	(+++)	(+++)
PO2. Steel Recycled Content	PO2A	PO2B	PO2C
Effectiveness	(o)	(+)	(++)
- incl. GHG savings (kton CO _{2eq})	0	+585	+1,404
Efficiency	(o)	(++)	(++)
- Benefit Cost Ratio (BCR)	N.A.	1.7*	2.4*
Coherence	(o)	(+++)	(++)
Proportionality	(o)	n.a.	n.a.
PO2. Plastics Recycled Content	PO2A	PO2B	PO2C
Effectiveness	(+)	(++)	(++)
- incl. GHG savings (kton CO _{2eq})	+426*	+1,313*	+1,599*
Efficiency	(-)	(+)	(-)
- Benefit Cost Ratio (BCR)	0.96*	1.2*	0.94*
Coherence	(+)	(+++)	(++)
Proportionality	(o)	(+)	(--)
PO3. Treat Better	PO3A	PO3B	PO3C
Effectiveness	(++)	(+++)	(++)
- incl. GHG savings (kton CO _{2eq})	+1,042*	+2,689*	+1,656*

(+++)	(+++) highly positive
(++)	(++) moderately positive
(+)	(+) slightly positive
(o)	(o) neutral/ baseline
(-)	(-) slightly negative

Efficiency	(-)	(+)	(o)	
- Benefit Cost Ratio (BCR)	0.91*	1.2*	0.99*	
Coherence	(++)	(+++)	(+)	
Proportionality	(+)	(+++)	(-)	
PO4. Collect More	PO4A	PO4B	PO4C	PO4D
Effectiveness	(+)	(++)	(+++)	(+++)
- incl. GHG savings (kton CO _{2eq})	+353	+1,513	+3,222	+5,218
Efficiency	(+++)	(+++)	(++)	(++)
- Benefit Cost Ratio (BCR)	4.0	3.5	2.1	2.7
Coherence	(+)	(+)	(++)	(++)
Proportionality	(++)	(++)	(+)	(++)
PO5. EPR	PO5A	PO5B	PO5C	
Effectiveness	(++)	(+++)	(+)	
Efficiency	(+)	(++)	(+)	
Coherence	(++)	(+++)	(++)	
Proportionality	(+)	(+++)	(++)	
PO6. Cover more vehicles	PO6A	PO6B	PO6C	
Effectiveness	(-)	(++)	(++)	
- incl. GHG savings (kton CO _{2eq})	n.a.	+1,120	n.a.	
Efficiency	(+)	(+++)	(-)	
- Benefit Cost Ratio (BCR)	n.a.	3.7	n.a.	
Coherence	(+)	(++)	(+++)	
Proportionality	(+)	(++)	(--)	

* Based under the same PO2/PO3 assumptions as applied to Table 15 and 16

The analysis reveals a range of consistent performances for almost all criteria for **PO1C**.

PO2C for recycled content of plastics has a lower score for proportionality, due to constraint availability of plastic recyclates. Both **PO2A** and **PO2C** for plastics have a benefit – cost ratio below 1, even when the monetised GHG savings of avoided incineration are added to the revenue side. The plastics recycling volume of **PO2B** appears to offer the best balance in costs and revenues.

For steel recycled content, **PO2A** is less efficient than **PO2B** and **PO2C**, however there are significant uncertainties in setting an appropriate target level, which make it difficult to derive a reliable assessment of the proportionality of the targets.

PO3A and **PO3C** (incl. PO3A and PO3B measures) have a benefit – cost ratio below 1 as well. The proportionality of **PO3C** is scoring low as the additional removal costs of materials and components are very costly compared to **PO3B** (incl. PO3A).

PO4C with the roadworthiness requirements upon export has a very significant impact on GHGs savings and therefore a higher effectiveness than PO4A and PO4B. It will also affect directly specialised car dealers exporting (low quality) used vehicles. The export requirements are proportionate: they do not set up a blanket ban on the export of used cars (even those above a certain age) but only require that used vehicles are roadworthy in compliance with Directive 2014/45/EU as a condition for export. Car dealers wishing to export a used vehicle whose roadworthiness certificate has expired can do a periodic technical inspection (PTI) to obtain a new certificate. This requirement is also consistent with the legislation applying in the EU as a vehicle which is not considered roadworthy cannot legally be driven on the EU roads. The cumulative **PO4D**, which combines measures from **PO4A**, **PO4B** and **PO4C**, has the maximum effectiveness as it provides for complementary measures applying both to (i) missing vehicles in the EU and (ii) ELVs and used cars exported outside the EU to ensure a higher collection in the EU.

PO5B (incl. PO5A measures) offers advantages of increasing harmonisation in the implementation of EPR requirements across the EU, whereas leaving room to member states for the market specific implementations. The measures under **PO5C** (incl. PO5A and PO5B measures) would be difficult to apply uniformly across the EU and may be unacceptable from a subsidiarity point of view (criterion not displayed in Table 17). Therefore, **PO5B** for EPR is the most effective, coherent and proportional choice.

PO6B (incl. PO6A measures) provides relevant environmental benefits. They are higher than PO6A which provides only limited benefits (even though they cannot be quantified). As indicated above, the impacts of **PO6C** cannot be completely quantified) but will certainly generate important costs and would not be proportionate. In that respect, **PO6B** is a coherent and proportionate approach to increase circularity a harmonised manner in sectors which are currently not subject to any specific EU legal requirements.

8 PREFERRED POLICY PACKAGE

Based on above comparison of options, the preferred policy package is a combination of the following options: **PO1C** (incl. PO1A and PO1B measures) for the design stage; A mix of choices for policy option 2: **PO2A**, M10a for recycled content for steel, **PO2B**, M9b for plastics and the empowerment for the Commission to establish targets for materials other than plastics and steel from **PO2C**, M11; **PO3B** (incl. PO3A measures) for waste management; the cumulative approach for **PO4D** for collection; **PO5B** (incl. PO5A measures) for economic incentives and EPR and **PO6B** (incl. PO6A measures) enabling a phased-in approach for the scope extension. These choices are explained below.

These options are included in this preferred policy package as they are the most effective and efficient in addressing each of the specific problems identified in section 2, first on their own merits. Second, the options are also mutually supportive and **together** form a carefully balanced package as explained at the end of section 8.1.

8.1 Preferred options

Design circular: PO1C, including all **PO1A** and **PO1B** measures (M1-3, M4c, M5c, M6-M8), is the preferred option. It anchors the circularity requirements as an important element of the type-approval of new vehicle types. It contains a mix of short term obligations (requirement for vehicle manufacturers to make available detailed and user-friendly dismantling and recycling information, including the use and location of CRMs in vehicles and on the share of recycled content used in new vehicles; follow-up on manufacturers' obligation to ensure recyclability and re-usability of type-approved vehicles through circularity strategies) and actions on a medium term (revision of the methodology to calculate recyclability and re-usability of new vehicles at type-approval stage and the development of an Circularity Vehicle Passport). This provides an ambitious, cost-effective and proportionate package to improve the circularity in the design of vehicles. For the substances in vehicles, the preferred option is to cover all new restrictions of substances in vehicles under REACH¹⁵², the Union's core chemicals legislation, while existing restrictions on four substances in vehicles (and their associated exemptions) would remain regulated under the ELV/3RTA legislation.

Feedback from affected stakeholders: Many stakeholders from the automotive manufacturing sector stressed that they have embarked into the transition to circularity and that only minimal amendments were needed to the applicable legislation. They also specifically requested to consider other design-related compliance demands related to safety and climate neutrality requirements to avoid conflicting requirements. They often oppose the

¹⁵² Or, for substances identified under the Stockholm convention as Persistent Organic Pollutants, addressed under the POPs Regulation [Regulation (EU) 2019/1021]

merger between the ELV Directive and the 3R TA Directive. A few of them however are in favour of addressing better design for recycling provisions in the new legislation, to ensure a level playing field and better transparency. The dismantling and recycling sectors (mostly SMEs) are calling for more ambitious legislation on the design for dismantling/recycling and on the sharing of information from vehicle manufacturers to help dismantling. Environmental NGOs, waste management authorities and public authorities are almost unanimously in support of a life-cycle approach covering all stages of the lifecycle and consequently to address the design for circularity measures.¹⁵³

Use recycled content: The preferred option includes a mix of the following measures: M9b for plastics, M10a for steel and M11 for other materials.

The ambition level of **PO2B**, M9b is the preferred option for **plastics** with recycled content targets of 25% applicable to newly type approved vehicles by 2031, of which 25% closed-loop. It provides a significant increase to the recycling of plastics from ELVs and lower the carbon footprint linked to the use of plastics in new vehicles. The **PO2B** level provides the best-cost-benefit balance, avoids excessive costs and risks of supply shortage, and offers most certainty for manufacturing planning.

For steel recycled content, all options can provide significant GHG savings and an important ‘pull effect’ to better utilise ELV steel scraps in the future, but to a different degree and in different stages. They complement the ‘push effect’ for increased quality of steel scrap defined under **PO3B** and enhance cooperation between manufacturers, steel industry and recyclers. The ambition level of **PO2A** (M10a) takes best into account the need to further address the uncertainty related to the ability of the automotive producers to increase the incorporation of steel scrap, in particular post-consumer scrap, in new electric vehicles¹⁵⁴. The advantages of **PO2B** would be that creating a pull to increase scrap utilisation in steel production can achieve faster decarbonisation of production compared to other, more long-term technology conversions and it reduces the need for natural gas, coal and iron-ore in steel production more short-term, provided high quality scraps are made available. **However, the uncertainty in setting an appropriate target level directly in the future legislation is too high.** This is due to uncertainties about (i) the future share of long products (more likely to be able to include recycled steel) in EVs; (ii) current uptake levels of post-consumer scrap in flat production; (iii) the share of pre-consumer versus post-consumer in current scrap utilisation rates and finally about (iv) the impact of such target on the availability and prices of scrap for other steel-demanding sectors. In that regard, the establishment of a steel recycled content target under **PO2B**, M10b, presents the risk to define the target level too low with the consequence that it would not form an actual incentive to higher post-consumer scrap uptake levels. **PO2C**, M10c with the higher target and closed loop percentage may reduce flexibility in the sourcing of post-consumer scrap and is therefore not selected. **PO2A**, M10a is **the preferred option** in the case of steel.

Other recycled content targets for materials like aluminium and other CRMs like magnesium and REE permanent magnet materials cannot yet be substantiated as automotive designs are changing fast and recycling markets are very dynamic with significant progress in sorting technologies. Aluminium is a complex material with a range of alloy types involved and complex logistics to achieve sufficient economies of scale from treatment from sorted alloy families. It is further challenging to establish specific recycled content targets for each type. There are many economic factors to consider, e.g. demand and market value, recycling

¹⁵³ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-End-of-life-vehicles-revision-of-EU-rules/public-consultation_en

¹⁵⁴ Notably linked to the future share of steel long products in electric vehicles, which are the best candidates for such incorporation

feasibility and profitability of each type, when determining targets for individual alloys. For these materials, the combination of the mandatory recycled content declaration under **PO1C** and the treatment requirements of **PO3B** are regarded adequate for the short term, but an empowerment for the Commission to come forward with recycled content targets for additional materials (such as CRMs, and aluminium) is foreseen within 5 years after the entry into force of the new legislation, if this proves necessary in the future (**PO2C**, M11).

Feedback from affected stakeholders: Strong support was expressed for recycled content targets from the recycling and dismantling sectors, which are mostly composed of SMEs, and by civil society organisations. The automotive sector was more split on the opportunity to set such targets for plastics, mentioning possible lack of supply of recyclates meeting the specifications of their sector, as well as advocating that any possible future target should include pre-consumer waste and allow for chemical recycling. The plastics industry also insisted that chemical recycling was needed to increase recycled plastics in vehicles. The steel industry did not express support for recycled steel target, with EUROFER indicating that higher ELV scrap target will compete with (hydrogen based) EAF-DRI in the future as part of long-term investments in ‘green steel’. The automotive sector is divided: individual vehicle manufacturers have been developing a proactive approach in increasing the use of recycled content, as a key element in their decarbonisation policy. Several car manufacturers acknowledge difficulties in sourcing steels with recycled contents above 25%. The recycling sector sees a steel recycled content target as essential to help securing their supply of high-quality steel scrap and compensate for their investments to improve it. ACEA explicitly stated the need for sufficient lead time to adjust supply chains to new recycled content requirements.

Treat better: PO3B (including measures (M12, M13a-b, M14a-b, M15b, M16a-b) related to **PO3A** as highlighted in Table 1) **is the preferred option**, as it most effectively addresses the complexity of improving recycling quantity and quality for a wide variety of different materials present in ELVs. The GHG savings are higher and the costs are lower for **PO3B** in comparison to **PO3C**. The stricter definition of “recycling” and restrictions on landfilling will ensure that residues from shredding are effectively recycled or recovered, rather than backfilled or landfilled. This option also contains specific and cost-effective measures for each of the materials and different types. The removal obligations prior to shredding of **PO3B** allow for substantial progress to recover and recycle batteries and electric drive motors from EVs and other parts/components containing plastics, precious metals and CRMs, which are associated with the electrification of the fleet and the wide use of electronics in new vehicles (M13a, M13b). To remain technology-neutral, a derogation from this obligation would apply when recyclers provide verifiable evidence that separation leads to recyclates of at least similar high quality as via manual dismantling. The **PO3B** ban on mixed treatment and mandatory removal and separate recycling of e-drive motors would thrive the permanent magnet recycling value chain and generate new flows of CRMs for further recycling. It is estimated that respectively circa 2.4 kton and 4.2 kton of permanent magnet flows would be made available in 2035 and 2040 for high quality recycling from future EU ELVs. The separate sorting and recycling of e-drive motors will have a positive impact on innovation and R&D in the EU. The available e-drive motors thanks to this option would thrive research, innovation and the development of new recycling technologies to increase the recovery of SRM, especially CRMs. It would further decrease copper contamination in steel and aluminium scraps from ELVs.

Feedback from affected stakeholders: The most common responses supported measures to improve the separate recycling of materials from ELVs, to increase their quality. The dismantling and recycling sectors pointed out that these measures would increase their costs.

EuRIC and BVSE¹⁵⁵ expressed strong concerns in case removal obligations would be strictly interpreted as a manual dismantling approach, which could lead to excessive costs and hamper innovation in (semi)-automated pre-treatment and PST.

Collect more: PO4D, which encompasses all measures (M17b, M18, M19a-c, M20, M21) of **PO4A**, **PO4B**, and **PO4C** as outlined in Table 1, represents the preferred option. Table 4 confirms that this combination is the most effective means of achieving the objective of increased ELV collection. Additionally, Table 15 demonstrates that this combination provides a high cost-benefit ratio at the same time. The traceability of used vehicles and ELVs would be improved through (i) a clearer allocation of responsibility for the issuing and reporting of the certificate of destruction (CoD) among economic operators and competent authorities and (ii) the integration of additional information in national vehicle registration systems and their interoperability between Member States. To address the illegal export of ELVs and reduce export of non-roadworthy vehicles, binding criteria for the distinction between used vehicles and ELVs would be established as well as (M19b) a requirement that the export of used vehicles is only authorised if it can be verified that the vehicle concerned is roadworthy. (M21). New provisions on enforcement would also help addressing illegal treatment and export of ELVs. The impact of these measures should be significant in terms of bringing additional ELVs for treatment to legal ATFs in the EU and reducing the EU external environmental footprint linked to the export of vehicles which are not roadworthy.

Feedback from affected stakeholders: There was strong support from stakeholders to adopt ambitious measures to address the persistent problems of “missing vehicles”, including through stricter conditions on the export of non-roadworthy used vehicles.

Financial and organisational incentives: PO5B (including all measures (M22-M25) related to **PO5A** as highlighted in Table 1) is the preferred option, providing substantial incentives for a better functioning of the recycling market via the establishment of an obligation for producers to increase collection of ELVs and cover costs of dismantling efforts that cannot be offset by the trade in used parts or recyclates. This will also help reducing illegal practices¹⁵⁶. To ensure harmonisation on how fees are calculated across the EU and further create design incentives leading to lower future recycling costs, this option sets out criteria on how EPR fees are to be modulated, such as the weight of the vehicle, the time to dismantle components such as the battery and amount of recycled content. In addition, it sets out a mechanism to ensure that fees by vehicle manufacturers are paid to recyclers, in the case where the vehicle is treated as an ELV in an EU Member State different than the one where it was placed on the market (“cross-border” EPR mechanism). This takes account of the important volume of intra-EU movements of used vehicles. It is particularly relevant for waste operators located in Member States which have a large share of old used vehicles in their fleet, as these vehicles often become waste and are treated in these Member States, while many of these vehicles were placed on the EU market as new vehicles in another Member State.

Feedback from affected stakeholders: Many vehicle manufacturers pointed out that the dismantling sector is profitable under normal market conditions and does not need extra financial compensation. Some of them stressed that they should be entitled to exercise their producer responsibility duties through individual schemes, and not be obliged to join Producer Responsibility Organisations. Stakeholders from the dismantling, shredding and recycling sector pleaded for more financial responsibility from the automotive industry to cover extra costs linked to increased collection and improved waste management, but also

¹⁵⁵ EuRIC-European Recycling Industries’ Confederation, BVSE - Bundesverband Sekundärrohstoffe und Entsorgung

¹⁵⁶ Umweltbundesamt,(2022), Illegal treatment of end of-life vehicles - Assessment of the environmental, micro- and macroeconomic effects, texte 130/20 22

underlined that EPR obligations should not reduce their independence and called for clear safeguards in future schemes in this regard.

Cover more vehicles: PO6B (including the information provision measures M28 from **PO6A** plus M30a-b, M31b, M32) as highlighted in Table 1) is selected as the preferred option for the scope extension to L3e-L7e category vehicles, lorries, buses and trailers. It sets out basic requirements for environmental protection and minimum recycling quality via (i) the provision of information by manufacturers on composition of these vehicles, (ii) the obligation that lorries, buses and L3e-L7e category vehicles reaching end-of-life shall only be treated in authorised treatment facilities (ATFs), (iii) new rules on the export of lorries and busses and (iv) the establishment of manufacturer's responsibility for the collection and reporting for these vehicles (basic EPR scheme). These requirements are reaching less far than those applying to M1-N1 vehicles, providing more moderate environmental benefits, at a limited cost. They represent a "phased-in" approach, i.e., a starting point to put these vehicles on a path to more circular business models, initiating a change in practices and allowing to gain additional information which could pave the way for more ambitious measures in the medium to long-term.

Feedback from affected stakeholders: Almost all stakeholder categories participating in the open public consultation were in favour of extending the Directive to additional vehicles, including all environmental NGOs, absolute majority of public authorities and waste management operators who were mainly represented by SMEs. For automotive producers and suppliers, more companies were in favour rather than against, but most of them indicated that a full extension of the scope to new vehicles would not be desirable in the short term, in view of the differences between these vehicles and the vehicles currently in the scope of the ELV and 3RTA Directives.

Interlinkages and synergies between the options in the preferred policy package

The preferred policy package offers the best choice of combination of options, as it addresses in a synergetic way all the objectives of this review and apply to all relevant stakeholders in an equitable manner¹⁵⁷. The options retained in the preferred package are closely interlinked and mutually supportive, as illustrated by the following examples

- The measures under the preferred option **PO1C** on design and type-approval (for example requirements for vehicle manufacturers to develop circularity strategies and provide better information to dismantlers and recyclers) will greatly support implementing the preferred measures under **PO3B** on waste treatment (for example removal and selective treatment by the dismantlers of components and parts, to allow for higher quality recycling and higher rate of re-use of spare parts).
- The measures under **PO3B** are needed to allow for a higher uptake of recycled materials, such as plastics, steel and CRMs in new vehicles, and thereby implement the preferred measures under PO2. At the same time, the measures on recycled content in PO2 are essential for the success of measures under PO3: they will boost the market for secondary materials, ensuring that a steady supply of high quality recyclates from ELVs will find its way for incorporation into new vehicles, thereby supporting the economic viability of measures under PO3.
- The increase in collection of ELVs generated by the preferred measure under **PO4D** increases the overall effectiveness of the package. It provides much higher amounts of

¹⁵⁷ The guidance provided in Tool 16 of the BRG (figure 1b in page 118), ie assessing measures for each objective first separately and selecting the best ones which should feature in the preferred package and then compute the synergies, is followed. This is applied with a computational order in the impact assessment as explained in Annex 4.2.2

materials to be treated from ELVs collected more and directly amplifies the recycling impacts (PO3) and availability of recycled content (PO2).

- The economic and governance incentives provided under **PO5B** are in turn essential to ensure that the costs for the new measures under PO3B and PO4C are equitably shared between dismantlers, shredder, recyclers and vehicle manufacturers, so that they can be implemented in cost-effective manner and have a maximised impact.

The choice of the preferred package of options PO1 to PO5 is therefore based both on the individual performance for each option in meeting its corresponding specific objective, but also on its impact in facilitating and maximising the implementation of other objectives. Other combinations of options, in particular those for PO4 and PO5 providing significant synergies for the recycling potential of PO3 and the recycled content of PO2, would provide a lower performance in this regard.

The option on the extension of scope (PO6) has less direct links with the other options, as it applies to different segments of the automotive sector. The preferred option (**PO6B**) consists in the best performing one for putting these segments on a path to more circular business models, taking fully into account the principle of proportionality: the measures proposed would represent limited new obligations in the short to medium term, avoiding the imposition of excessive costs or burdens.

8.2 Combined impacts of the preferred policy package

The combined impacts of the preferred policy package are presented in Table 18. They are calculated for the year 2035 and compared to the baseline scenario. Data for 2030 and 2040 are provided in Annex 8.5. Compared to the impacts presented per policy option in Section 6, there are significant synergies when applied in combination as explained in Section 8.1.

The overall environmental benefits are assessed as an **annual reduction of 12.3 million tons of CO₂-eq in 2035** (10.8 million tons in 2030 to 14.0 million tonnes in 2040), key for the decarbonisation of the automotive industry. These CO₂ savings represent **2.8 billion EUR when monetised**. This is linked notably to a **better valorisation of 5.4 million tons of materials** (plastics, steel, aluminium, copper, CRMs) which would be either recycled at higher quality or re-used, as well as to the fact that **up to 3.8 million additional ELVs would be collected and treated** extra in the EU. **350 tons of rare earths** in permanent magnet materials would be separately collected for reuse and recycling in 2035 (1,500 tons in 2040), which would **contribute greatly to the EU efforts for strategic autonomy for CRMs**.

The total annual revenues for the preferred option is 5.2 billion EUR in 2035, including 2.8 billion EUR of monetised GHG savings, **against a cost of 3.3 billion EUR, leading to a 1.8 billion net revenue. The cost of the preferred option is determined at 66 EUR for all new vehicle put on the market in 2035. The estimated additional jobs are determined at 22,100, of which 14,200 are created in SMEs.**

The overall costs for public authorities are estimated to reach 24 million EUR (less than 2 EUR/vehicle), mostly linked to the supervision of EPR schemes, enforcement activities (in particular inspection campaigns and control on export of ELVs and used vehicles¹⁵⁸) and adaptation of national vehicles registration systems. The various measures on digitalisation of procedures¹⁵⁹ will increase efficiency for enforcement authorities and economic operators, and alleviate their burden.

¹⁵⁸ Costs related to enforcement measures M17, M19 and M21 are specified in Annex 3.2 in Table 3.5 in detail.

¹⁵⁹ Digital reporting on certificate of destruction; exchange of information from national vehicle registries via digital means; interoperability with single windows system to allow customs to act on export-related measures

Table 18 Total environmental benefits and costs and per vehicle for the preferred option in 2035

Environmental impacts (2035, compared to baseline)		Preferred option	Economic impacts (2035, vs. baseline, incl. admin burden)		Preferred option
PO	All life-cycle stages (in kton of materials)		Design + production (M EUR, - = cost, + = revenue)		
2	Steel recycled content	+0	Manufacturers (incl. admin burden)		-430
2	Plastics recycled content	+713	Admin burden authorities		-23
3	Materials at higher quality (recycling)	+2,322	Collection + recycling (M EUR, - = cost, + = revenue)		
4	Materials recovered (collection + export)	+1,876	Consumers, vehicle owners (incl. admin burden)		-153
6	Materials recovered (scope extension)	+508	Car dealers (export requirements)		-574
Total materials recycled at HQ (kton)		+5,420	ATFs		-40
ELVs collected, treated +reported (M units)		8.2	Shredders/PST operators		-110
4,5,6	Extra ELVs to ATFs and CoD reported	+3.8	Recyclers (incl. plastics, steel RC)		+375
4,5,6	Non-reported treatment	-1.7	Admin burden treatment		-42
4,5,6	Export of ELVs/used vehicles	-2.1	Collection+recycling (M EUR, - =cost, + =revenue)		
GHG savings (ktons of CO2-eq)			Total costs (all)		-€ 3,417
1,2	GHG savings production (steel RC)	+0	Total revenues (all)		€ 2,420
2	GHG savings production (plastics RC)	+314	Total (M EUR, excl CO2 credits)		-€ 997
3	GHG savings recycling (N1,M1)	+4,536	Total (M EUR, incl CO2 credits)		€ 1,797
4	GHG savings collection + export (N1,M1)	+6,350	Total (EUR/ vehicle, excl. CO2 credits)*		-€ 66.34
6	GHG savings scope extension (L+HDV)	+1,120	Total (EUR/ vehicle, incl. CO2 credits)*		€ 119.58
GHG savings (ktons of CO2-eq)		+12,320	Average cost GHG savings (EUR/ton)		-€ 80.91

* Represents all costs and benefits allocated to all new vehicles, including the scope extension and recurring administrative burden; The net costs per new N1,M1 vehicle, e.g. excluding the scope extension, is 65.01 EUR, see Annex 8.5.4 for all vehicle numbers and disaggregated numbers per vehicle category

The costs and revenues for the different stakeholders affected by the preferred option, calculated per vehicle and for all stages of the process (type-approval, design, production, collection, waste treatment, export), are estimated as follows:

- **For vehicle manufacturers**, the net costs linked to production and design, primarily related to plastic recycled content, would represent roughly 26 EUR per vehicle (N1,M1, 392 million EUR adjustment costs, 38 million EUR administrative burden for the manufacturer and 23 million EUR administrative burden for authorities). In addition, the costs linked to collection and treatment (150 million EUR not covered by revenues, including administrative burden for treatment of 42 million EUR) which could potentially be covered by the manufacturers under the EPR schemes would amount to 12 EUR per new vehicle¹⁶⁰. The total costs (580 million EUR) for manufacturers (production + EPR fees) of 39 EUR per new vehicle are expected to be ultimately covered by the consumer when buying a new vehicle. These are short to medium-term costs for the EU automotive industry. The preferred option would also reduce its energy and strategic raw material dependencies and provide for important savings. While these revenues cannot all be quantified, they are expected to be significant and spill over to the whole automotive supply chain (see section 8.3 for more elements on this point);
- **For the waste treatment sector**, the costs (530 million EUR) for ATFs of 44 EUR per vehicle, mainly from dismantling efforts, slightly outweigh anticipated revenue increases (490 million EUR) of 40 EUR per vehicle. Similarly, for shredders, the 101 EUR of extra cost per vehicle (1,230 million EUR in total) mainly from new investments in better sorting technologies compares against a 92 EUR of revenue potential (1,120 million EUR). In these two cases, the differential between costs and revenues is expected to be covered by fees from manufacturers under EPR schemes. It is important to stress that the

¹⁶⁰ The sensitivity analysis shows for the EU as a whole, the EPR fee may range between 3 EUR and 33 EUR per vehicle placed on the market. See Annex 8.2.5 for more details.

situation will considerably differ between Member States and economic operators, depending on the current treatment technologies used (esp. availability of PST) and labour costs. For **recyclers**, due to increased materials availability (incl. CRMs removed) and improved prior separation in previous stages, the revenue potential of 49 EUR per vehicle (440 million EUR) clearly outweighs a 29 EUR per vehicle cost increase (770 million EUR). The combined administrative burden for treatment operators is 3.50 EUR per new vehicle. The preferred option would also reinforce and boost the recycling sector, encouraging its modernisation and expansion. The preferred option would favour innovation in new processes and technologies, for sorting and high-quality recycling, building on current research¹⁶¹.

- **For specialised car and heavy-duty vehicle exporters**, the revenue loss is expected to reach around 47 EUR per new vehicle sold (570 million EUR);
- For **consumers**, in addition to a likely increase in prices of new vehicles of around 39 EUR per vehicle (aforementioned 580 million EUR), they might also expect a decrease in prices when selling second-hand cars due to reduced export there of 12 EUR per vehicle (150 million EUR), but should also be able to benefit from cheaper prices for used spare parts due to all measures designed to support their recovery and sales;
- The **administrative costs for public authorities** (23 million EUR) dealing with type approval, vehicle registration, customs control and ECHA) are 1.40 EUR per vehicle.
- The total **one-off administrative costs** are 2.45 million EUR for manufacturers and 1.55 million EUR for authorities.

Annex 8.5.4 specifies the costs and revenues breakdown per vehicle and stakeholder. It further quantifies the uncertainty in the costs per vehicle, for various scenarios as well as the breakdown for the current vehicle category scope.

8.3 Expected impacts on the competitiveness of the automotive industry

Reducing the negative environmental impacts linked to the design, production, service life and end-of-life treatment of vehicles will contribute to the sustainability of the vehicle production and recycling sectors, but it is also important to discuss the distinct impacts of the initiative on the competitiveness of the automotive industry as a whole. This is especially so in the current context of the transition to climate neutrality, which puts pressures on the automotive industry, requiring significant investments, innovation and new technologies, reorganisation of supply chains and reducing strategic dependencies of raw materials.

Despite the moderate cost increases for the automotive industry¹⁶² resulting from the application of the proposed measures, increased circularity of the automotive sector can grow its competitiveness in several ways.

First and foremost, by increasing the use of recycled materials and reducing waste, vehicle manufacturers can reduce the energy embedded in their products. As evidenced by the substantial GHG savings foreseen for all policy options assessed, increasing levels of ambition in circularity will help manufacturers decarbonise in a cost-efficient way. Some of the measures in the preferred policy package –notably, those related to extended producer responsibility schemes under option PO3– would result in a net transfer of funds from vehicle manufacturers to dismantlers and shredders, for instance to cover necessary recycling technology investments in the short term. However, these funds will ultimately benefit the

¹⁶¹ Since 2000, under the Horizon 2020 and LIFE, the EU has funded around 100 different projects which have contributed to higher scale of knowledge, expertise in advancement of relevant ELV treatment operations, material recovery. See Annex 12.

¹⁶² See, in particular, the costs per vehicle for the preferred package in section 8.2. The average cost of 65 EUR are modest in relation to the purchase price of a vehicle or the additional cost of an EV as compared to a baseline conventional vehicle and constitute a 0.2% increase in case an average sales price of EUR 38,000 is assumed.

markets for secondary raw materials serving the automotive industry with higher quality recycled materials with a lower environmental footprint.

Secondly, the proposed measures under policy options PO1 and PO2 can help manufacturers reduce their dependence on virgin raw materials, which can be subject to price fluctuations and supply chain disruptions. By using recycled materials and implementing circular processes, vehicle manufacturers will create more resilient supply chains and reduce their exposure to price volatility. This is especially true for CRMs and to increase their recovery from end-of-life vehicles, this initiative sets out that the Commission will develop specific requirements on the design for dismantling, removability and recycling of CRM relevant parts and components from vehicles.

Third, circular practices can create new revenue streams for companies by turning waste into a valuable resource. For example, vehicle manufacturers can sell recycled materials to other industries, or offer recycling services to customers. Some manufacturers are already pursuing innovative business models where they lease EV batteries and take them back from their customers at the end-of-life stage to recycle them to extract valuable materials such as lithium and cobalt.

Fourth, as an indirect benefit, circular practices can enhance a company's brand image and reputation by demonstrating its commitment to sustainability and environmental responsibility. This can, in turn, attract investors which are interested in investing in sustainable products and thereby allowing the manufacturers to benefit of a green investment premium. Furthermore, it can also attract environmentally conscious consumers willing to pay a premium for sustainable products and increase brand loyalty. Several EU manufacturers may be considered front-runners in different aspects of circular production and design. An increased focus on circularity will also help vehicle manufacturers meet the regulatory requirements in non-EU markets and increase the appeal of their products and services.

8.4 REFIT (simplification and improved efficiency)

The preferred option provides for improved efficiency and harmonisation and takes into account majority of suggestions provided in the Fit for Future Platform (F4F) opinion¹⁶³. In terms of the overall regulatory burden, the costs and benefits of the preferred package are considered to be balanced and proportionate to achieve the objectives of the revision. There are higher costs in the short term for applying new requirements related to the vehicle design and improving the quality of ELV treatment which would be offset over time and result in significant GHG savings in the production phase, and higher economic viability of ELV treatment operators¹⁶⁴, while also supporting the competitiveness of the operators across automotive value chain.

Specification of common requirements for vehicle type-approval procedures (e.g. clarification of the type-approval procedure, information requirements) will streamline internal market procedures for manufacturers (PO1-2). Further simplification would result in new restrictions on chemical substances being centralized under REACH, the primary EU chemical legislation (PO1), including the restrictions relevant to the extended vehicle categories (PO6). As regards the treatment of ELVs, the alignment of recycling definition with the Waste Framework Directive will simplify the legal interpretation and will increase comparability of the reporting data by MS (PO3). Setting ELV criteria for EPR schemes will limit diverging approaches in Member States (PO5). This will allow to simplify procedures, and thus would improve transparency. Alignment of requirements for the extended vehicle categories will provide legal clarity for the economic operators of the automotive sector (PO6).

¹⁶³ For more information about the selected suggestions from the F4F opinion see Annexes 1 and 5.

¹⁶⁴ Impacts on the affected groups of stakeholders is provided in Annex 3.

8.5 Application of the ‘one in, one out’ approach

The estimates of administrative costs for the purposes of the Commission’s ‘one-in-one-out’ policy are presented in Table 19 below and in Annex 3. The administrative costs for public authorities and inspection-related activities have been excluded.

Table 19 Costs related to the ‘one in, one out’ approach

Costs in million EUR	Citizens/ consumers		Businesses	
	One-off	Recurrent	One-off	Recurrent
Administrative costs (for offsetting)	0	2.331	2.452	79.720

Overall, the recurrent costs related to the ‘one-in, one-out’ approach per vehicle are assessed at 81.8 million EUR or EUR 5.45 per new vehicle for the preferred option package. The preferred option makes a maximum use of the digitalisation potential to ensure efficient enforcement of new requirements, without which the impacts would have been an additional 32.2 million EUR or 40% higher costs. In comparison, streamlining of reporting obligation with existing requirements prevents another 8.8 million EUR or 11% higher costs. The development of digitally accessible documentation through existing platforms and then via the Circularity Vehicle Passport will ensure an efficient access by economic operators, in particular SMEs (e.g. ATFs, garages and repair shops), to information needed to boost circular use of automotive materials. Digitalisation will also play a significant role in increasing the collection of ELV and addressing the problem of “missing vehicles”. This will be done through digitalisation of reporting of ELVs by ATFs to competent authorities and by ensuring that Member States authorities exchange digitally the vehicle registration information required to better track used vehicles and ELVs across the EU. ATFs would benefit due to more streamlined issuing and tracking of CoDs¹⁶⁵. Interconnection with the EU Single Window Environment for Customs would enable customs authorities to enforce new conditions on the export of used vehicles.

8.6 International Aspects

In 2021, the European automobile industry exported 5 million passenger cars, while over 3 million passenger cars were imported to the EU¹⁶⁶. The sales of new vehicles manufactured outside the EU represent 30% of the overall sales in the EU, while 46% of the vehicles manufactured in the EU are exported¹⁶⁷. Measures under the preferred option on **design and production** equally apply to domestic and imported products. Exporters to the EU would have to comply with the requirements under type-approval and with the plastics and steel recycled content targets¹⁶⁸. This would complement other requirements which are mandatory for the placing of a vehicle on the EU market. An assessment of the economic

¹⁶⁵ There is significant synergy between this revision and the general digitalisation of the national vehicle registration system under DG MOVE’s revision of the roadworthiness package and Directive 2014/46/EU on vehicle registration documents. The reduced administrative burden from digitalisation of vehicle registration documents is potentially worth up to 1 EUR per vehicle or 9.8 million EUR of recurrent savings in total when fully implemented. This potential ‘one-out’ saving is fully allocated to DG MOVE’s impact assessment and, despite the synergies, not to this proposal.

¹⁶⁶ In 2021, the EU imported 458,769 passenger cars from Türkiye, followed by China (435,080), the United Kingdom (393,410), Japan (401,276), South Korea (377,404), the United States of America (308,506). More information available at: <https://www.acea.auto/figure/eu-motor-vehicle-trade-by-vehicle-type-in-units/>, <https://www.acea.auto/figure/eu-passenger-car-imports-main-countries-of-origin-in-units/>

¹⁶⁷ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008.

¹⁶⁸ The recycled plastics and steel could be sourced from within or outside the EU.

impact demonstrates that the proposed new design related requirements¹⁶⁹ would not significantly affect production cost per vehicle. The obligation for vehicle manufacturers and importers to provide information on substances of concern, dismantling of parts/components and of recycled content will be based on digital platforms already in existence or in development by the entire automotive supply chain, regardless of producing inside or outside Europe. The costs linked to financial contributions for **EPR schemes under PO5B** would apply equally to manufacturers of vehicles in the EU and those importing vehicles in the EU, similar as what is foreseen for example for batteries under the future Regulation on batteries.

The improved recycling obligations of **PO3B** may lead to reduced amounts of waste fractions shipped from the EU. This is consistent with the CEAP objective that the EU should take more responsibility for the waste generated in Europe, while respecting the EU's international legal obligations. The proposal is fully consistent with the Basel Convention. For fractions that will be exported for treatment abroad, the approach is in line with the Waste Shipment Regulation that they should be treated in "broadly equivalent conditions" as in the EU. The export limitation for used vehicles which are not roadworthy, combined with all collection enhancing measures and improved traceability via interoperable registers under **PO4D**, ensures vehicles that are not technically fit to be on the EU roads would not be exported and not create safety and environmental (pollution) problems in third countries. The expected export reduction for used passenger vehicles could reach up to 65%. This is a maximum level, based on available studies^{170,171} indicating that a large share of used vehicles currently exported are of low quality and value and do not comply with the roadworthiness requirements in accordance with Directive 2014/45/EU. **These export requirements complement actions and policies which have been launched recently by many receiving countries** to improve air quality and road safety, via restrictions on the import of used vehicles based on roadworthiness conditions, age limits or compliance with Euro emission standards¹⁷². The export measures are justified by the need to address the EU environmental footprint linked are consistent with the EU environmental policy, as reflected notably in the EU Action Plan: "Towards Zero Pollution for Air, Water and Soil"¹⁷³. Additionally, these measures are also consistent with the CEAP and the EU waste policy as they contribute to the implementation of 'waste hierarchy', in particular by preventing non-roadworthy vehicles, which are at the end of their useful life, from being disposed in the receiving countries where often substandard treatment of ELVs causes environmental damages, such as oil spillage, unsound treatment of refrigerants or improper removal of hazardous substances and of components for higher quality of recycling¹⁷⁴. Addressing the problem of unsustainable trade in used vehicles which generate environmental pollution and road safety is not solely the responsibility of importing countries. As indicated in section 5.1, the control on the import of used vehicles represents substantial challenges for importing countries. In addition, the

¹⁶⁹ i.e. recycled content target, requirement to adopt vehicle-type circularity strategy

¹⁷⁰ Umweltbundesamt, (2022), Illegal treatment of end of-life vehicles - Assessment of the environmental, micro- and macroeconomic effects, texte 130/20 22.

¹⁷¹ Netherlands Human Environment and Transport Inspectorate, Ministry of Infrastructure and Water Management (2020): Used vehicles exported to Africa: A study on the quality of used export vehicles.

¹⁷² For example, specific age limitations for the import of used vehicles have been adopted in 2020 under the umbrella of the Economic Community of West African States (ECOWAS). The age limit for importing vehicles into the ECOWAS region is 5 years for light duty vehicles, two-wheel motor vehicles, tricycles and quadricycles and 10 years for heavy-duty vehicles. A period of 10 years is granted to countries that have not yet adopted these age limits to gradually comply. See Directive C/Dir.2/09/20 relating to the harmonization of the limits of gas and exhaust particle emission for light and heavy vehicles, two wheel vehicles, tricycles and quadricycles within the ECOWAS region.

¹⁷³ https://eur-lex.europa.eu/resource.html?uri=cellar:a1c34a56-b314-11eb-8aca-01aa75ed71a1.0001.02/DOC_1&format=PDF

¹⁷⁴ This is for example associated with the pollution risks linked, among others, with the informal recycling of lead-acid batteries.

technical control processes are not yet robust enough to identify unsafe or high pollutant vehicles in some countries relying on the import of used vehicles¹⁷⁵. **The export-related measures contained in the preferred option and the import measures taken by importing countries are therefore mutually supportive. Export measures enhance the efficiency of measures taken by importing countries and are key to ensure that the overall global trade in used vehicles becomes more sustainable.** This is in line with the recognition by the UN Environmental Assembly of the global environmental challenges linked to trade of used vehicles. On this basis, the UN Environment Programme, working together with other international organisations¹⁷⁶, is spearheading international cooperation to ensure that exporting and importing countries address jointly these problems. **The export related measures are also consistent with the current efforts of the European Commission to support the African Union and its members states in harmonising road transport regulations and policies.** Under the current Multiannual Financial Perspectives, the Commission provides more than EUR 50 million to the African Union for projects in that regard, such as the African Transport Policy Programme¹⁷⁷, providing assistance with setting vehicle's standards and safety ratings for new and used vehicles, the Tripartite Transport and Transit Facilitation Programme¹⁷⁸, enforcing vehicle load management and vehicle standard regulations, and the UN Road Safety Fund (UNRSF¹⁷⁹) which, among other things, promotes the use of roadworthy vehicles with an emphasis on periodic technical inspection.

The new export requirements should not lead to major disruptions in the supply of used vehicles to the recipient countries. The collected evidence suggests that countries which have already implemented comprehensive import restrictions for several years, which notably require inspections of used vehicles prior to export by private companies¹⁸⁰, have not seen major changes in the volume of used vehicles that they imported. While in some cases there was a decrease for a short transitional term, imports resumed to previous levels after a few years. These regulatory changes have been contributing to higher quality of second-hand vehicles and the renewal of the fleet with safer and cleaner vehicles¹⁸¹. The export-related measures will contribute to ensure that the future demand for vehicles in developing countries is increasingly met by cleaner vehicles: while the export of vehicles from the EU which are not roadworthy will result in a decrease in the export of the most polluting and dangerous ones, the export of roadworthy used vehicles will continue to be allowed. These vehicles are expected to be less polluting in the future in light of the new emission standards applying in the EU. Used vehicles of a higher quality will also last longer which means that there will be a reduced need to replace them and increase imports. The possibility that the supply of used vehicles shifts from the EU to other exporting countries cannot be ruled out, but would

¹⁷⁵ See for example reports from International Motor Vehicle Inspection Committee (CITA) for Togo: https://citainsp.org/wp-content/uploads/2018/07/TogoReportFinalEN.Final_.pdf and for Cameroon: https://citainsp.org/wp-content/uploads/2020/07/Report_AVIS_Cameroun_final.pdf

¹⁷⁶ Especially the United Nations Economic Commissions for Europe (ECE), the International Motor Vehicle Inspection Committee (CITA) and the Fédération Internationale de l'Automobile (FIA), which have established the "Project of Safer and Cleaner Used Vehicles for Africa". See <https://unece.org/sites/default/files/2023-05/Safer%20and%20Cleaner%20Used%20Vehicles%20for%20Africa%20%28Final%29.pdf>

¹⁷⁷ <https://www.ssatp.org/topics/urban-mobility>

¹⁷⁸ <https://tttfp.org/>

¹⁷⁹ <https://roadsafetyfund.un.org/>

¹⁸⁰ Kenya and Mauritius have for example established and implemented a sophisticated regime governing the import of used vehicles for many years (since 2008 for Kenya and 2017 for Mauritius), which require notably that import is only authorised upon the presentation of a test operated by accredited specialised companies in the exporting country and verifying the roadworthiness of the vehicles concerned. The volume of imported used vehicles has not decreased but the imported vehicles are newer and cleaner. Such comprehensive regimes are not yet in place in most other importing countries, which have only more recently started to set out rules on the import and placing on the market of used vehicles.

¹⁸¹ For more information see Annex 7.2.4.

require significant changes in the market and its possible negative environmental consequences would be mitigated through the ongoing international cooperation initiatives led by UNEP on this issue.

9 HOW WILL ACTUAL IMPACTS BE MONITORED?

Effective monitoring relies on harmonised reporting on all measures included in the preferred option package. Reporting over the design and production differs from reporting on the ELV requirements in type of information to be reported, timing and type of stakeholders. For the design and production stages, the main responsibilities are with manufacturers to provide reliable information on their compliance with the recyclability/re-usability targets, on the circularity strategy and chemical content (including substances of concern information, and recycled content). Verification is mainly up to type-approval and market surveillance competent authorities of Member States to check requirements at the level of economic operators. Communication of dismantling information to treatment operators and general circularity data to vehicles owners will be increasingly digitalised and made available via existing IT platforms. The reporting over collection, treatment and EPR predominantly follows existing reporting sequences from treatment operators to PROs, to competent authorities and to the Commission, including Eurostat. Table 19 provides a list of indicators to monitor implementation of the new Regulation. Based on these elements, the Commission will carry out a review of the new legislation within 8 years after its entry into force.

Table 20 Monitoring indicators

Objectives	Monitoring indicators	Monitoring details
Design and production stages		
Design circular (PO1)	3R percentages declared at 3R type-approvals per vehicle type	M1 in Annex 7.2.1
	The number of verified substances of concern declarations	M4a in Annex 7.2.1
	The number of verified recycled content declarations	M4b in Annex 7.2.1
	Verification of circularity strategy information	M6 in Annex 7.2.1
Use recycled content (PO2)	Percentage of recycled content for steel per new vehicle type	M9, M10 in Annex 7.2.2
Collection and recycling stages		
Treat better (PO3)	Reuse + recycling and reuse + recovery rates (ESTAT)	M12 in Annex 7.2.3
	Amount of removed parts and components prior shredding	M13 a-c in Annex 7.2.3
	Number of inspections at treatment operators	M17b in Annex 7.2.4
	Monitoring overviews warnings and fines at treatment operators	M17b in Annex 7.2.4
Collect more (PO4)	Number of vehicles and weight collected and recycled (ESTAT)	Existing at Eurostat
	Number of vehicles and weight placed on the marked (ESTAT)	Idem
	Number of vehicles and weight in the national fleets (NEW)	M20 in Annex 7.2.4
	Number of used vehicles exported from the EU	M21
Financial Incentives (PO5)	Number of inspections of exports of ELV or used vehicles	M19a
	Number of ELV specific PROs and the number of ATFs and PST plants and their treatment capacity	M23 in Annex 7.2.5
All life-cycle stages		
Cover more vehicles (PO6)	Number of reports on the fleet development and number of vehicles treated at ATFS with CoDs issued	M30a,b, M31b in Annex 7.2.6

ESTAT = existing data field in Eurostat ELV statistics¹⁸²; NEW = recommended addition to ESTAT ELV statistics

¹⁸² https://ec.europa.eu/eurostat/statistics-explained/index.php?title=End-of-life_vehicle_statistics#Number_of_end-of-life_vehicles



EUROPEAN
COMMISSION

Brussels, 13.7.2023
SWD(2023) 256 final

PART 2/4

COMMISSION STAFF WORKING DOCUMENT
IMPACT ASSESSMENT REPORT

ANNEXES 1 TO 6 to the IMPACT ASSESSMENT REPORT

Accompanying the document

**Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE
COUNCIL**

**on circularity requirements for vehicle design and on management of end-of-life
vehicles, amending Regulations (EU) 2018/858 and 2019/1020 and repealing Directives
2000/53/EC and 2005/64/EC**

{COM(2023) 451 final} - {SEC(2023) 292 final} - {SWD(2023) 255 final} -
{SWD(2023) 257 final}

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ANNEX 1: PROCEDURAL INFORMATION

1.1 Lead DG, Decide Planning/CWP references

The preparation of this file was led by DG Environment (ENV), under a co-lead/coordination with DG Internal Market, Industry, Entrepreneurship and SMEs (GROW) and supported from DG Joint Research Centre D.3 European IPPC Bureau (JRC.D.3).

The file essentially comprises a revision of Directive 2000/53/EC on end-of-life vehicles¹ (“ELV Directive”) and Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability² (“3R type-approval” Directive), which links the requirements on the placing of the market of new vehicles with the provisions of the ELV Directive.

This revision takes into account the two evaluations that were performed for the two legal instruments and incorporates as many as possible of those recommendations that have resulted from those evaluations. In addition, the objective of the combined review of the ELV Directive and its mirror 3R type-approval Directive is to update the two instruments to be able to deliver the key objectives of the European Green Deal and Circular Economy Action Plan and to update both legislations to make them fully operational as described in Section 2 (below).

Since this file comprises two combined sub-initiatives, they were included under a single entry in DECIDE/Agenda Planning database, as follows:

Commission proposal for the revision EU legislation on end-of-life vehicles	PLAN/2020/8644

1.2 Organisation and timing

This joint review of the EU rules on end-of-life vehicles and the 3R type-approval Directive is a deliverable under the European Green Deal³, the Zero Pollution Action Plan⁴, the Circular

¹ Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles (OJ L 269, 21.10.2000, p. 34–43).

² Directive 2005/64/EC of the European Parliament and of the Council of 26 October 2005 on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability and amending Council Directive 70/156/EEC (OJ L 310, 25.11.2005, p. 10–27).

³ COM(2019) 640 final <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019DC0640>

⁴ COM(2021) 400 final <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0400&qid=1623311742827>

Economy Action Plan⁵ (CEAP) and has strong links to the revised in May 2021 Industrial Strategy for Europe⁶, which in turn built on the 2020 Industrial Strategy.⁷

The **Inception Impact Assessment Roadmap** was published on 22 October 2020 with a feedback period until 19 November 2020⁸.

Following the conclusions of the evaluation of the EU rules on end-of-life vehicles, which revealed the operational inconsistencies between the ELV Directive and the 3R type-approval Directive, the DG ENV and DG GROW decided to carry a joint review of the two legislations.

A 14 week **open public consultation**, held between 20 July 2021 and 26 October 2021, was published on the Commission EUSurvey website⁹.

The Inter Service Steering Group (ISSG) for the Impact Assessment was set up by the DG Environment. It included the following DGs and services: CLIMA (Climate Action), COMP (Competition), CONNECT (Communications Networks, Content and Technology), ENER (Energy), ESTAT (Eurostat), GROW (Internal Market, Industry, Entrepreneurship and SMEs), INTPA (International Partnerships), JRC (Joint Research Centre), MOVE (Mobility and Transport), NEAR (Neighbourhood and Enlargement), RTD (Research and Innovation), SG (Secretariat-General), SJ (Legal Service), TAXUD (Taxation and Customs Union) and TRADE (Trade).

The ISSG has been consulted regarding, and has given input to, key deliverables from the support study, and the joint draft Impact Assessment report on the ELV Directive and 3R type-approval Directive prior to its submission to the Regulatory Scrutiny Board (RSB). This was the case notably at two ISSG meetings which took place on 1 December 2022 and 24 January 2023.

1.3 Consultation of the Regulatory Scrutiny Board (RSB)

An informal upstream meeting with the RSB took place on 28 February 2021.

After final discussion with the ISC, a draft of the impact assessment was submitted to the RSB on 15th February 2023 and discussed at a meeting with the RSB on 15^h March 2023.

Following the negative opinion of the RSB from 15 March 2023, changes were made to the IA in order to reflect the recommendations of the Board. The table below presents an overview of the RSB's comments and how these have been addressed.

⁵ COM(2020) 98 final https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF

⁶ COM(2021) 350 final https://ec.europa.eu/info/sites/default/files/communication-industrial-strategy-update-2020_en.pdf

⁷ COM(2020) 102 final <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1593086905382&uri=CELEX%3A52020DC0102>

⁸ [End-of-life vehicles – revision of EU rules \(europa.eu\)](https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-End-of-life-vehicles-revision-of-EU-rules/public-consultation_en)

⁹ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-End-of-life-vehicles-revision-of-EU-rules/public-consultation_en

Table 1.1a: How RSB comments of the first opinion have been addressed

RSB comments	How addressed
Main findings	
B(1). Objectives: the report needs to clarify relation of the specific objectives with the general objective of contributing to the competitiveness of the automotive sector	The impact assessment report has been changed, so that the contribution of the initiative to the competitiveness of the automotive sector is no longer included among the general objectives of the initiative. As the initiative will however have a number of positive impacts on the competitiveness and resilience of this sector, a new section 8.3 on this point has been added.
B(2) Definition of problems: the report is not clear on the key policy choices and the robustness of the evidence informing these choices.	Clarifications have been added in section 2 on the definition of the problems and their interrelationships, and in section 8 (as well as in Annex 4) on the interrelationships and synergies between the options contained in the preferred policy package. This responds to the second point raised by the RSB and “point for improvement” C(2). The evidences on the robustness of the choices build on a comprehensive IA support study by Oeko-Institut as well as dedicated studies by the JRC on plastics and CRMs and extensive consultation with stakeholders. This is described in Annex 4. A summary table specifying all measures per policy option in a single overview, their inclusion in the preferred package as well as implementation dates, has been added to section 5.2.
B(3) Data analysis: The level of quantitative analysis on the extension of scope of the ELV legislation is not proportionate to the scale of the expected impacts. The report does not sufficiently assess the impacts on competitiveness of affected EU sectors, international partnership countries and the enforcement capacities of Member States.	New data and analyses have been added throughout the text concerning the extension of the scope of the current legislation to new vehicles. This is particularly the case for the quantification of the economic and environmental impacts of the preferred option (see in particular sections 6.2.6 and 6.3.6). This is based on new estimates, stemming from dedicated work by the Oeko-Institut on this issue. In addition, a new section has been added in appendix 15 on the relevance of measures to extend the scope of recovery of critical raw materials (CRM). This new section has been prepared by the JRC based on a recently completed study (made available after the first submission). The total administrative burden has been better presented per operator and reduced due to some double counting of one-offs as yearly costs in the tables of the contractor. The detailed tables in the appropriate template are included in Annex 3. No ‘one-out’ costs are identified. The recurring and one-off costs are consistently presented for the policy options. New elements were provided on the impacts of the proposed export measures on importing countries, based in particular on the contributions of INTPA (see section 8.6 and annex 8, section 7.2.4) - the costs of the export measures enforcement and other public authorities are quantified in Section 8.2 and Annex 8.
B(4) Comparison of different policy	The analysis on the comparison of the effectiveness and efficiency

RSB comments	How addressed
options: the report does not clearly compare the different policy options in terms of effectiveness and efficiency. It does not sufficiently demonstrate that the preferred combination of options is the most proportionate and best performing one.	of the options has been considerably reinforced in the impact analysis report (see section 7.2), as well as the demonstration of the performance of the preferred package of options (section 8.2). It includes a cost-benefit analysis in line with the Better Regulation Guidelines incorporating costs for the extended scope as well as the cost-effectiveness assessment moved from the annexes to the main text. The choice of the preferred option for recycled content for steel has been amended and clarified, i.e. by specifying that future legislation will not directly set a mandatory target level but that there should be an empowerment for the Commission to lay down such a target based on a dedicated feasibility study (see section 8.1).
What to improve (comments summarised)	
C(1). The report needs to define important terms and concepts, provide a structured and clear set of general and specific objectives that support competitiveness and enhance EU sectors. The specific objectives must be precise and measurable to track progress and success	The definitions of ELVs have been added in section 1.2, the general legal context is described (also in section 1.2) and some terms clarified, like the scope of the L-category vehicles. As indicated above, the expected impacts on the competitiveness of the automotive industry are presented in a dedicated section 8.3. In order to ensure better measurement of progress and success, the specific objectives have been formulated more precisely (see section 4.2), to allow for an assessment of the performance of the preferred package of options in the future.
C(2). The report should clearly outline policy options and specify if the policymaker can prioritize specific issues by selecting a limited set of interventions from various areas, leading to alternative combinations of measures. Additionally, the report should evaluate and compare these alternatives against the baseline for effectiveness, efficiency, and proportionality.	The specific features and interlinkages between the problems and associated objectives have been described more in details in section 2.1, stressing the importance of treating them in a consistent and mutually supportive manner. The interplay between each best performing option and their synergies is also explained in more details in sections 8.1 and 8.2. This provides policy makers with additional information on the rationale for the preferred package. The impact assessment identifies a set of problems, as well as objectives and options designed to address each of these problems separately, with a dedicated assessment of their impacts. This provides clear information for policy makers on all problems and ways to address them. Based on the methodology foreseen in the Better Regulation Guidelines, the report shows that the preferred package of options is the best performing one to address all problems, both individually and taken together, in view of their synergies. In that regard, and in line with the Better Regulation Guidelines, alternative combinations of options have not been assessed in the report, but the information that is contained on each option could be used by policy makers to evaluate alternative solutions.
C(3) The report needs to clarify why EU-wide Extended Producer Responsibility schemes were not considered and how banning the	Regarding the choice to discard the option of individual and/or collective EU-wide Extended Producer Responsibility schemes, additional explanations have been provided in the revised version of the report and in Annex 7.3.5). This measure is discarded mostly

RSB comments	How addressed
export of vehicles aligns with the waste hierarchy. It should also explain the environmental impact of this ban, specifically the increased number of vehicles left in the EU requiring ELV disposal.	for subsidiarity reasons as it would represent a direct intervention at the EU level on the organisation and governance of the waste management sectors and operators which are currently dealt with by Member States. The existence of national vehicles registers and the absence of EU financial and human resources to assume new tasks linked to the running and supervision of EU EPR schemes also make this option unrealistic in the current context. With regard to setting requirements for export vehicles that can still be used in third countries, the report has been complemented with data exposing the environmental and road safety consequences of the current patterns of export of used vehicles from the EU, where no distinction is made between roadworthy and non-roadworthy vehicles. The export measures are justified by the need to address the EU environmental footprint linked to such practices, consistent with the EU environmental policy, as reflected notably in the EU Zero Pollution Action Plan. This is also supportive of efforts at global level and by importing countries for trade in cleaner and safer used vehicles. These measures are not inconsistent with the EU waste policy as they will avoid that the dismantling of a large number of used vehicles originating from the EU takes place in substandard conditions at the end of their life (which associated pollution risks linked for example to informal recycling of lead-acid batteries). The report provides also more information on the environmental impacts of these measures in the EU, including quantified estimates on increased vehicle quantities used that would be subject to ELV treatment in the EU, as described in Section 8.6 and Annex 8, Section 7.2.4.
C(4). The report needs to improve the impact analysis by ensuring that the quantitative analysis matches the expected impacts. It should quantify the costs and benefits of extending the scope of the ELV legislation, and if this is not possible, explain why and discuss the quality of available evidence. The report should clarify how much of an evidence-based decision can be made based on available information and what the risks are if cost estimates are absent.	The revised report now includes a more detailed and better quantified analysis of the costs and benefits associated with options for extending the scope of ELV legislation. Where quantification has not been possible or proportionate, the report explains why and provides a qualitative assessment of the options at stake.
C(5). The report needs to enhance its impact analysis. It should be transparent about the impact on competitiveness, particularly for the automotive sector, and clarify the total costs of the preferred option	The revised version provides an enhanced analysis of the impacts of the various options analysed. It contains notably more information on the impact of the preferred package on the competitiveness of the automotive sector. The total costs resulting from the preferred option for EU vehicle manufacturers and other operators have also been clarified, including quantitative estimates

RSB comments	How addressed
for EU vehicle manufacturers. The report should also assess the impact on international partner countries and evaluate if an export ban would reduce mobility options, particularly for vulnerable groups, or result in trade diversion with potentially polluting vehicles imported from other third countries. Additionally, the report should assess the impact on Member States' enforcement capacities and clarify how.	and qualitative assessments of non-quantified costs and as costs per vehicle detailed further in the Annexes. Regarding impacts on international partner countries, the report has been completed with case studies data from countries which have been imposing strict and comprehensive import measures for many years already (see section 8.4 and Annex 7.2.4). The report also assesses, as part of the administrative burden, the impact on Member States' enforcement capacities and clarified how the administrative burden is estimated, taking into account the One In, One Out approach.
C(6).The report should analyse and explicitly present the distribution of impacts and show who will benefit from this initiative and who will bear the costs, taking into account that the overall net benefit of the initiative is critically linked to credited CO ₂ savings.	The revised version contains an analysis of the distribution of impacts among stakeholders, explicitly presenting who will benefit and bear the costs of the initiative (with a breakdown of the expected costs and benefits for each group). The report integrates the CO ₂ savings as part of the overall monetised benefits of the preferred package.
C(7). The report should provide a clear comparison of options, mainly in terms of effectiveness and efficiency. It should present the cost-benefit analysis (net impacts and Benefit Cost Ratios) for each option (and relevant combinations thereof) to allow for a solid comparison of options which in turn can support the selection and justification of the preferred set of measures. The total net impact and Benefit Cost Ratio of the preferred option should be presented. The comparison should bring together all monetised and non-monetised impacts – economic, environmental and social. The integration of environmental benefits in the analysis should be transparent and consistent.	The revised version of the report includes a cost-benefit ratio analysis for each option, as well as a more developed assessment of their effectiveness, coherence and proportionality and the underlying assessment. The total net impact and the benefit-cost ratio of the preferred option are also presented in Section 8.5. The environmental benefits are explained and, except when this was not possible, quantified. Additionally, the revised report includes a comparison of all monetised and non-monetised impacts, including economic, environmental and social impacts.
C(8).The report should improve the explanation of its methodological approach and the analytical clarity throughout. All the key assumptions and data should be explained. The report should present the aggregated and disaggregated estimates in a way that it is clear how the figures relate to one another.	The report now provides a more detailed explanation of the key assumptions and data used in the analysis. It also presents aggregated and disaggregated estimates in a concise manner, making it easier to understand the relationship between the numbers. In addition, the Annexes to the report present all estimates in a disaggregated manner with greater granularity, making it easier to understand how the figures relate to one another. The report

RSB comments	How addressed
References to the supporting study and presentation need to be improved.	explains all key assumptions and data used in the analysis, providing readers with greater transparency and ensuring that the report's conclusions are based on sound evidence. The supporting study and other supporting document are presented in Annex 4 and referred to throughout the document, when the measures proposed or the analysed impacts are based on these document.

Resubmission

A revised Impact Assessment was submitted to the Regulatory Scrutiny Board on 28th of April 2023. The Regulatory Scrutiny Board (RSB) of the European Commission assessed the revised Impact Assessment and issued a positive opinion with reservations on the 16th of May 2023.

The Board's main findings were the following and these were addressed in the final impact assessment report as indicated below in Table 1.1b.

Table 1.1b: How RSB comments of the second opinion have been addressed

RSB comments	How addressed
Main findings	
(1) The report should explain the differences between used vehicles, waste and vehicles without a roadworthiness certificate and carry this differentiation throughout the text.	Differences are explained in Section 2.3.2. of the IA report and Annex 6.4.2. in particular analysing the regulatory failures related to the waste, used vehicles and the distinction with ELVs, the relevance of the roadworthiness certificate.
It should better demonstrate that requiring a roadworthiness certificate for exporting used cars is the best option in view of other potential available alternative measures (e.g. based on age of the vehicle).	Importance of use of the roadworthiness certificate was clarified in the Section 2.3.2 of the impact assessment report, by explaining that the roadworthiness certificate is an essential part of the EU regime designed to ensure that vehicles are kept in a safe and environmentally acceptable condition during their use. Directive 2014/45/EU specifies the minimum elements which have to be tested, in order for a vehicle to obtain a certificate. While these requirements are a condition for a vehicle to be used on EU roads, a prerequisite for a vehicle to have a valid roadworthiness certificate is considered to be the best option in regulating export of used vehicles without creating additional administrative burden, as it builds on already available documentation.
It should clarify if different roadworthiness requirements are set by different Member States and if this would influence the internal market for exporting used vehicles to third countries.	As it is explained in Section 2.3.2, Directive 2014/45/EU sets minimum mandatory elements which have to be tested, in order for a vehicle to obtain a roadworthiness certificate. Therefore, the mandatory scope of roadworthiness requirements is harmonised at the EU level. Additionally, each Member State shall recognise the roadworthiness certificate issued by other Member State, in accordance with Directive 2014/45/EU, which thus ensures the smooth functioning of the

RSB comments	How addressed
	internal market.
It should explain why the applicable regulations of the recipient country are not deemed sufficient in determining whether an export should be permitted.	Additional clarifications have been added to the sections describing the problems and drivers on the issue (Section 2.3.1. and Annexes 6.4.1, 7.2.4. under the description of M21 - export requirements for used vehicles linked to roadworthiness certificate). The text explains why the regulations of the recipient countries are not deemed sufficient, which is mostly related to the situation that currently there are no global standards or consolidated import requirements that would be commonly applied by the recipient countries. There are destination countries which are currently not requiring vehicles to meet certain safety standards, such as the presence of airbags. Furthermore, the enforcement by the third parties of adopted import requirements is not always effectively ensured compromising the quality of used vehicles imported into the region, resulting in negative consequences on the environment, health, and road safety, as well as additional costs. These facts prove the necessity to establish a mechanism on setting binding requirements for used vehicles which are subject to be exported from the EU to third countries, including the non-OECD countries. An additional measure describing these alternatives is added to the list of discarded measures (M47a).
(2) The report should discuss the (global) environmental footprint of discarding vehicles as waste by banning their export that could still be used in third countries where different legal requirements and standards allow this. It should demonstrate how this is compatible with the waste hierarchy and if a potential better end-of-life treatment of the vehicle in the EU outweighs the impacts resulting from the extension of its lifetime when further used in third countries from a lifecycle perspective. The report should better demonstrate the coherence with the European Commission circular economy strategy and action plan.	The coherence of export measures with the CEAP, including their contribution to the implementation of the ‘waste hierarchy’ has been substantiated in the Section 8.6 of the IA report, as well as Annex 7.2.4., where the comprehensive background information is provided on the challenges global trade of used vehicles, and the actions taken by the import countries to mitigate negative consequences associated with the export of used vehicles, with the aim to continue receiving used vehicles that could be placed in service for further use on the market of third country.
(3) The report should better justify the difference in approach for setting targets for recycled content for steel compared to the measure proposed for setting targets for aluminium and Critical Raw Materials. It should explain how the envisaged feasibility studies will subsequently inform the impact assessment and comparison of alternative targets and related policy choices when	The differences between the two feasibility studies is explained in Annex 7.2. for M10 respectively M11 and in the main SWD in Section 5.2.2. The study for steel focuses at the technical feasibility to determine an appropriate target level, whereas the study for other material has a wider scope in assessing wider economic feasibility elements.

RSB comments	How addressed
preparing the corresponding implementing measures.	
(4) The report should better explain why the option of EU-level Extended Producer Responsibility (EPR) is discarded while Member State level EPR is required given the EU-wide, cross-border, nature of the motor vehicle market.	There is a difference between a single EU wide EPR scheme triggering various subsidiarity and feasibility concerns, versus cross-border EPR supporting measures that facilitate EU wide coordination between schemes. The justification for the discard is sufficiently specified with the three main arguments listed on page 36. An additional reference to the reasons for discarding the related M48 in Section 5.3 is added to the description in Annex 7.3.6 to improve traceability.
(5) The report should be clearer on the distributional impacts, in particular on who is likely to benefit from the estimated CO2 credits as their final allocation seems to be instrumental in identifying how the different categories of stakeholders, including consumers, will be affected by the preferred policy package.	Except for the recycled content related GHG savings of PO2 and the financial relevance for the future functioning of CBAM, the other GHG savings cannot be attributed unambiguously to individual economic operators and not be reflected in currently existing financial instruments. More consistent use of the terms ‘GHG savings’ when credits are not directly attributable versus ‘avoided CO₂ taxation under ETS’ when they can be attributed financially is improved in the report in Section 7.1 and 7.2, the Glossary (link to ETS framework) and footnote 147 are improved accordingly. The approach to monetise the external costs related to total GHG savings as ‘societal benefits’ is in line with the BRG instructions for the Cost-Benefits Approach following the externalisation of costs in the DG MOVE handbook.
(6) The assumptions and calculations of the administrative costs should be clarified and better presented, including those related to the ‘one in, one out’ approach. The tables in Annex 3 on the administrative costs should come with more explanation and cross-reference with the estimates presented elsewhere.	The assumptions related to the administrative costs are moved from Annex 3 to Annex 8.3 following the overview tables describing each individual cost element. Some minor changes are included in these table for administrative costs that are not in the scope of the OIOO approach. Administrative costs for non-preferred options are displayed separately for consistency in detail for the total costs per economic operator and policy option in Annex 8.3. A compact table is added to Section 8.5 specifying the sum of costs under the OIOO approach as well as a quantitative estimate of the effect of streamlining information via digitalisation and alignment with existing reporting practices.
The Board notes the estimated costs and benefits of the preferred option in this initiative, as summarised in the attached quantification tables.	

1.4 Evidence, sources and quality

To support the analysis of the different options, the European Commission awarded a **support contract** to external experts. The consortium of consultants comprised: Oeko-Institut e.V. (Consortium Lead) with Rambøll Management Consulting A/S and the supported by the Mehlhart Consulting¹⁰. Evidence was compiled from the evaluation reports of the ELV Directive¹¹ and the targeted evaluation of the 3R type-approval Directive, which was carried out in parallel to the impact assessment and presented in a dedicated Annex 11 of this document. Additional supporting evidence was as well as retrieved via specific desk studies and data collection performed, feeding into the overall impact assessment work.

Further information is given regarding the evidence bases compiled by the external consultants in the following annexes:

1. Annex 2 (Stakeholder consultation synopsis)

The external consultants worked in close cooperation with the European Commission throughout the different phases of the study, and partly in consultation with one another throughout the process, particularly in the latter stages of assembling a coherent evidence base and in assessing, screening and adjusting policy measures and options.

2. Technical report of the Joint Research Centre (JRC)

The Joint Research Centre (JRC), the European Commission's science and knowledge service, produced a dedicated technical report on recycled plastic content targets in new passenger cars¹², which results have been directly included into the overall impact assessment of the current review. The work consists in an analysis of data and knowledge on plastics contained in vehicles, current and future practices and on evaluating capacity of the recycling industry to produce adequate quality and quantity of recycled plastics from end-of-life vehicle sources. The objective was to assess technical barriers and opportunities for further uptake of recycled plastics in vehicle. Finally, this study aimed to produce technical proposals for mandatory recycled plastic content targets (with associated levels), and link them with pros, cons and potential implications. These policy options were analysed within a dedicated Section 6 of the Impact Assessment and then discussed in view of their potential integration within the review of the ELV Directive and 3R type-approval Directive. In addition, a second JRC study was produced targeting specific measures related to increased CRM recovery, in alignment with the recently adopted CRM Act¹³.

¹⁰ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023.

¹¹ SWD(2021) 60 final.

¹² Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008.

¹³ N. Tazi, M. Orefice, C. Marmy, Y. Baron, M. Ljunggren, P. Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821

In 2022, the **Fit for Future Platform (F4F)** adopted an opinion¹⁴ regarding joint revision of the End-of-life vehicles directive and the directive on the 3R type-approval of motor vehicles making the following suggestions:

- Suggestion 1: Consider a digital vehicle passport including details on used materials
- Suggestion 2: Refine the definitions for end-of-life vehicles and used vehicles/ parts of vehicles
- Suggestion 3: Consider full digitalisation of the registration system and (2) installation of a central registration system and/or interoperable systems or ensuring the compatibility and coordination of the registration systems across and within Member States
- Suggestion 4: Enforce the certificate of destruction (COD) necessary for deregistration and implement a systemic differentiation between temporary and permanent deregistration
- Suggestion 5: Improve implementability of the ELV-Directive's requirements through a reward system for deregistration and/or dismantling
- Suggestion 6: Ensure coherence with other legislation, e.g., the Batteries Directive 2006/66/EC and the REACH Regulation
- Suggestion 7: Improve compliance and enforcement possibilities through more realistic targets, common methodologies, and increased producer responsibility

The Commission has considered the findings and suggestions of the F4F opinion, and majority of them translated them into set of concrete measures. These namely include extended use of digital means (Vehicle Environmental Passport – suggestion 1), alignment of recycling definitions with the Waste Framework Directive and setting mandatory criteria that would help distinguishing ELVs from used vehicles (suggestion 2), improve interoperability between national vehicle registers with the aim to address the problem “missing vehicles” (suggestion 3), increasing functionality of COD by clarifying its linkage with vehicle de-registration as well adding additional information to vehicle registers (suggestion 4). Setting penalties and inspection requirements partially correspond to suggestion 4, while suggestion 6 on better coherence with sectoral legislation, e.g. Batteries Regulation¹⁵, has been addressed in measures considering future regulatory approaches on substances of concern in vehicles. The package of preferred option extensively covers the elements proposed in the suggestion 6, notably setting mandatory used of recycled content, setting material specific targets (e.g. plastic, glass). Impact assessment also considers the suggested ways to improve EPR, monitoring and the overall enforcement of the advanced ELV treatment requirements (removal of parts before shredding). These suggestions are considered to best address the stakeholder concerns and comply with subsidiarity, feasibility, proportionality, effectiveness, efficiency and effectiveness criteria. In cases, where suggestions or some elements of these suggestions could not fulfil these criteria, they were not included in the policy options. Such cases mainly concern the aspects related to subsidiarity and feasibility constraints, for

¹⁴ [https://commission.europa.eu/system/files/2022-12/Final opinion 2022_SBGR2_05 ELV_rev.pdf](https://commission.europa.eu/system/files/2022-12/Final%20opinion%202022_SBGR2_05_ELIV_rev.pdf)

¹⁵ Regulation of the European Parliament and the Council of [date] 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (OJ L [...]).

example, establish the EU wide Deposit Refund System for vehicles, central EU vehicle registration system, setting financial premiums. The full F4F report is presented in the dedicated Annex 5 of the Staff Working Document.

ANNEX 2: STAKEHOLDER CONSULTATION (SYNOPSIS REPORT)

2.1 Objectives of the consultation

The Commission completed an evaluation of the Directive 2000/53/EC on end-of-life vehicles (ELV Directive)¹⁶ in 2021¹⁷. Following up on the evaluation, the European Commission initiated work on an impact assessment in support of a review of the ELV Directive. In view of the links between the ELV Directive and the Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability¹⁸ (“3R type-approval” Directive), a joint review of both Directives was carried out. The purpose of the impact assessment was to gather and analyse evidence to support review of the EU legislation on end-of-life vehicles. It involved verifying the existence of a problem, identifying its underlying causes, assessing whether EU action is needed, and analysing the advantages and disadvantages of available solutions¹⁹.

The objective of the consultation process was to ensure that stakeholders' views are sought on all key impact assessment aspects. All inputs (data, information, etc.) from the consultation have been incorporated into the impact assessment at appropriate points and will also be taken into consideration in the resulting legislative proposal.

It aimed to collect information from stakeholders in relation to the various problem areas and the measures proposed for achieving the objectives defined for each area and their likely impacts. This information has complemented the information and data gathered through other sources (e.g., literature review, existing policy and position papers, Eurostat data and other statistical data sources, etc.) and supported the analysis of the problem areas, the identification of options addressing the objectives of the review, as well as the analysis of their impact.

Mapping of stakeholders

The review of the ELV and 3R Type-approval Directives affects a broad spectrum of stakeholders, as requirements for sustainable products in the automotive sector and sound management of waste from ELVs are of relevance for all stakeholders involved in the

¹⁶ Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles (OJ L 269, 21.10.2000, p. 34–43).

¹⁷ SWD(2021) 60 final.

¹⁸ Directive 2005/64/EC of the European Parliament and of the Council of 26 October 2005 on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability and amending Council Directive 70/156/EEC (OJ L 310, 25.11.2005, p. 10–27).

¹⁹ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-End-of-life-vehicles-revision-of-EU-rules/public-consultation_en

automotive value chain (designers, producers and their suppliers, retailers, consumers, repairers, waste handlers, recyclers).

Therefore, a dedicated mapping was carried out to ensure that all relevant stakeholders are identified and consulted in a structured way, especially in the context of targeted consultation actions. For the public consultation and subsequent consultation activities, stakeholders from relevant groups have been contacted in the context of preparation of the study supporting the Commission Impact Assessment.

Stakeholder groups relevant to this public consultation were identified as follow:

- a) **International governance bodies** such as UNEP, the Secretariat of the Basel Convention, etc.;
- b) **Government experts from all Member States**, particularly environmental agencies/Ministries, registration and type-approval authorities, inspection services, market surveillance bodies, etc.;
- c) **Associations and individual enterprises of the various sectors:**
 - Vehicle and parts manufacturers – automobile industry actors, main suppliers;
 - Treatment operators – garages, ATFs, dismantlers, shredders, recyclers;
 - National EPR organisations;
 - Steel, aluminium, copper and plastic producers;
 - Insurance sector;
- d) **Environment non-governmental organisations** (for waste management, pollution, circular economy etc.) and consumer organisations;
- e) **Experts** (academics, research institutes) for waste management, pollution, circular economy etc.

2.2 Consultation and method tools

A variety of methods and tools have been applied to ensure a comprehensive and well-balanced consultation process, including the following:

- Publication of the **inception impact assessment**: to gather first reactions by stakeholders on the outline of the initiative (22 October 2020)²⁰. The feedback period was open until 19 November 2020 and 61 contributions were received;
- A dedicated **support study**: this has been carried out by an external consultant, and made an important contribution to the preparatory work. The study has been examining different policy options and measures by providing key environmental, social, legal and economic expertise, data and analysis.
- A 14 week **open public consultation**, held between 20 July 2021 and 26 October 2021, was published on the Commission EU Survey website²¹. This open public consultation

²⁰ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-End-of-life-vehicles-revision-of-EU-rules_en

covered the key subjects and elements addressed in the impact assessment (i.e. problem definitions, drivers, problems and consequences, possibility to extend the scope of the ELV Directive; design for circularity aspects; setting of separate reuse/ material specific-recycled content targets; ways to address the issue of missing vehicles; illegal export of ELVs and used vehicles; possible policy options and their likely environmental, social and economic impacts etc.). The questionnaire contained both closed and open questions. Close questions with multiple-choice answers were used where possible (yes/no, ranges of expected impacts, etc.) to allow statistical evaluation of the results. For some areas, in particular to collect data, open questions were necessary. These general questions were supplemented by more detailed questions targeting stakeholders with specialised knowledge on the subject. These responses are in detailed provided in the separate document²².

- **Targeted consultation:** In a form of email correspondence and personal interviews, this consultation method was used to:
 - collect data and initial views about feasibility of certain measures;
 - confirm and validate final assumptions and results of the study; or
 - collect missing data.

Throughout the assessment, the areas where data is missing or where impacts exist that are uncertain but may significantly influence the final results needed to be identified. From this analysis, specific stakeholders were consulted for filling the information gap and further refining the results.

Where necessary, stakeholders have been approached in a format of emails with the request to provide written answers to certain questions or to substantiate claims shared in the first consultation stages. Contact has been conducted on *ad hoc* basis as specific aspects arise.

Additionally, up to twenty **personal interviews** took place in three stages. Most of these were performed between the online public consultation (OPC) and the stakeholder workshop. A few were performed before the end of the OPC and others followed the workshop.

All interviews were documented; interviewees asked to confirm or adjust the interview results and to specify if the interview may be used as a source.

Stakeholder workshop: A two-day workshop 24-25 March 2022, held after the public consultation, provided a forum to discuss particular aspects of the assessment related to the defined problem areas and measures attributed to the policy options.

During the workshop, open discussions with stakeholders allowed to collect views and discuss conflicting perspectives. Workshop discussions and results were documented. Stakeholders has two weeks following the workshop to submit additional information and data to substantiate their views.

²¹ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-End-of-life-vehicles-revision-of-EU-rules/public-consultation_en

²² <https://circabc.europa.eu/ui/group/636f928d-2669-41d3-83db-093e90ca93a2/library/ecb8ebdf-6a62-4986-886a-a79685f76c05/details?download=true>

The results of all the activities were in detail summarised and presented in the following sections of this synopsis report.

Table 2.1 Overview of different methods of the consultation strategy

What	Public feedback ²³	Online public consultation (OPC)	Targeted consultation	Stakeholder workshop	Consultation of Member States	Follow up consultation activities after the workshops
How	No specific format of feedback required, additional written contributions possible	Online Questionnaire Survey with the possibility to provide additional written contributions	Web conference interviews	2-day online meeting	Ad-hoc survey and 1-day meeting	Written feedback on the content presented in the workshop and written exchange
Why	To explain the approach and invite them to contribute	To validate/obtain data and information and to gain opinions on more detailed/specific aspects	To validate/obtain data and information and to gain opinions on more detailed/specific aspects	To discuss specific aspects, validate findings, gather additional evidence	To inform MS on measures and policy options, to discuss specific aspects, gather additional evidence and experiences from MS	To gather evidence that was requested in the workshop, to ask clarification questions on feedback, opinion and information provided, to request additional data
Who	All stakeholders	Specific stakeholder groups	Selected key stakeholders from specific stakeholder groups	Specific stakeholder groups	Representatives / Experts of MS authorities	Targeted stakeholders
How data / information was used in the impact assessment	Information used to structure the OPC questionnaire, to provide an initial overview of interested stakeholders	Identification of opinions of stakeholder groups; participating stakeholders were invited to the stakeholder workshop; for stakeholders invited to the targeted consultation, identify topics to which the study team expected the interviewed stakeholder to contribute.	Validate assumptions, understand the situation of selected key stakeholders, information used for identification of measures and policy options for reviewing the ELV Directive, information used for the impact analysis of measures.	Information used for revising the measures and policy options for reviewing the ELV Directive, information used for the impact analysis of measures.	Learn from experiences of MS-specific legislation already addressing problems targeted in the review of the ELV Directive and with regards to the measures proposed on EU level	Used for the impact analysis of measures

2.3. Stakeholder consultation

2.3.1. Overview of open public consultation

Questions concerning various problem areas were presented in the form of a questionnaire which was divided into two sections. The first section, comprising of ten questions, was

²³ <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-Revision-of-EU-legislation-on-end-of-life-vehicles>

addressed to the general public, including those not familiar with the ELV Directive and the vehicle sector. The second section contained thirty more specific questions and focussed on those who had specific knowledge and interest in the vehicle sector. Nevertheless, the entire questionnaire was open for participants to express their views.

The questionnaire was made available in all the EU official languages between 20 July 2021 and 26 October 2021 (14 weeks). To maximise the response rate, a link to the questionnaires was placed on the Waste Policy pages within the EUROPA Website²⁴, and a number of organisations were also contacted directly and asked to help disseminate the link.

In total, 208 respondents filled in the questionnaire during the consultation period. 199 (95%) specified that they had specific knowledge and interest in the vehicle sector. In the group of citizens and consumer NGOs, only 5 participants indicated not having specific knowledge of relevance.

57 stakeholders submitted a written contribution to further elaborate on their views.

Of the total participants, 69 requested their contribution to remain anonymous. The rest, which accounted 67%, agreed to the publication of all information of their contribution. Around 54% of participants were aware that their organisations were listed in the EU transparency register, while on the other hand, 95 of the participant organisations did not provide information on their status in the transparency register.

In the following sections, there is a quantitative analysis for the survey answers where predetermined answers were given. The factual summary of the “general questions” of the questionnaire is available in the ‘Have your say’ portal²⁵. The responses to the more specific questions have been taken into consideration as part of the impact assessment process and summarized in the further sections of the annex, including the contributions received during a targeted consultation.

Participation by the SMEs

In total, 208 stakeholders participated in the open public consultation²⁶ (OPC conducted between 20 July 2021 and 26 October 2021). 199 (95%) specified that they had specific knowledge and interest in the vehicle sector. Classifying by size, 59 stakeholders identified themselves as large companies with 250 or more employees and comprised almost 1/3 of all participants. 130 of all stakeholders identified themselves as belonging to micro, small or medium (SMEs) companies, which total share was equal to 62.5%. 19 participants or 9.13% of stakeholders did not provide the answer on the size of organization they represent.

More information about the consultation with SMEs is provided in Annex 13.

²⁴ <http://ec.europa.eu/environment/waste/index.htm>

²⁵ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-Revision-of-EU-legislation-on-end-of-life-vehicles/public-consultation_en

²⁶ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-End-of-life-vehicles-revision-of-EU-rules/public-consultation_en

2.3.2. 2.3.2. Survey in relation to 3R type-approval Directive

A 3R type-approval Directive-specific survey was conducted with stakeholders on this subject in proximity to interviews (see section before). The survey was developed similarly to the interview questionnaires for consulting three different stakeholder groups: OEMs, technical services, and type approval authorities. For all three groups, questions on the link to the ELV Directive, on the process of type approval and on possible future amendments were identical, a stakeholder group-specific set of questions was added to each one. The questionnaire was agreed on and is available to the European Commission.

The survey was distributed to OEMs through requesting the association ACEA to send the survey questionnaire to its members. The European Commission assisted in sending the questionnaire to type approval authorities. The survey was also forwarded to type approval technical services that had been initially identified but not interviewed.

Four Member States participated (3 provided the filled-out survey, 1 provided short input per email), and one OEM send a confidential contribution. Additional information was received from three more organizations/stakeholder groups

- one position paper (from ACEA),
- one interview in the main study was used to get specific information on the 3R type-approval Directive (UN ECE/UNEP), and
- one e-mail with additional explanatory information was received, in relation to the information provided in one of the specific interviews (from MS representatives from France).

In the round of written feedback in April 2022 (follow-up after the workshop in March 2022), a further written contribution from Germany was received.

Based on the indication of a lot of stakeholders, most of the information cannot be cited in this report as information has been provided on a confidential basis or interview documentations have not been confirmed by interviewees.

The positions of stakeholders are summarised in chapter 2.5.6.

2.3.3. 2.3.3. Overview of the targeted stakeholder consultation

A targeted consultation (interviews) was held starting in November 2021. The phase was split into two rounds of interviews:

1. The **main study interviews** held in the period from 3 November to 3 December 2021. In this round, the consultants conducted 20 interviews, see the list of interviewed organizations. One additionally invited stakeholder (ANEC BEUC) did not participate due to the questions being too technical for the stakeholder group they represent. The group of stakeholders that participated in the main study interviews consisted of automotive manufacturers for cars, lorries, vans, buses and motorcycles (n=3), suppliers of materials and (second-hand) components (n=6), stakeholders involved in the management of ELVs (n=7), and individual other stakeholders including a Producers Responsibility Organisation, a registration and international authority, a stakeholder representing insurance companies, and environmental NGOs.
2. **Interviews held in relation to the 3R type-approval Directive** in the period from 17 December 2021 to 7 February 2022. The invited group of stakeholders consisted of

automotive manufacturers (n=5), type approval technical services (n=3), type-approval authority / market surveillance (n=2), international authorities and one stakeholder conducting dismantling trials. Inputs were obtained from 8 out of 12 invited stakeholders.

The consultation phase was organised as follows: The interviews were distributed internally according to the focus of the respective associations or stakeholders and the work focus of the experts. The interviewees were initially contacted indicating the goal and scope of the study. When no answer was received, reminders were sent. Date and time for the interview were agreed on and consultants provided a web conference tool. An interview guideline was sent to the stakeholders in advance of the meeting. Due to the extent of the main study questionnaire, it was accompanied by an indication of the sections to which the study team expected the interviewed stakeholder to contribute. Other sections were included for transparency, and the interviewees could also contribute to the questions therein. Often, answers were received with specification of topics of interest for the stakeholders. In some cases, stakeholders responded to topics additional to those planned for the interview. Only in some cases, the whole questionnaire was subject of the interview. Protocols of results were prepared after the interview and sent for approval to the respective interview partner. Together with the approval, consultants asked for the permission to cite answers given in the interview in the study report. If rejected, information was not included in the report.

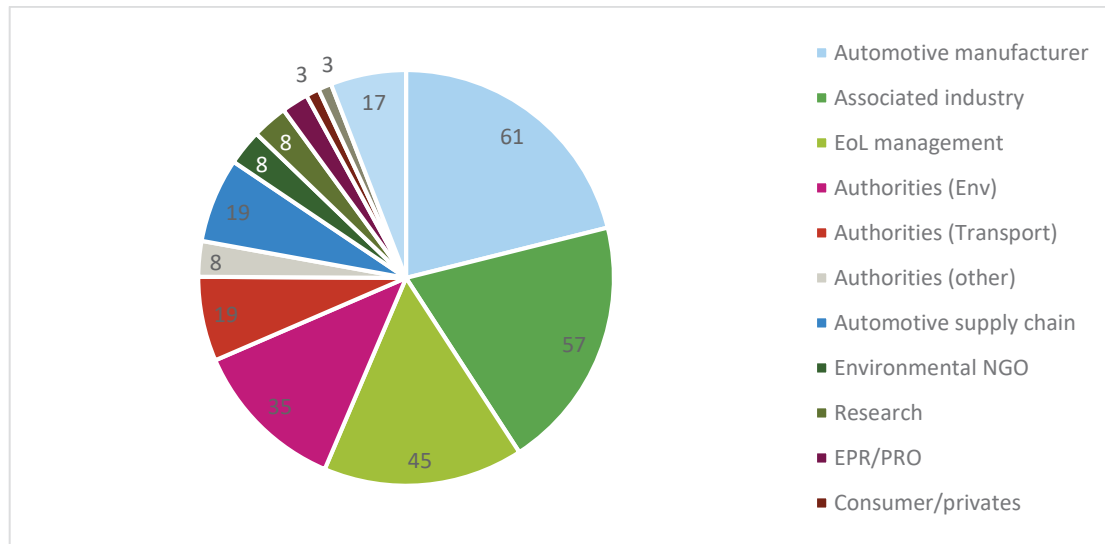
Table 3.2 Stakeholders invited to main study interviews, dates of interview and indication of the sections to which the study team expected the interviewed stakeholder to contribute.

#		Scope	Hazardous substances	Design 4 circularity	Coherence (3RD)	Recycling definition	Reuse target	Material recycling targets	Data accessibility	EPR	Missing vehicles	Illegal export	Reporting: vehicle fleet	Reporting: reuse recycling
1	European Automobile Manufacturers' Association (ACEA)	x	x	x	x		x	x	x	x	(x)	(x)	x	
2	ACEM	x	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)			(x)	(x)
3	Renault	x	x	x		x	x	x	x			x		
4	European Automotive Suppliers (CLEPA)	x	x	x	(x)				x					
5	Eurometaux		x	x		x		x	x	x				
6	Eurofer		x	x		x		x	x	x				
7	Automotive Parts Remanufacturers Association (apra)	(x)	x	x	(x)		x		x	(x)				
8	European Ferrous Recovery and Recycling Branch (EFR), a branch of the European Recycling Industries' Confederation (EuRIC)	x	x	x	(x)	x	x	x*	x	x				x
9	European Federation of Glass Recyclers (FERVER)			x	(x)	x		x		x				x
10	European Plastics Recycling		x	x	x	(x)		x	x	x				x

meeting, the contractor gave an input (presentation) on the current situation in relation to the problems, the measures under consideration, initial results and topics for discussion.

The meetings were structured according to the topics. The agenda is provided below. Meetings were facilitated by the consultant's team members; minutes were prepared of each meeting.

Figure 3.1 Overview of composition of stakeholder registered for the workshop (n=289)



Note: The category of "automotive manufacturers" includes manufacturers of all types of vehicles, incl. motorcycles, vehicles accessible to disabled people, caravanning industry, to name some. / The category of "associated industry" includes, among others, all (secondary) raw material-related industry stakeholders. / () The numbers relate to the registrations for the workshop. Due to changing audience during and last minute requests before the workshop, it was not possible to analyse the composition of stakeholders in relation to their actual participation. Source: Own compilation*

Possibilities of participation in the meeting:

- To gather input from a larger audience of stakeholders, and additional interaction tool (app called *Slido*) was used during the workshop to survey the views of the participants on certain aspects. Slido questions were answered by participants in the course of the presentations of the consultants or in the days following the workshop.
- For oral contributions, stakeholders could write in the chat the essence of their comment and wait to be requested to speak.
- After the workshop, all participants had two weeks to submit additional information and data to substantiate their views.

For each of the topics, the consultants took into account aspects that were discussed in the meetings, and where (updates of) data was provided, e.g., in relation to the material composition of L-type approved vehicles, these were feed into the calculation of impacts for the final report.

The parts of the documentation of the stakeholder workshop not intended for publication and provided solely to the EC include:

- Participants list;
- Minutes of the meeting;

- Documentation of the chat of the online meeting; and
- Slido results.

2.3.5. 2.3.5. Consultation of Member States

The consultation of Member States consisted of two elements:

a) Ad hoc survey

A questionnaire for Member State Experts was prepared covering the four topics:

- Management of Shredder Light Fraction (SLF) and Shredder Heavy Fraction (SHF),
- Fees or taxes to support recycling of ELVs,
- Extended Producer Responsibility (EPR) System,
- Waste management of other types of vehicles.

The questionnaire was sent out to the MS in February with most MS sending answers prior to the workshop, and a few (2-3) sent afterwards. Answers to the questionnaire were provided by 15 Member States, namely Lithuania, Belgium, Ireland, Estonia, Slovakia, Greece, Malta, Finland, Croatia, Spain, France, Czech Republic, the Netherlands, Sweden, and Germany. Additional documents were received from Belgium only.

As for the processing of the data, it is to be said that no statistical evaluation of responses was made, but responses are exemplarily summarized for two of the four topics as follows. Where information from the survey is used in the main report, it is referenced, and all questionnaires are available to the EC.

Management of Shredder Light Fraction (SLF) and Shredder Heavy Fraction (SHF). In 6 MS, the disposal of untreated SLF/SHF in landfills is prohibited. 4 MS prohibit the disposal in landfills of fractions from post shredder treatment (PST). 4 MS (in case of BE only Flanders) allow to consider untreated SLF for the purpose of road construction, within which 3 consider it as recycling. Selected detailed responses showed that some countries defined certain criteria for acceptance of waste at the landfill that have to be fulfilled (e.g., POP content in the residues or that the residues intended to landfill cannot be recycled or incinerated anymore). BE (Flanders) allows the disposal in landfills of fractions from PST, however the costs for disposal are higher than the costs for recycling or thermal treatment. Some countries admitted that due to a disposal ban in their countries the recycling rates of ELVs increased.

Waste management of other types of vehicles. In ES, FR, CZ, BE (Flanders), and LT the waste management of **motorcycles** is governed by specific national legislation. This is not the case in SK, EL, MT, FI, HR, NL, DE, SE, and IE. In ES, CZ, BE (Flanders), and LT waste management of **lorries** is governed by specific national legislation. This is not the case in SK, EL, MT, FI, HR, FR, NL, DE, SE, IE. Of those that do not have specific national legislation, several countries (HR, FI, EL, NL, DE) indicated that the treatment of motorcycles and lorries is ensured and/or environmental permits for facilities are requested through general waste legislation. Additional information on waste management of other types of vehicles was provided by 4 MS (LT, BE, CZ, DE).

b) Member State Workshop on 31 March 2022

In cooperation with the Commission, the contractor prepared a Member State Representatives workshop in addition to the stakeholder workshop (see above). The meeting was organised as web conferences. The same material as for the stakeholder workshop was distributed among MS representatives to inform participants on the contents of the meeting beforehand, also,

representatives of the Member States were invited to participate in the stakeholder workshop. Thus, assuming that Member States representatives could inform themselves in the stakeholder workshop as well as with the provided information, at the meeting, the contractor gave a very short additional input (presentation) the problems, the measures under consideration, and topics for discussion.

The meeting was structured according to the topics. Additional three presentations were held by Member State representatives from France, Belgium and the Netherlands. The agenda is reproduced below. Meetings were facilitated by the consultant's team members; minutes were prepared and provided to the European Commission.

2.3.6. 2.3.6. *Follow-up after the workshop and ad-hoc consultation*

Discussions during the stakeholder workshop left open several questions and stakeholders were asked to provide information on certain topics at the end of each meeting. 39 representatives for different associations and stakeholder groups have submitted additional information.

In addition to other consultation stages, several stakeholders were consulted individually in terms of specific aspects of interest for the consultants. The information provided was used for the impact analysis of measures and policy options.

2.4. Key positions of stakeholders on specific topics

2.3.7. 2.4.1. *Circularity*

Design for circularity

Statistical OPC

On the question if there should be an obligation on vehicle manufacturers to improve circularity characteristics of a vehicle during the design phase, all groups of stakeholders agreed in over 50% to this question. Support was the lowest (51 %) in the category of the automotive manufacturers, where almost 25% did not support this option. The highest support was registered by environmental NGOs (100%), waste management operators (93%) and public authorities (86%).

For more details please refer to "Analysis of open public consultations" (Oeko-Institut e. V. 2022).

Written OPC

Ten contributions mention the topic of (eco-)design specifically. One of the focus topics is the design for dismantlability which various stakeholders would like to see promoted through the new regulation (VEOLIA²⁷, EEB²⁸, Federec²⁹, INDRA³⁰, FNADE³¹) whereas others have objections or comments, such as:

²⁷ Veolia Environnement S.A., branded as Veolia, is a French transnational company with activities in three main service and utility areas traditionally managed by public authorities – water management, waste management and energy services <https://www.veolia.com/en>

²⁸ The European Environmental Bureau (EEB) <https://eeb.org/>

²⁹ Fédération des entreprises du recyclage / FEDEREC <https://federec.com/fr/>

- ‘life cycle approach more efficient to promote circularity than imposing design requirements’ (Volvo³²);
- ‘dismantling provisions must not impair the essential targets of safety, comfort, environmental performance such as fuel/electricity consumption, costs etc’ (Plastics Europe); and
- ‘solutions on eco-design therefore should not be solely based on manual separation/sorting’ (EuRIC) stating that PST sorting should be taken into account.
- Design for circularity could be supported by sensor-based technology (ECI) and free knowledge sharing and discussion between recyclers and manufacturers (EuRIC, FNADE; see also under ‘data availability’).

Eco-Design is mentioned in combination with the 3R type-approval Directive by EuRIC in terms of merging ELV Directive and 3R type-approval Directive; and by Federec and INDRA with regards to ‘practicability checks’ of recyclability under the 3R type-approval. Volvo suggests that ‘ELV Directive should focus instead on requiring OEMs to have a strategy to cover the 3 Rs’, which is already part of the provisions of Art. 6 of 3R type-approval Directive.

Another focus is on the means of eco-design to phase out hazardous substances mentioned by VEOLIA. Other stakeholders mentioned hazardous substances under the topics of ‘data availability’, in combination with recycled content targets or with regards to ‘coherence’.

Individual aspects include ethical sourcing as part of material decisions in eco-design (ECI), less different polymers (‘there are currently 39 different types of basic plastics and polymers used to make an automobile’, and a proposal from FEAD to limit the use of non-recyclable materials based on The Plastics Industry Trade Association, 2016).

It should be noted that in their contributions some stakeholders consider recycled content targets as part of the 3R targets and some connect the recycled content targets with the topic of (eco-) design.

Interviews

Regarding non-recyclable materials, the vehicle manufacturing sector generally pointed out the benefit of using such materials for light weighting due to the benefits during the use phase in terms of CO₂ emissions reduction. Stakeholders representing the waste phase referred to the obstacle that large amounts of such materials pose for achieving targets but were against their prohibitions, explaining that this would affect innovation, whereas proven materials would increase in use and at some point suffice to develop manufacturing (with less beneficial ones being used shortly and then abandoned).

ATFs referred to the phenomenon of locking components with digital keys (e.g., window wiper motor, injector, inverter, mirror, window motor, navigation, etc.) as a problem, explaining that it is an obstacle for reuse as a component removed without the key will not be reusable. The information does not have to be free but the price should not be prohibitive for

³⁰ INDRA is an automotive recycler and a forerunner in the trade <https://www.indra.fr/en/international/leader-en-france-recyclage-automobile>

³¹ La FNADE est l'organisation professionnelle représentative des industriels de l'environnement <https://www.fnade.org/fr>

³² <https://www.volvocars.com>

reuse practices of ATFs. This is understood to particularly affect establishments that work with multiple vehicle models and brands and that do not have contracts with specific OEMs. Vehicle manufacturers on the other side claim that the locks are of importance for the safety of vehicles, anti-theft and provision of the data could disclose proprietary. It is not clear what type of data would be at risk. Components that are interchangeable between models and brands were also raised as a type of component where OEMs are reluctant to provide data (e.g., when the same supplier provides multiple vehicles models and brands with the same component) and where this can have an effect on the ability to reuse parts.

As for IDIS, ATFs said that it contained a lot of information but that the level of detail is not always sufficient to support dismantling. Information is not available through IDIS for parts with reuse potential (the objective of IDIS is to support quick dismantling – ensuring that the component remains functional is not always in line with this objective). Though OEMs say that such data can be accessed under the RMI (Repair and maintenance information systems of the OEMs – each is individual to a certain OEM) ATFs complain about the cost of such data. Here too, the information does not have to be free but the price should be fair to encourage dismantling for reuse.

Some stakeholders state that the 3R type-approval Directive calculation is too theoretical, recommending requiring OEMs to also specify how certain parts can be dismantled. The calculation should also reflect the ease or difficulty of recycling a part that would be a separate Annex of depending on whether it is a mono-material or not.

Workshop

During the workshop the issue of compliance of automotive manufacturers with diverse regulations was brought up (ACEA). Thus, new regulations should consider the other compliance demands, in particular for passenger safety and environmental protections. Vehicles typically comply the existing regulations on the day that they are brought to the market. The changes in regulations that happen during the vehicle lifetime can be covered by post-shredder technologies.

The idea to combine the ELV aspects from the ELV Directive and the 3R type-approval Directive into a single regulation was also encouraged (ECOS³³). Additionally, it was proposed to bring the EU ELV legislation to the level of the United Nations when looking at lifecycle provisions (UNECE³⁴).

Definitions

Statistical OPC

Most stakeholders (56%) agreed or agreed strongly that the ELV definition for **recycling** should be aligned to that of the WFD as this would support a higher level of material recovery. Aside from the automotive producers that were mainly neutral, the majority in all stakeholder categories supported an alignment. Only 3% disagreed with this statement, however there was also a large share of stakeholders that were neutral (40 individuals) or that

³³ <https://ecostandard.org/>

³⁴ <https://unece.org/>

did not have an opinion (31 individuals) making for a total of 40% together with those that did not specify an answer (13 individuals).

Status of parts to be recycled/**remanufactured** must be clearly distinguished from waste and benefit from same conditions as spare parts. EU should establish a harmonized definition of waste and non-waste for reuse/remanufacturing purpose.

Written OPC

Coherence with the WFD is referred to in a general way (WEEE AUDITS³⁵; CRM Alliance³⁶) or by pointing out specific needs, e.g., to exclude backfilling from the definition of **recycling** (FNADE) or the need for harmonized definitions of waste and recycling in order to prevent distortions of competition due to different national implementation (FORS³⁷). Also, consistency with the landfill directive is mentioned (Plastics Europe³⁸). Definition of when a car becomes an **ELV** was also raised (Febelauto³⁹) also in the context of vehicles export (FEDEREC⁴⁰), where it should be required to present a valid technical control certificate to authorize their export.

Interviews

It is generally agreed that the definition of **recycling** should be aligned with the WFD to exclude backfilling. Many stakeholders do not expect that this will change the achievability of the 3R targets as backfilling operations are not so common and do not cover all downcycling operations. This is particularly understood to be relevant for glass, which is mainly considered recycled through the post-shredder mineral fraction.

The need to align the definition of **reuse** with the WFD was raised in relation to the later reference to “preparing for reuse”. Changes to the definition could affect what is considered waste and what is considered a product and need to look into how they work with the definition of “end-of-waste” to ensure that obstacles are not created for shipments of used or remanufactured parts. A definition for **remanufactured** components should also be introduced to strengthen how such parts are perceived in comparison to reused ones and to ensure that remanufacturing practices fulfil minimum requirements.

A few stakeholders raised the need to define ELVs as compared to **second hand** vehicle so that the differences between these two categories are clearer and easier to enforce for customs authorities to prevent illegal exports.

Workshop

As shared by a car manufacturer representative (Renault), the current legal definition of a new product does not allow inclusion of **remanufactured parts**. This means that a new vehicle currently, in legal terms, may not contain remanufactured elements; the entire vehicle must be made new, though perhaps using recycled materials. This legal issue is not specific to

³⁵ <https://weee-forum.org/>

³⁶ The Critical Raw Materials Alliance (CRM Alliance) <https://www.crmalliance.eu/>

³⁷ <https://www.fors-online.org.uk/cms/>

³⁸ <https://plasticseurope.org/>

³⁹ <https://www.febelauto.be/>

⁴⁰ <https://federec.com/>

vehicles. However, from a technical perspective, remanufactured vehicle parts are certified as equivalent in functionality and reliability/safety/etc. to new parts and could therefore be acceptable for use in new vehicles. This legal limitation restricts the sale of remanufactured vehicle parts to the repairs market. Also, there is anyway a limited feedstock of remanufactured parts because the long vehicular lifetime means that the current ELVs do not offer many parts for remanufacture. Additionally, the term and definitions of remanufactured parts should be included in the 3R type-approval Directive.

A definition of differentiating between **pre- and post-consumer** plastics would be helpful as well as applicable definitions of ‘open-loop’, ‘closed-loop’, etc.

In Belgium, each total technical loss means the vehicle is an **ELV**, regardless of the price of repair in the home country or elsewhere. However, total economic loss is not considered in the definition of an ELV; such vehicles may be exported from Belgium as damaged vehicles without any special conditions.

Separate Reuse target

Statistical OPC

46% of the participants either agreed or strongly agreed with the implementation of a reuse target separately from the recycled target. This included all environmental NGOs, most waste operators (53% of the category) and most public authorities (68% of the category). 22% disagreed or disagreed strongly with this option, with the automotive manufacturing sector most often providing these answers (51% of the category).

On the question on which measures would contribute to increase the reuse of vehicles parts, the most common answers were: obligation for repair shops to offer customers used spare parts as an alternative to new ones, obligation for ATFs to remove certain parts of ELVs before shredding to help increase reuse, obligation for car manufacturers to enable (e.g. the ATFs) unlocking parts so that they can be reused and dismantled, and obligation for car manufacturers to provide the dismantling centres (ATFs) with information about which parts can be used as identical parts in other models of the manufacturer or even other brands.

Written OPC

When asked to explain their views, the most common views in support of a separate reuse target were that reuse is higher up in the EU waste hierarchy than recycling, also supporting circularity. Others explained that before a part is recycled it could be reused. Specific targets were explained to allow monitoring reuse, in relation to the “quantity of pieces reintroduced in the market” (an indicator of eco-design, and percentage of reuse and repairability) and as an indicator of the “efficiency of treatment operations of the authorized centres”.

Of those that disagreed with such measures it was explained that reuse was mainly economically motivated (if no one needs a particular spare part it’s better to recycle). Though reuse was stated to be important, as reuse is market driven it was questioned if targets would increase the amount of reuse. It was also said that vehicles that are recycled are often too old (20 years) for re-use of parts as well as mentioning that this was also the case for vehicles after a crash. Though reuse is said to be practiced commonly by ATFs, one stakeholder explained that it may not be reported to “avoid reporting taxable income in the ATFs”.

Additionally, separate reuse target worsening quality and safety risks witnessed in the informal refurbished vehicles market. Reuse and recycling should be considered as on par equivalents if separate targets for each were to be created.

Interviews

Regarding reuse, many stakeholders spoke against the idea of separate targets for reuse and recycling, explaining that fulfilment of the one may have negative effects on the other. Obligatory dismantling to promote the reuse of parts was explained to create significant costs while not guaranteeing that the level of reuse would actually increase. ATFs explained that they need flexibility to look at the demand on the market and respond through deciding what components to reuse and which ones not to. This was due to fluctuations in the demand for reused components but also in the quality of components of some models. The example was given (EGARA⁴¹) of the engine, where some models may have frequent malfunctions, in which case ATFs would avoid their reuse as a minimum guarantee could not be ensured. In some models, malfunctions are very rare, so that dismantling for reuse would result in the engine being stored for years, also creating large costs. Rather ATFs explain that measures should be considered that increase the demand for reused parts, with ATFs than following suit to ensure sufficient supply.

Workshops

Participants commented that decisions concerning remanufacturing are of high relevance in a circular economy, with such processes being essential for encouraging recycling. However, it is not recommendable to strictly consider reuse targets for aspects that may not have market options; ELV parts should not be required to be removed before shredding where there is no market for reselling such parts. It could be useful to consider environmental issues, market forces and overall demand in the recommendation.

A target for reuse/ remanufacturing of parts could potentially be helpful. However, it is necessary to consider the traceability of parts to know which ones would at all be suitable for reuse (as opposed to remanufacturing). It can be noted that the age of a used part may be much younger than the vehicle in which it is found. Safety should in particular be considered, especially for parts relating to vehicle safety, as was specified by one Member State.

Setting material-specific recycling targets

Statistical OPC

The most common answer to this question (31 participants or 15%) supported the view that the establishment of material-specific recycling targets would increase the separate recycling of materials addressed by targets, their quality and revenues from sale of such materials while also increasing the costs of recycling. 12% (24 participants) answered that this would increase separate recycling and secondary material quality while also increasing costs. The same share of participants estimate that such targets would only increase the recycling costs. From 47 respondents in the automotive manufacturing sector, 72% (34 individuals) stated that this

⁴¹ <https://egaranet.org/>

would increase costs, while 51% (24 individuals) stated that it would increase separate recycling of materials. An increase in separate recycling was supported by all environmental NGOs, 85% (5 individuals) of which also supported that it would increase the quality of recycled materials. Public authorities supported the four options similar, with between 15 and 11 individuals (68-50%) indicating the various options. Waste management operators most often indicated that this measure would support separate recycling of materials (71%) but also increase the costs (60%).

The vast majority (64%) of stakeholders agreed that material-specific recycling targets have an impact on innovation. This was the most common answer in all stakeholder categories with most categories showing 60-70% agreement. Only 8% were against this, while the rest did not have an opinion (23%) or did not answer (5%).

The most common answer to this question was either no answer (79 individuals or 38%) or that material specific recycling targets would lead to an increase in high quality recycling, in innovative recycling opportunities and processes and in innovative eco-design of products (59 individuals or 28%). The distribution of answers was quite similar among stakeholder categories.

Written OPC

When asked to provide detail on answers, one stakeholder stated that “Targets for the entire vehicle proved to be effective. Splitting the target into different material-specific ones should be done only for improving the quality of recycling and the effectiveness of the directive. They should not be legally binding”. Against the measure it was said that “some materials are recoverable but without any outlet / market”.

Materials mentioned in the context of specific material recycling were the Platinum Group Metals (PGMs). For glass and plastics, it was mentioned that the costs of recycling are higher than revenues while for electronic components it was assumed that revenues were possible. In some cases, it was stated that this would allow a greater separation of certain materials prior to shredding, like plastics.

Stakeholders provided also further details on the question on “how material-specific recycling targets would impact innovation” and introduced negative (e.g. documentation/monitoring will be impossible: volume flows in tonnes range, versus quantities in milligram range to be documented; limits the use new materials, e.g., non-recyclables like carbon fibre composite, until a viable solutions has been developed and implemented in Europe) as well as positive sides (e.g.: increase of development of post-shredding technologies as well as processing technologies of secondary raw materials, increase use of secondary raw materials).

Interviews

When asked about the option of introducing separate material targets for recycling, many stakeholders explained that it was difficult to comment on the targets proposed as whether a specific value was achievable depended on how the targets were measured

(EUROMETAUX⁴²). If recycling is to be measured based on the actual material that is included in the composition of a specific vehicle or based on a theoretical value would make a big difference. Whether reporting is on the total inputs of a materials, the amount sent by operators for recycling or the amount that is actually recycled affects the achievability of a target. Also, for some materials like aluminium, there are big differences in the total content between models. Luxury cars will have higher amounts but are also more often exported, so that an average value may be difficult to fulfil. For steel it was explained that 90% is already achieved. The rate could be increased, however every marginal increase from this level will also increase the costs significantly. On tyres, views were raised that the market is still very much developing in terms of recycling options. Some outlets could be considered to increase the total recycling, but have low acceptability with MS (e.g., rubber turf for playgrounds and sport fields).

Workshop

Material-specific recycling targets should be seen as an addition to the common targets. The MS mainly report data from dismantlers, shredders and ATFs, data which is collected from different points in the recycling process. Ultimately, the recycling quota of the MS is reported, not dismantling rates (Swedish EPA).

Recycled content targets

For key positions of stakeholders on a recycled content target content for plastic please refer to the respective report by the EC Joint Research Centre.

Statistical OPC

There was one question on other materials (other than plastics) for which a recycled content target should be considered in the OPC. Though a few materials were mentioned in this respect by about a third of stakeholders (e.g., aluminium, glass, REE but also platinum group metals and steel), a larger share of stakeholders (45%) did not provide input, indicating the answers “none”, “no opinion” or just skipping the question altogether.

Interviews

Regarding recycled content for other materials, for most metals it was explained that recycling was already quite high, and that a recycled content target would not change this much but rather create competition between (high quality) uses, which will not result in resource savings. Recycled content targets should only be considered where there is a market failure. Positive views were raised for plastics and in some cases for glass and tyres, where high quality recycling is low and where secondary raw materials are less common for use in vehicles

Vehicle data accessibility

⁴² <https://eurometaux.eu/>

Statistical OPC

In the OPC, when stakeholders were asked to specify what kind of information producers should provide free of charge to ATF, a large number of stakeholders (41%) specified all of the available options, namely, information on:

- where dismantled components can be reused (which vehicle or brands, models and types);
- how to correctly remove parts with digital components and how to appropriately prepare them for reuse/ installation;
- the duration / effort for obligatory depollution;
- the duration / effort for dismantling components for reuse.

There was furthermore strong agreement (over 70%) that manufacturers should provide such information in a fair and non-discriminatory manner and at reasonable prices (if any) to all ATFs. Stakeholders were also asked to indicate whether vehicle manufacturers should be obliged to provide information on the content of certain substance groups to support plastic recycling. Here there was a diversity of answers, with a third having no opinion, but also with large support for information obligations on flame retardants (66%), plasticisers (49%) and stabilisers (46%).

Written OPC

Stakeholders emphasised the importance of access to information on vehicle contents for dismantling and safe treatment of vehicles. Though some stakeholders stressed the need for data at model level, in some cases mentioning IDIS. The option to develop a Digital Product Passport was also mentioned as well as the option to use a Radio-frequency identification (RFID) or a QR code.

Interviews

ATFs raise the difficulties that they experience with the availability of various data types. IDIS was said to include a lot of information however stakeholders of this sector complain that the level of data is not homogenous for all models and makes and that the amount of data on how to dismantle specific parts is not always sufficient to support the process. Availability to data on components that are locked with a digital key is problematic. Though data is understood to be made available by OEMs for a cost, ATFs explain that there is no harmonised system and rather that ATFs need to register for multiple systems, each with separate costs. For facilities dismantling vehicles of multiple brands (and also for repair shops) this makes the use of such data prohibitive as the costs paid for access will depend on how often a system is accessed. Access to data on the contents of hazardous substances may be available through the SCIP database⁴³, but this is not practical to support removal of relevant parts during dismantling. Data is not available as to the contents of hazardous

⁴³ SCIP is the database for information on Substances of Concern in articles as such or in complex objects (Products) established under the Waste Framework Directive (WFD), see <https://echa.europa.eu/scip>.

substance at the level of the specific component in a specific model (except data on mercury in components that need to be removed or lead in Pb-acid batteries). This is a problem for example for substances that are prohibited by the POPs Regulation (e.g., DecaBDE) resulting in the need to send plastics with a risk of containing such materials to incineration as the level of content cannot be determined during dismantling for each material part separately.

Workshop

The concern was raised that if the method for making data available to ATFs is in the form of a digital product passport (DPP), this would probably not work for all the 250 million vehicles on the road, that will take several decades to be treated. Either ATFs would not have data for these or IDIS will have to continue working even if it is not any more the solution and no new information is introduced. Also, in relation to the option of a DPP, it was mentioned that a single system would need to be developed, rather than having multiple DPP for the vehicle.

2.3.8. 2.4.2. Hazardous substances

Statistical OPC

The OPC had two questions on hazardous substances. The first on whether the revised ELV Directive should ban hazardous substances in vehicles, taking into account that restrictions on hazardous substances are also specified in other pieces of EU legislation (notably REACH). 66 of the responding stakeholders (32%) were of the view that all substances in vehicles should be regulated in the future under chemicals regulation. The same amount indicated that substances prohibited under ELV legislation should remain there, but that future prohibitions should be addressed under chemical legislation. In practice this would mean that for future prohibitions, 64% of stakeholders would prefer regulation under chemical legislation than under ELV legislation. Only 20% (41 individuals) were of the opinion that substances in vehicles should continue to be regulated under ELV legislation. For waste management operators, public authorities, environmental NGOs and dealers and repair shops the distribution between these answers was similar. Automotive producers had a stronger tendency to support the options where chemical legislation would be used for future prohibitions as opposed to the ELV Directive. The situation was similar for citizens and their organizations and “others”. Only 6% had no opinion or did not provide an answer.

To the second question, on which, if any, additional criteria for evaluating exemptions from the list of substance prohibitions would be necessary, the answers were quite variable. This is however also due to the fact that 7 different criteria were proposed as possible answers aside from “none” and “other”. Most combinations were indicated 1-2 times, in some cases having support of 6-9 stakeholders. The most common answers were to indicate all criteria (46 individuals or 22%), none (30 individuals or 14%), no answer (28 individuals or 13%) and the “Criterion on comparison of the use of the restricted substance with that of available substitutes in terms of environmental and health impacts (15 individuals or 7%)”. All other combinations received less support.

Asked to provide additional detail, stakeholders stated that:

- No exemption to the list of substance prohibitions in the ELV Directive, except for limited transition, if needed. Substances meeting the criteria for CLP⁴⁴ & SVHC⁴⁵ under REACH should be banned. The ELV Directive should allow for additional chemicals to be banned,
- The prohibitions and Annex II of ELV Directive need to be aligned with other EU legislations (REACH, RoHS, Batteries) concerning hazardous substances (3 stakeholders),
- impossible to give a “single” answer to this incredibly complicated question: as for flame retardant: you prefer the vehicle burn, or the people are exposed to a possible endocrine disruptor chemical? the answer is not technical, it is political (courage).

Other criteria mentioned:

- CO₂ footprint assessment (2 stakeholders),
- To check whether the use of the substance creates a risk impossible to manage or prevents recycling,
- Full life cycle consideration for the existing substance & substitute (2 stakeholders),
- Balanced approach for chemicals management, climate aspects and circularity (2 stakeholders),
- Technical and economic feasibility (2 stakeholders).

Interviews

Many stakeholders when asked about the options of having all prohibitions under one legislation (ELV or REACH), did not really consider this option. Though certain stakeholders prefer REACH for (further) substance restrictions (material suppliers and recyclers), they explain that they would rather leave the exemptions for the four heavy metals under ELV legislation as the review mechanism is already established. Vehicle manufacturers were the only ones that clearly favoured the alternative of having all restrictions under ELV. Though some general statements were made as to costs of the exemption process or the environmental benefit that accrued so far from the prohibition of the 4 heavy metals, these were not quantified or e.g. explained in relation to how costs break down in to specific activities.

Written OPC

With regards to the prohibition of hazardous substances, coherence with REACH and CLP Regulations are mentioned in support of less hazardous substances (Anonymous, FNADE, Swedish Government), reminding to the current obligation for reporting in the SCIP database⁴⁶ to assist recyclers with understanding if SVHCs are present or not is also relevant here (FNADE; Plastics Europe), for the assessment of hazardous substances, uses and exposure as established for the risk assessment under REACH should be considered (Plastics Europe).

⁴⁴ Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (OJ L 353, 31.12.2008, p. 1–1355).

⁴⁵ Substances of Very High Concern (SVHC).

⁴⁶ SCIP is the database for information on Substances of Concern In articles as such or in complex objects (Products) established under the Waste Framework Directive (WFD) <https://echa.europa.eu/scip>

Workshop

The discussion on the hazardous substances part was surprisingly vivid.

Some participants stressed in the chat that they prefer REACH as central legislation for substance restrictions because REACH became a robust legal instrument and that this horizontal legislation should be referred to in all product legislation that restrict the use of substances due to risks. Also the coherence issue was noted to avoid different interpretations of legislative text or different content of definitions.

On the other hand, it was argued that so far REACH restriction barely covers chemicals in products as until now this only appears for textiles and PAH in rubber. A participant from NGOs claimed that substances that meet the criteria for SVHC under REACH and meet the CLP criteria should be prohibited in the new ELV Regulation for supporting a toxic-free environment policy purpose. Other participants however reminded that the “hazard” approach does not sufficiently support “a true circular economy” as contaminants might always remain in materials that are however embedded in the solid material and no health problem occurs. For this reason, the participant reminded to the risk approach, with exposure scenarios, which, in the case of a vehicle is relatively easy to define.

Besides, various participants reminded the difficulty of the time span until vehicles reach their end-of-life that makes the information on chemicals difficult (“How should the recycler and the automotive manufacturer know if they can use the material in a new car?” – “If you start now a digital product passport etc. the result will (perhaps) be visible/useful in 20 years.”) To solve this problem it was proposed to define specific exemptions not only for spare parts but also for recycling material. Participants argued that though this would not be in line with the aim of a non-toxic environment of chemicals strategy for sustainability, there is a risk that material will not be recycled because of legal risk or additional burden, which makes the circular business unprofitable.

2.3.9. 2.4.3. Collection / Missing vehicles

Statistical OPC

That a charge applicable to the owner during periods of temporary de-registration would help ensure that owners follow their obligation to report any change of ownership or export to the authority was strongly supported by environmental NGOs, waste operators and public authorities. Only 11% were against this measure, mostly represented by consumers and their organizations who would also be the most negatively affected by such a measure. A vast majority agreed that better traceability should be established between the EU Member States’ registration systems on a legal status of a vehicle until its final deregistration. Including a roadworthiness test as a condition was considered by the largest number of stakeholders as an appropriate measure to overcome the problem of ‘illegal exports’ of ELVs and of exports of ELVs as used vehicles. Compliance with certain environmental criteria was the second most favoured, followed by conditions on maximum age or on maximum mileage. Among 14 different options for reducing the number of missing vehicles, over half of the participants (52%) indicated a combination of at least 6 of the various options which shows the high support for the implementation of additional measures to reduce the problems related with missing vehicles. A total of 46 participants (22%) did not provide an answer, 17 of which were from the automotive producing sector.

Results of a stakeholder consultation held in the course of the study on the ELVs of unknown whereabouts (Mehlhart et al. 2017) can provide additional insights as to the pros and cons of the various options. Due to former public consultations on the aspect of vehicles of unknown whereabouts, exported vehicles and collection, this OPC did not put a strong focus on this topic, but only asked the questions summarized above. To display a comprehensive stakeholder feedback on the topic, the OPC results from a study in 2016 can be found in the following box:

Excuse: Open Public Consultation in 2016

The 'Public consultation on potential measures to improve the implementation of certain aspects of Directive on end-of-life vehicles, with emphasis on vehicles of unknown whereabouts' was open for twelve weeks from 29 June to 21 September 2016.

The objective of this public consultation was to receive the views of stakeholders concerned with the topics of the consultation.

The online survey covers 6 topics below:

1. Keeping track of vehicles within the EU (intra EU trade);
2. Methods to achieve more complete reporting on extra EU export and ways to distinguish between exporting ELVs vs. used vehicle;
3. Enforcement techniques to reduce illegal dismantling of ELVs at dealers and repair shops (garages) and actions to improve ATF compliance;
4. Public awareness and incentives for ELV tracking and environmental risks;
5. Aspects to improve coverage and data quality when reporting on ELVs (possible revision of the Commission Decision 2005/293/EC);
6. Persistent Organic Pollutants (POPs) and ELVs.

According to the conclusion from the OPC in 2016⁴⁷, "there is a broad and joint understanding among all stakeholders that the current procedures need further improvement to keep track of vehicles and to strengthen the requirement to issue and present a CoD. This applies for the provision of evidence on the vehicles fate during a temporary de-registration and also applies for fines to owners which do not provide statement of whereabouts for such temporary de-registered vehicles.

Most of the stakeholder support the implementation of economic incentives for instance fees or refund systems to ensure that ELVs are delivered to ATFs. Only car manufacturers and importers oppose such economic incentives.

With regard to the extra EU export of used vehicles (some of them possibly to be considered as ELV) the proposal to make Correspondents Guideline No 9 legally binding, many stakeholders oppose this proposal. Several stakeholders argue that the current version is difficult to apply and adjustments are needed before making the stipulations legally binding. Also, the approach to ban the extra EU export of used vehicles was not supported by the stakeholders. Instead, the stricter enforcement of inspections (when exporting) cooperation between IMPEL, police and customs authorities and the adjustment of reporting on waste shipment found strong support by all stakeholders.

With regard to the fight against illegal treatment within the EU the majority of stakeholders acknowledged the need for action in particular the need for national/ regional

⁴⁷ Mehlhart et. al (2017).

authorities to perform regular inspections of the sector (not only ATF and shredders but with a broader scope for garages, repair shops and spare part dealers) to identify illegal operations. Comments expressed the concern that improved burden to ATF only might even cause adverse effects (more illegal operator) and inspections should carefully focus to support legal operating facilities.

The proposal to establish minimum requirements for such inspection activities is less supported and partly rejected by the car manufacturers and importers. Again, proposals to establish economic incentives to strengthen the legally operating sector are opposed by the car manufacturers and importers. The proposal to improve the reporting mechanism when issuing a CoD and upon arrival of an ELV at ATFs or shredder facilities was in general supported, including the establishment of electronic notifications to the registration authorities.

Supporting public awareness for the management of ELVs is considered as relevant by the stakeholders. While penalties to car owners not fulfilling their duties are supported by the vast majority of stakeholders, incentives based on funds/ deposits are again opposed by the car manufacturers and importers.

All replies of the stakeholders to the manyfold questions in details can be found in the mentioned report “Assessment of the implementation of Directive 2000/53/EU on end-of-life vehicles (the ELV Directive) with emphasis on the end-of-life vehicles of unknown whereabouts⁴⁸” published by the EC in 2017.

Written OPC

The topic was of high interest for stakeholders providing written input. Of 57 contributions, 15 contained information or opinion on vehicles of unknown whereabouts, 13 on (de-)registration, and additional 6 on reporting. Contributions on these topics were received from all stakeholder groups.

Workshop

Topics discussed at the workshop following the presentation of the consultants on the topic of missing vehicles were:

- The suitability of road-worthiness test where various stakeholders have different opinions on details of the use of such test, however, it is seen a “key question”;
- ELV registration competencies, e.g., a Member States representative pointed out that EU-wide information exchange (database) on CoDs accessible by the EU registration authorities would be an effective tool, industry agreed. It was clarified that EUCARIS, the data exchange mechanism for vehicle data in Europe, does already have a CoD-message in place to exchange the CoD-info across Member States. EUCARIS is used by many EU Member States, however the CoD-message is currently not being used;
- vehicles deregistration, e.g., in relation to the limitations of temporary deregistration, harmonized rules, and automotive industry requested that an automatic deletion from the registration systems after seven years for example like in some MS should not be

⁴⁸ Mehlhart et. al (2017).

continued. Recyclers pointed out to the responsibilities of insurance companies and total technical loss status, but also the definition of an ELV compared to used vehicles

In general, many stakeholders engaged in the debate. Many of the stakeholders participating in the debate shared perspectives and experiences from MS, e.g. from Sweden or Germany (MS representatives), the Netherlands (stakeholders engaged in repair and dismantling and EPR), Belgium (representative of the EPR system) or Latvia, Poland, France etc. (recyclers). Further, a representative of the Dutch EPR said that a good cooperation between the Ministry of Environment and Ministry of Infrastructure/transportation (etc.) is key [...] to be able to monitor ELVs. Another idea presented by stakeholders were 'massive citizens information about legal way to dispose your ELV' (recycler + manufacturers).

2.3.10. 2.4.4. EPR System

Statistical OPC

In the OPC, most stakeholders argued that in order to ensure a high quality of recycling, it is necessary to compensate ATFs for their dismantling efforts, which are not economically viable under the current conditions. This was mainly supported by environmental NGOs and consumer organizations, waste management operators, public authorities, and citizens but also a fair share of automotive producers (32%). When asked in more detail, 56% of all stakeholders agreed that producers should compensate the ATFs for their dismantling efforts and for appropriate treatment and disposal of these wastes. Here, waste management operators were the most prominent in their support of this aspect.

Written OPC

A few written contributions addressed Extended Producer Responsibility aspects, some only as a simple need that has to be implemented and others with more elaboration. Several stakeholders explained the purpose of an EPR scheme to be to affect the design of products so that they result in less negative environmental impacts. Others see the EPR scheme mainly as a funding opportunity to e.g. to balance costs for dismantling in particular when secondary materials are more expensive than virgin materials, to boost investment in high-quality PST through economic incentives. One stakeholder raised the concern that the creation of an EPR monopoly dominated by producers could end up limiting the free and fair competitiveness of the current network of dismantlers and shredders.

Interviews

Waste management operators look at the establishment of an EPR positively, in particular where it is necessary to support the financing of components of materials that need to be dismantled and treated in a way that is not economical. Though EPRs exist for some MS, a difficulty was raised that they are usually run by OEMs without involving ATFs in their management. The difficulties in managing funds for a European EPR were raised in light of the frequent exports between countries and also the different costs that waste management results in each country that would make setting a single fee for an EPR fund at EU level tricky.

Workshop

Participants commented that there are concerns about what entity has authority over EPR schemes. A few stakeholders mentioned that funds have not shown big advantages to support the economic feasibility of ATFs and stated that the processes that ATFs should treat vehicles and then producers have to cover negative market value vehicles is the direction that the EPR should develop, with it being established in the Directive. In contrast it was mentioned that funds were effective in compensating unprofitable labour (material dismantling), allowing the dismantler to compete more effectively with the illegal sector and being less dependent on enforcement. A few stakeholders raised the aspect of the CoD and the need for more enforcement to lower illegal exports leading to less vehicles being treated in the EU. The EPR was mentioned as an option to address the problem of cars going to other continents and not just for ensuring financial feasibility of ELV treatment.

2.3.11. 2.4.5. Scope of the ELV Directive

Statistical OPC

For almost all stakeholder categories participating in the OPC, over 50% of the individual answers were in favour of extending the Directive to additional vehicles. The highest support of this option was given by environmental organizations (100%), public authorities (90.9%) and waste management stakeholders (85.7%). On the question which additional vehicles should be included into the scope of the ELV Directive, the majority was in favour of adding motorcycles and lorries with a higher preference for lorries from the waste management operators and a higher preference for motorcycles from the manufacturers.

Avoidance of environmental harms to the environment thanks to minimum requirements for end-of-life treatment, increased resource recovery and increased recyclability were the top 3 important advantages of extending the scope of the ELV Directive largely supported by all stakeholder categories. Individual stakeholders explained that including them in the scope would increase the supply of recycled materials and lead to better dismantling, that heavy vehicles are exported to a larger extent than cars and reuse of spare parts is not as developed. And illegal vehicle dismantling, and unfair competition take place. This should be dealt with in the legislation. One third had no opinion on disadvantages of the scope extension. The most supported individual answers were that “These other vehicles (e.g., motorcycles and lorries) have features which are different from the vehicles covered by the ELV Directive, so that the provisions of the ELV Directive are not adapted to these other vehicles” (62 individuals or 30%) and “Higher burdens for SMEs” (48 individuals or 23%). Answers were distributed relatively evenly between the various categories. The stakeholders themselves relativised their statements on disadvantages when asked to detail: Though, “motorcycles are small, so it will be a lot of work for a very small amount of materials”, and “trucks [lorries] are big and require specialised facilities for dismantling”, stakeholders say that “recycling facilities are suitable for all of the ELV Directive scope”. “Today these vehicles [it is not clear which] are already treated in authorized facilities even if they are not covered by the scope of the Directive.” Or: “The ELV Directive change will result in some system changes and investment costs. It however involves an investment for the future. If the demand for recycled material is successfully established, it will pay itself back.”

More than one third of the stakeholders did not have an opinion on / did not know the areas where compliance for motorcycles and/or lorries would be difficult, and 15% said there are

none. About 20% support that the following measures may be difficult to comply with: Material-specific recycling targets (45 individuals or 22%), reuse target (47 individuals or 23%), and recycled content target (38 individuals or 18%).

Written OPC

Various stakeholders from the motorcycles sector contributed additional information: ACEM emphasises that the sector consists of many SMEs that have no experience with the requirements of the current ELV Directive. Besides the quantitative results from a survey on the numbers of recycled motorcycles in Finland, SMOTO⁴⁹ brings forward the concern that the common reuse practices could be undermined by the perceived focus of the current ELV Directive on recycling rather than reuse. An anonymous stakeholder (motorcycle manufacturer) proposes non-reusable parts for motorcycles in addition to those listed in Art. 8 of the 3R Type approval Directive for M1 and N1⁵⁰. FORS (a Polish recycling association) speaks for the practice of certificates of destruction for end-of-life motorcycles. A recyclability target is preferred whereas recycled content targets and reuse targets are explicitly not recommended for motorcycles (EUROFER⁵¹).

For lorries, the Swedish Government considers it important to distinguish between light and heavy-duty vehicles. If lorries were included, the Czech Ministry of Environment sees “problems in their size and different composition of materials”. Generally, for new vehicles in scope, the regulation should prevent the phenomenon seen for missing vehicles, i.e., the avoidance of the EU end of life treatment requirements (Swedish Governmental Agencies).

Six contributions focus on historic cars and motorcycles. Current practice of exempting historic cars should be pursued.

Interviews

Relevant interviewees are ACEA and ACEM presenting the manufacturers of lorries and L-type approved vehicles, and ANERVI⁵²/AETRAC⁵³, EuRIC⁵⁴ and EGARA⁵⁵ representing the EoL stakeholders. To describe the status quo of the dismantling of lorries, the main messages in the interviews were that lorries are not just bigger cars, that depollution is in practice in some MS, that lorry recycling infrastructure is different in different Member States, and that ATFs that can manage a lorry also manages trailers. As for the status quo of EoL treatment of motorcycles, it was noted that reuse is important, that L-type approved vehicles have no chassis which is relevant for the definition of what is an ELV. Then, a very small number of L-type approved vehicles are returned to recyclers, and that there is no statistics on motorcycles, e.g., no separate waste code, right now.

⁴⁹ <https://smoto.sg/>

⁵⁰ Wheel suspension (front / rear) incl. triple clamp, swing arm and all damping parts, handle bar, all kind/material of rims, sub-frame, all kind/material of fuel tank.

⁵¹ <https://www.eurofer.eu/>

⁵² <https://www.anervi.com/>

⁵³ <https://www.aetrac.es/>

⁵⁴ <https://www.euric-aisbl.eu/>

⁵⁵ <https://egaranet.org/>

In relation to potential regulation covering additional vehicles, the clear message was sent that vehicles different to M1 and N1 vehicles require specific rules, e.g., that the same 3R targets could not apply, and that these vehicles potentially require different exemptions from heavy metal restrictions (or new substance restrictions).

Workshop

Views differed on exemptions for hazardous substances in additional vehicle categories. Vehicle manufacturers were in favour of a category specific Annex II, i.e., to review the application of existing Annex II bans per vehicle category. The issue was also brought up in relation to multi-stage built vehicles, incl. wheelchair accessible vehicles. There is also a difficulty if more than one vehicle category applies to a vehicle.

Stakeholders broadly support that it is currently not recommended to apply the 3R type approval Directive to multi-stage built vehicles.

In the workshop, various participants of all stakeholder groups commented on the presented data and/or provided additional data (on the calculation of the fleet of motorcycles and lorries, on actual fleet data from Spain and Germany). ACEA is currently performing a study on lorry, with results expected at a later stage.

A representative from the European Environmental Bureau (Environmental NGO) stated that, if the scope of these Directives is currently being discussed, the discussion should not be limited to a scope for only on-road vehicles.

2.3.12. 2.4.6. 3R Type-Approval and its relation to the ELV Directive

Current situation. Questions were asked to understand better the role of type-approval technical services', the type-approval authorities' and the OEMs' in the process of type-approvals in general as well as the special part of the 3R type-approval in particular. Because this is more for the understanding of the current situation, the answers are not summarised here.

Effectiveness. Type approval authorities state that the Directive generally facilitates the achievement of the 3R targets. This is also supported by OEMs. However, this is not supported with data. Stakeholders are of different opinion in relation to whether the 3R Directive facilitates "high-quality" recycling. There is no systematic monitoring or studies that compare between the targets reported in type approval declarations of OEMs for specific vehicle models and between their actual performance at end-of-life. Quantitative feedback is scattered.

The number of 3R Type Approvals performed per Member State varies largely:

- Some have not performed any type-approvals since Directive 2005/64/EC came into force (e.g., Latvia, Finland) but do report on Regular TAs for second stage of N vehicles. Some perform 3R type-approvals regularly (6-9 per annum).
- One authority estimated the costs for the process at "< 0.25 years FTE per each 3R type approval"
- Some Member States collect fees for the type-approval and some do not – amount also depends on certificate type (0-600 €).

- 3 of 5 Member States agreed that the 3R type-approval should cover all stages of multi-stage vehicles (2 did not answer the question)

A second cluster of question was asked around the possible future amendments of the ELV Directive. In general, little to no input is provided on impacts of introducing certain measures proposed to be changed in the 3R Directive. One stakeholder is of the opinion, that the scope of the 3R type-approval should be extended to include additional vehicles.

On the merge of ELV Directive and 3R Directive. Of the interviewed stakeholders, one is of the opinion that there is a missing link and missing references between 3R Directive and ELV Directive. Member States that perform 3R type-approvals were against a merge with ELV. At least, two times China was provided as an example where one legal instrument is in place, however, the European market would be more diverse according to stakeholders. Looking at the stakeholder groups that provided their input on this topic, it should be noted that the stakeholders rarely take the perspective of the end-of-life. An ACEA position paper refers to the positions of the automotive industry in relation to the merge of 3R type-approval Directive and ELV Directive: ACEA “call[s] for the current legal framework to be maintained.” Rather than focusing on recyclability, they would like to see their engagement in the field of emission reductions during the use phase, i.e., strategies focusing on light weight, acknowledged framing it Design for Sustainability.⁵⁶ Another argument put forward (stakeholder shall not be named) is that currently, the responsibilities are distributed, i.e., recyclers fulfil the ELV Directive and manufacturers fulfil 3R type-approval Directive requirements. A merge of the Directives producing a legislation with joint responsibilities could increase innovation times and create longer discussion processes.

⁵⁶ ACEA wants to “point out that, for the necessary new and innovative materials for achieving the ambitious goals of targeted carbon neutrality by 2050, there might not yet be available appropriate recycling technologies for vehicles on an industrial scale” (ACEA, 2022).

ANNEX 3: WHO IS AFFECTED AND HOW?

This annex sets out the implications of the preferred policy package for all affected groups of stakeholders. It describes the actions that public authorities and economic operators might need to take in order to comply with the obligations under the revised legislation and indicates the expected costs and benefits to be incurred in complying with new obligations. Where quantitative information is not available, the overview on the nature and costs and benefits is provided.

3.1 Introduction

The stakeholders affected by the initiative are listed below.

Vehicle producers: they have traditionally been involved in facilitating the collection of ELVs across the EU (in line with the obligations set out in the ELV Directive). They also have to demonstrate to the type-approval competent authorities that new vehicle types comply with the provisions of the 3R TA Directive and the ELV Directive relating to recyclability, re-usability and recoverability and the restrictions of hazardous substances. Some vehicle producers have taken voluntary initiatives to promote the use of remanufactured components or the incorporation of recycled materials in new models. Overall, however, vehicles producers have not made the transition to a circular economy a priority in their overall sustainability strategies. They would be affected by measures aiming at changing the design and production of new vehicles (especially obligations linked to the use of recycled materials, the provision of information on the composition of vehicles to the dismantling and recycling sector and the development of circularity strategies), as well as by measures designed to increase the responsibility of producers in the collection and treatment of ELVs, especially through the establishment or reinforcement of EPR schemes. Producers of motorcycles and of lorries have until recently paid limited attention to the potential offered by the transition to a circular economy for their sector. The new legislation will strengthen the cooperation between the car manufacturers and the ATFs. For instance, the vehicle manufacturers would be required to provide ATFs with detailed instructions for the dismantling and disposal/recycling/reuse of all components of a vehicle type. These instructions will be submitted to the type approval authorities during type approval and be made available through the existing methodologies related to Repair and Maintenance Information (RMI). Furthermore, Manufacturers will have to make this information accessible to the relevant operators of the vehicle engaged into the end-of-life treatment.

Suppliers of vehicle producers: the suppliers of components and parts for the automotive industry have been affected by the restrictions on the use of hazardous substances set out in the ELV legislation. They would be affected by any new provisions affecting the design and production of vehicles.

Dismantlers: there are approximately 12,000 “authorised treatment facilities” in the EU, which are on the frontline for the dismantling of ELVs. Most of them are SMEs. Some are integrated in bigger units and companies which also comprise shredding activities. Some of them also have contractual links with car producers. They receive ELVs from their last owners, carry out their depollution and remove the most valuable parts and components. They

make most of their business in the commercialisation of these parts removed and the sale of depolluted ELVs to shredders. Many of them also deal with “used vehicles” that they purchase and sell inside or outside the EU. They are directly affected by the provisions of the ELV Directive on collection, treatment and depollution, as well as on recycling/re-use and recovery targets. While they have to abide by the EU requirements, they face competition (both to receive ELV but also when selling spare parts) from the informal sector which collect ELVs and dismantle them in less environmentally sound manner.

Shredding/recycling companies: there are a few hundred⁵⁷ companies in the EU active in the sorting, shredding and processing of ELVs and waste fractions resulting from ELVs. Most of them are linked to large waste companies. They buy depolluted ELVs from ATFs, sell the resulting sorted and shredded materials to industries using secondary materials as feedstock in their production processes and send residual waste to landfills or incineration with energy recovery. Such companies are not evenly equipped with modern technologies, some of them having invested in “post-shredding technologies” allowing to better sort and decontaminate materials mixed during the shredding process, while other rely on more basic technology. They have traditionally been focusing on the commercialisation of ferrous and non-ferrous scrap, which are by far the most profitable waste fractions from ELVs. A large share of this metal scrap is exported outside the EU. Some of them however have been investing in plastics recycling and have called for the establishment of recycled content obligations for these materials in new vehicles to support their activities.

Industries relying on scraps as feedstock for their production: scrap/secondary materials from shredding companies are incorporated in the production processes of large industries (steel, aluminium, copper or plastics industries) which see them as an important feedstock for their decarbonisation. They have been calling for higher quality of materials which could replace primary materials and save additional amount of energy and greenhouse gas emissions.

Repair shops and garages: this group of stakeholders is composed of SMEs which would be affected mostly by measures impacting the purchase and selling of used parts and components. They are indeed important actors in the market of spare parts: this is the case both of new spare parts, which they buy from vehicle manufacturers or spare part suppliers and used spare parts stemming from ATFs or other garages. Measures dedicated to support reuse of remanufactured and used parts would enlarge the supply of used parts to these stakeholders but could also generate additional administrative burden for them compares to the baseline scenario.

Companies involved in the export of used vehicles: most companies exporting used vehicles outside the EU are SMEs. This is the case of some garages or ATFs which sell used vehicles as part of their regular business activities. There are also companies which exercise exclusively these activities, buying used cars from garages, insurance companies or individual

⁵⁷ See the supporting study for the impact assessment, which refers to data collected in 2014 according to which 350 shredders are established in the EU. According to Eurostat, there are shredders equipped for ELVs in all EU Member States except Luxembourg and Malta.

owners, and organising their export to non-EU countries. They will be affected by the measures designed to ensure a better control on the interdiction to export ELVs outside the OECD, as well as by the new measures governing the export of used vehicles (only authorised upon presentation of a roadworthiness certificate). The companies specialised in the export of used cars will be the most affected. They would incur costs linked to the obligation for them to carry out roadworthiness tests for vehicles which are currently exported after the certificate has expired. In addition, they are likely to see a decrease in revenues linked to a reduction in the export of used vehicles which do not meet the conditions to obtain a roadworthiness certificate. They would then have to sell these vehicles as ELVs to ATFs in the EU, at a much lower price than what they could have obtained for exporting them.

Insurance companies: insurance companies are amongst the largest owners of ELVs, which own on average 14% of ELVs obtained from their customers after accidents⁵⁸. A few of these companies have adopted an ambitious approach based on circular economy considerations, but the majority of them have so far shown little interest in this dimension and are mostly interested in getting the highest prices for the ELVs and used vehicles that they sell, often in bulks in auction sales.

EU Consumers/citizens: EU consumers and citizens have little information to date on the environmental stakes linked to the design, production and end-of-life treatment of vehicles. This is partly due to a lack of proactive information on this issue by the automotive industry⁵⁹. Consumers might be affected by changes in EU legislation to improve the re-use, remanufacturing and recycling of vehicles, which could lead to an increase in the price of new vehicles. Changes designed to boost the market for used spare parts might on the other hand lower the prices of these parts, to the benefits of consumers who have to change parts (for example during repair operations), as used parts are usually considerably cheaper than new parts.

Non-EU stakeholders: non-EU stakeholders are mostly affected by the export from the EU of used vehicles and ELVs, which constitute an important supply for the automotive market in some countries, especially on the African continent.

Society as a whole: the challenges linked to the implementation of the ELV and 3R type-approval Directives are also relevant to the society as a whole, in as much as they can greatly help reducing the environmental footprint and associated harm to the environment linked to the production and end-of-life treatment of vehicles. The transition of the sector to a circular economy would also bring with it considerable environmental gains.

- **Administrations in the Member States:** different national administrations in the Member States are responsible for the implementation of the ELV and 3R type-approval directives (from environment Ministries or agencies, type-approval authorities, market surveillance authorities, inspection services and customs) authorities. They would be

⁵⁸ In Extenso Innovation Croissance, Alice Deprouw, Déborah Gaillard, Arthur Robin. Ademe, Éric Lecointre. Octobre 2021. Automobiles – Données 2019 – Rapport annuel. 110 pages.

⁵⁹ Despite the provisions in Article 9(2) on this point in the ELV Directive.

affected by the adoption of new measures, which will create additional burden linked to the reporting on new data and information, as well as the implementation and enforcement of new obligations for economic actors. For instance, upon entry into effect of the new legislation, the competent authorities of the Member States will have increased responsibilities in two fronts: 1) ensuring the market surveillance of newly type-approved vehicles; 2) monitoring, reporting on the overall performance of ATFs and other corresponding actors of the automotive sector through implementing reporting obligations.

3.2 Summary of costs and benefits

Table 3.1 Overview of benefits

I. Overview of Benefits (total for all provisions, compared to a “business as usual baseline”) – Preferred Option - in 2035		
Description	Amount	Comments
Direct benefits - materials		
Materials recycled at higher quality (in addition to baseline)	+5,400 ktons	Total amount: this covers materials used as recycled content, treated at higher quality and collected more.
Plastics used as recycled content in new vehicles	+710 ktons	Post-consumer plastics used in new vehicles
Materials reused, removed and recycled at higher quality (current vehicle scope)	+2,300 ktons	Steel: Reuse +600 ktons; Recycled +860 ktons; Aluminium: Reuse +120 ktons; Recycling +330 ktons Copper: Reuse +15 kton; Recycled +82 ktons Glass: Recycled +160 kton Plastics: Reused +87 kton; Recycled +160 kton CRMs - REEs: Recycled +2.4 kton
Materials collected and treated more	+1,900 ktons	Steel: +1,550 ktons Aluminium: +240 ktons Copper: +31 ktons Plastics: + 60 ktons Platinum in catalysts: +7 tons
Materials reused, removed and recycled at higher quality from extended scope	+510 ktons	Motorcycles: + 57 ktons Heavy-duty vehicles: + 450 ktons
Direct benefits – Economic revenues (in current value)		
Revenues from improved collection and recycling	+2,400 million EUR	Total value of revenues and avoided costs for materials used as recycled content, treated at higher quality and collected more.
Plastics used as recycled content in new vehicles	+600 million EUR	Post-consumer plastics used in new vehicles: shredders and PST operators

Materials reused, removed and recycled at higher quality (current vehicle scope)	+1,380 million EUR	ATFs: +110 million EUR (net revenues) Shredders/ PST operators: +1,090 million EUR Recyclers: +170 million EUR
Materials collected and treated more	+360 million EUR	ATFs: + 328 million EUR Shredders/ PST operators: +29 million EUR
Materials reused, removed and recycled at higher quality from extended scope	+81 million EUR	ATFs: + 42 million EUR Recyclers: +39 million EUR
GHG savings (- = reduction)	-12,300 kton CO2eq	Production share only: Plastics recycled content: -310 kton CO2eq Reuse and recycling: -4,540 kton CO2eq Increased collection: -6,350 kton CO2eq Scope extension: -1,120 kton CO2eq
Energy savings plastics recycled content (- = reduction)	-7,300 GWh (plastics)	Plastics recycled content -4.5 million barrels of oil eq.
Reduced air pollution emissions, plastics recycling	+13	Reduced decease incidences due to particulate matter
ELVs collected and treated more	+3.8 million vehicles	+3.2 million for N1,M1; +0.6 million for scope extension. Includes 1.1 million vehicles more from illegal/ informal treatment EU, in total 65% less low value used vehicles and ELVs exported less for N1,M1
Export reduction used vehicles + ELVs	-2.1 million vehicles	
Indirect benefits		
Additional EU jobs	+22,100	Of which: Manufacturers: +7,200 SMEs: ATFs and shredders: +14,200
Improved resource efficiency	Not quantified	Manufacturers
Reduced environmental externalities of mismanaged waste and health risks in third countries	Not quantified	Reduced offer of second-hand vehicles in 3rd countries” expected with 2.1 million vehicles and “increase in prices of second hand vehicles in 3rd countries”. Improved quality of vehicles exported with a valid roadworthiness. Many importing countries are taking measures to ban the import of second hand cars over a certain age, or below certain emission levels.
Lower amounts of landfill	Not quantified	Waste management sector
Improved recycling rates vehicles	+5%	Based on improved recycling definitions, main benefits are improved recycling quality

Lower repair costs from 2nd-hand spare parts	Not quantified	Vehicle owners, reduced costs by avoiding new spare parts. Rough estimation is a 50% lower parts costs on average, very dependent on the type of parts and age of the vehicle
More legitimate income	Not quantified	Waste management sector
Increased tax revenue	Not quantified	Member States
Administrative cost savings related to the ‘one in, one out’ approach*		
Not applicable	Not applicable	Not applicable

For more details per policy option and for 2030 and 2040, see Annex 8.

With respect to one out costs, there are no ‘one out’ costs included. There is however, potentially reduced administrative burdens not included as a result of the aimed digitalisation of vehicle registration documents facilitating the exchange of information between Member States on their registers. This line is worth up to 1 EUR per vehicle and thus 9.8 million EUR of recurrent savings when fully implemented. It benefits ATFs in particular due to more streamlined issuing and tracking of CoDs. The saving is however not included for this impact assessment as it results primarily from the general digitalisation of the national vehicle registration system under DG MOVE’s impact assessment⁶⁰ of the roadworthiness package and Directive 2014/46/EU on vehicle registration documents.

Table 3.2 Overview of costs

II. Overview of costs – Preferred option, compared to a “business as usual baseline”, all values in million EUR, in 2035, current value							
		Citizens/Consumers		Businesses		Administrations	
		One-off	Recurrent	One-off	Recurrent	One-off	Recurrent
Design circular PO1	Direct administrative costs			Manufacturers: 2.370	Manufacturers: 5.20; ATFs, shredders 0.16	EC: 0.200	Type approval: 0.014; market surveillance 0.191
Recycled content plastics and steel PO2	Direct adjustment costs			Plastic recyclers capacity investment : 690	Manufacturers: 392, Recyclers 284		
	Direct administrative costs				Manufacturers 0.24		

⁶⁰ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13132-Vehicle-safety-revising-the-EUs-roadworthiness-package_en

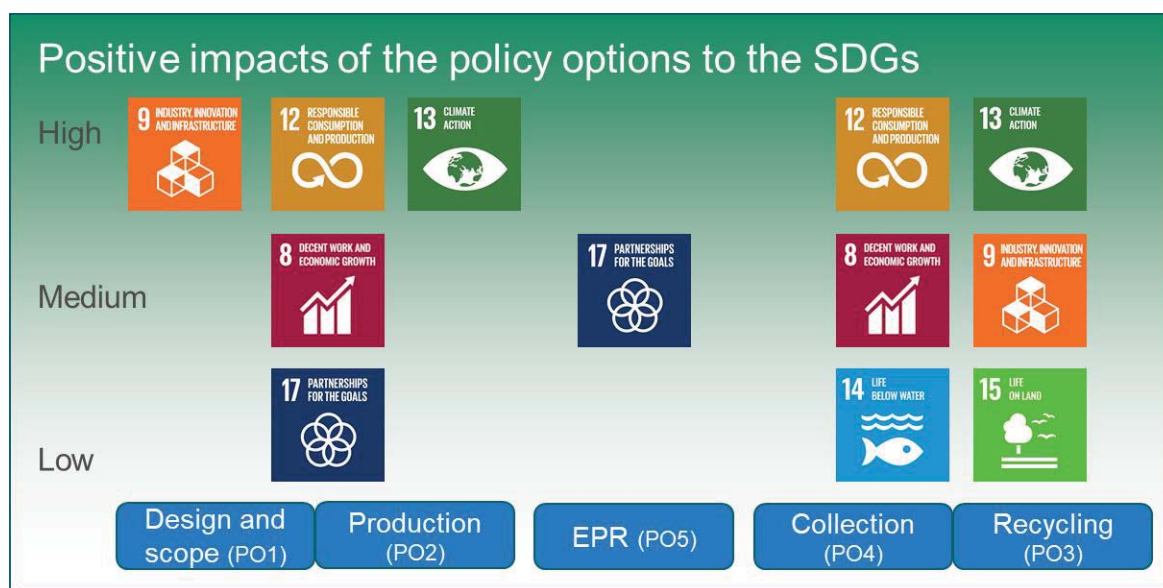
Recycling PO3	Direct adjustment costs				ATFs: 491 Shredders/ PST operators: 1,230 Recyclers: 83		
	Direct administrative costs				ATFs: 16.2 Shredders/ PST operators: 12.9 Recyclers: 2.52		MS waste authorities 0.043
Collection and EPR (PO4,5)	Direct adjustment costs		Reduced export value: 151		Specialised export car dealers: 523		
	Direct administrative costs				Manufacturers: 32.1	MS waste authoriti es 1.35	MS waste, 4.87; MS vehicle registration 16.6; EC: 0.850
Scope extension PO6	Direct adjustment costs				Specialised exporters HDV: 51; ATFs: 39		
	Direct administrative costs		Private vehicle owners (L3e- L7e): 2.331	Manufactu rers L: 0.056; Manufactu rers HDV: 0.026	Manufacturers: 0.016, ATFs: 10.4; HDV vehicle owners: 0.574		MS waste authorities 0.280
Costs related to the 'one in, one out' approach (in million EUR)							
Total	Direct adjustment costs	n.a.	n.a.	n.a.	n.a.		
	Indirect adjustment costs	n.a.	n.a.	n.a.	n.a.		
	Administrativ e costs (for offsetting)	0	2.331	2.452	79.720		

Detailed recurrent and one-off costs per measure and policy option are provided in Tables 8.29 to 8.37 in Annex 8.3.

3.3 Relevant sustainable development goals

Figure 3 visualises the contribution of the policy options to the SDGs. On the left-hand ‘design and production’ side of the diagram, policy options **PO1** and **PO2** contribute mostly to sustainable innovations (SDG9), responsible consumption and production with a lower environmental footprint (SDG12) and climate action (SDG13). The collection and recycling options **PO3** and **PO4** contribute to the same SDGs and to less pollution water and air pollution (SDG14 and SDG15) to a lesser extent. PO5 will improve partnerships for the goals (SDG17).

Figure 3.1 Contribution of the Regulation to the SDGs



As demonstrated in the figure, the implementation of the preferred option of the joint revision of the ELV and 3R type-approval directives will make a significant contribution to the United Nations' Sustainable Development Goals, promoting responsible consumption and production, decent work and economic growth, industry, innovation and infrastructure, and climate action. More detailed description is provided in the table below.

Table 3.8 Overview of relevant SDGs

III. Overview of relevant Sustainable Development Goals – Preferred Option			
Relevant SDG	Expected progress towards the Goal		Comments
SDG no. 9 – Industry, innovation and infrastructure	The revised guidelines will promote the use of cutting-edge technologies and services, leading to increased innovation in the automotive industry and improved infrastructure for the automotive recycling sector. The use of advanced technologies and services in the automotive sector (e.g. development of PST, improvement of sorting operations) will contribute to the development of smart industry, innovation and infrastructure.		Representing 27% of the region’s total R&D investments, the automotive industry is Europe’s largest R&D investor. In 2021, Automotive R&D investment (EU) was equal to 58.8 billion Eur. The new requirements will increase the investment need, e.g. recycled content for plastic is estimated to have a need to boost recycling capacity by 69 million EUR by 2035.

SDG no. 12 – Responsible consumption and production	The implementation of the new legislation will increase the reusability, recyclability and recoverability of vehicles and their components, thus promoting more responsible and sustainable consumption and production practices throughout the automotive value chain. More precise and stricter European end-of-life rules, focusing on the reuse of spare parts and high-quality treatment, will require that end-of-life vehicles are treated efficiently and that their parts are reused or recycled in wherever possible. Clearer requirements for 3R type-approval of vehicles (e.g. disassembly requirements, adoption of a circularity strategy, use of recycled content) will ensure that vehicles are designed in a more sustainable way, to reduce their environmental impact.	The implementation of the preferred measures will result in additional 5.4 million t of materials recycled at higher quality or reused than today. 350 tons of rare earth permanent magnet materials would be separately collected for reuse and recycling in 2035, which would contribute greatly to the EU efforts for strategic autonomy for CRMs. That will also allow better quality secondary materials to be available on the market. Incentives to support reuse of spare parts will make the vehicle maintenance to be more affordable by a roughly 50% of lower costs depended on the model, type.
SDG no. 13 – Climate action	Setting a comprehensive EU wide legal framework that covers design, production and end-of-life treatment of vehicles will reduce the environmental footprint of vehicles throughout their lifecycle, contributing to efforts to mitigate the effects of climate change. The major contribution is expected though the reduced dependence of primary materials and mandatory uptake of recycled content in manufacturing new vehicles. This shift will accelerate the decarbonisation of automotive industry which is one of the biggest contributors to CO ₂ emissions.	The production of vehicles and their components involves energy-intensive processes requiring large amounts of energy, which is often generated from the burning of fossil fuels, leading to GHG emissions. The transportation of components also results in additional emissions. Implementation of the new legislation will result in annual reduction of 12.3 million tons of CO ₂ -eq in 2035. (10.8 million tons in 2030 to 14.0 million tonnes in 2040), key for the decarbonisation of the automotive industry. These CO ₂ savings represent 2.8 billion EUR when monetised.
SDG no. 14 – Life below water	The new legislation is expected to contribute to SDG14 in several ways: Conservation of marine life and ecosystems: SDG14 aims to conserve and sustainably use the oceans, seas and marine resources. The initiative emphasizes the importance of reuse, recovery and recycling of end-of-life vehicles. Clearer requirements for depollution and disposal of end-of-life vehicles, as well as stricter regulations on the export of used cars in working order from the EU to third countries will reduce the risks pollution of water and ecosystems. Resource conservation: the new legislation will help conserve resources by encouraging the reuse and recycling of end-of-life vehicles, increasing the secondary use of spare parts and reducing dependence on raw materials. Increased use of recycled materials and improved quality of ELV processing will address the triggers	Today, the problem of "missing vehicles" leads to illegal dismantling in the EU or illegal export outside the EU. In all cases, the treatment of ELVs and the recovery of materials from these ELVs do not comply with the requirements and cause environmental damage, such as oil spills, improper treatment of refrigerants or improper disposal of hazardous substances. and components for better recycling quality. Successful enforcement of export requirements is expected to prevent 2.1 million unroadworthy (not-roadworthy) vehicles from being not exported from the EU to third countries. In total 65% less low value used vehicles and ELVs will be exported than today. These

	of climate change and its effects on marine life and ecosystems.	initiatives address the problems presented in UNEP report ⁶¹ where a significant part of the used vehicles exported to African countries do not meet Euro 4/IV emissions standard, i.e., they are older than 15 years, and do not have a valid roadworthiness certificate. They present a serious risk of polluting the environment and for road safety.
SDG no. 15 – Life on land	All the measures of the preferred option aiming to collect more ELVs and to improve the treatment conditions will contribute to the protection of biodiversity, ecosystems, water quality. Reduction of air pollution: Old and highly polluting vehicles emit high levels of air pollutants such as nitrogen oxides, particulate matter, and greenhouse gases. By regulating export of such vehicles, the levels of air pollution in non-EU countries will be reduced, protecting the environment and preserving life on land. These measures will also help to protect wildlife and their habitats. This is particularly important in areas where the impact of air pollution on the environment is already significant.	<u>Support for local communities:</u> By reducing the EU's external pollution footprint resulting from the export of poor-driving vehicles, the new rules will help local communities and improve road safety and overall quality lives of people living in the most vulnerable third countries.
SDG no.17 – Partnerships for the goals	The implementation of the measures will promote collaboration between different actors from governments to automotive industry and ELV operators that will contribute to the achievement of common environmental and sustainability objectives. The most intensive cooperation is expected in the implementation of the ERP requirements. This will involve sharing best practices, technology and knowledge, as well as developing new partnerships to support sustainable production and consumption practices in the automotive industry. Accordingly, enforcement of EU export requirements for the used vehicles will boost partnerships both intra- and extra-EU.	For a smooth implementation of EPR requirements, Member States will be required to designate an independent competent authority (“clearinghouse”) to monitor producers' compliance with mandatory requirements for end-of-life treatment of ELVs. It will ensure the dialogue between vehicle manufacturers and ELV operators in the assessment of the compensation of costs related to mandatory treatment operations, e.g. collection, depollution, dismantling and recycling of ELVs.

⁶¹ <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

ANNEX 4: ANALYTICAL METHODS

4.1 Main sources

This impact assessment relies on a multitude of sources, including the evaluation of the ELV Directive, evaluation of the 3RTA Directive (see separate Annex), a literature review, an open public consultation, targeted interviews with a number of stakeholders from Member States, industry and non-governmental organisations, and a two-day stakeholder workshop.

Three studies are particularly carried out to support this impact assessment:

- a comprehensive IA support study by Oeko-Institut⁶², which includes a custom-made impact assessment model for the purpose of this revision,
- a study by the Commission Joint Research Centre (JRC) entitled “*Towards recycled plastic content targets in new passenger cars*”⁶³,
- a JRC study focusing particularly on critical raw materials in vehicles⁶⁴.

This Annex provides information on the analytical methods used to identify and screen the measures described in this impact assessment, as well as for assessing their environmental, social and economic impacts.

In the following sections, the individual tables summarise the main environmental and economic impacts for each of the policy options. The main year of comparison is 2035 and the number of collected ELVs expected to derive in that year from the model calculation. In most cases such calculations are based on all types of ELVs, in specific cases only the relevant share of specific types of EVs (ICE, EV, hybrids and plug-in hybrids) are covered due to different assumptions and relevancies for the different vehicle categories.

For the environmental impacts, net global warming potential and the amounts of materials recovered (in addition) are chosen as the main categories to summarise results. Some of the measures target an improvement in the quality of materials recycled from vehicles and not just an increase in quantity.

The different recycling qualities have a financial significance which is captured in the calculation of revenues from recycled material. Data for other years are available in Annex 8 – Summary of costs and benefits. In the tables below, when referring to monetary impacts, the minus symbol is used when a cost is referred to (a negative monetary impact) and a plus when a revenue is referred to (a positive monetary impact).

⁶² Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

⁶³ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

⁶⁴ N. Tazi, M. Orefice, C. Marmy, Y. Baron, M Ljunggren, P Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821.

4.2 Structuring of measures and options

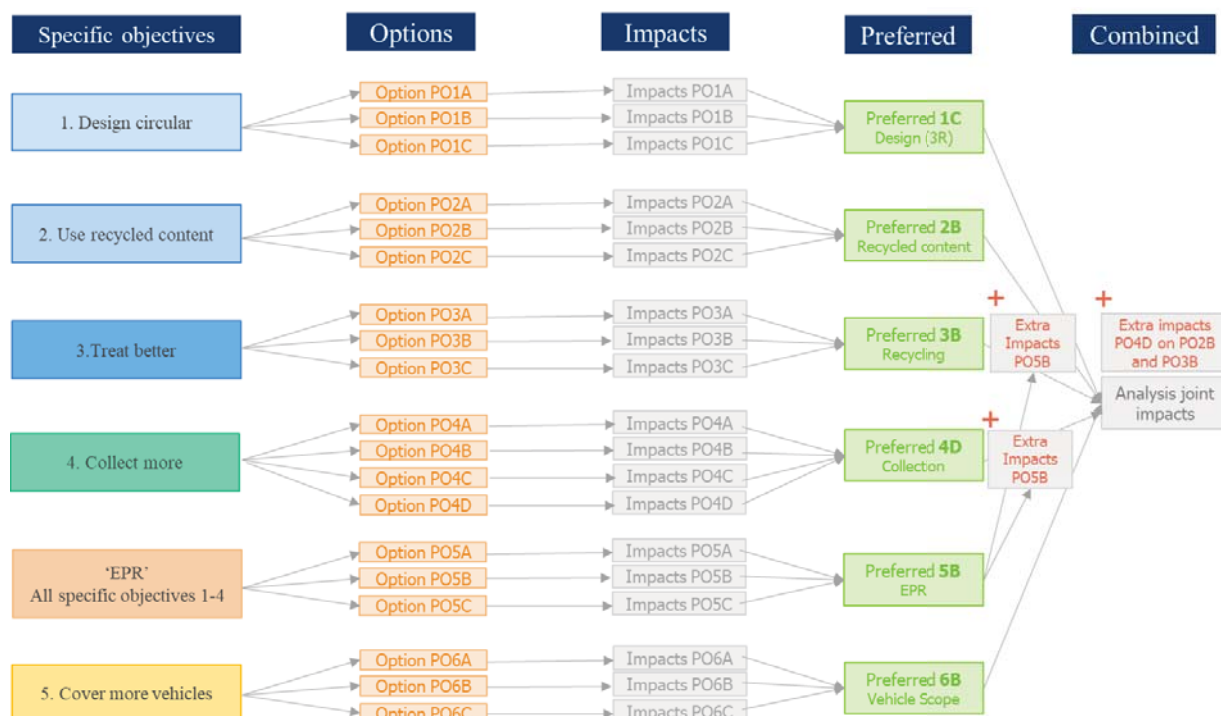
2.3.13. 4.2.1 Identification and screening of measures

In line with the Commission better regulation guidelines⁶⁵, the identification and screening of measures analysed in this impact assessment have been done on the basis of the criteria described below. The application of these criteria to the measures assessed to meet the various objectives of this revision is presented in detail in the IA support study by the Oeko-Institut.

2.3.14. 4.2.2 Structuring of options and impacts calculation order

The Better Regulation Guidance (BRG), tool #16 on the structuring of options is followed.

Figure 4.1 Structuring of options and calculation of joint impacts



While there are links between the 5 specific objectives plus the EPR supporting objectives, they respond to specific problems, have distinct features and denominators, and affect different stakeholders. It has therefore been chosen for this impact assessment to first treat all 5 specific objectives plus the EPR one **as if they are unrelated** (in line with the BRG Tool#16 - Figure 1b approach). For each of these problems, specific objectives and options are developed (in section 5), their impacts assessed (in section 6) and compared (in section 7), and finally the best performing option selected for each problem (section 8.1). However, in view of the links between these problems and options, the preferred package of option also

⁶⁵ Source: Better Regulation toolbox Tool #16, Textbox page 114 – 115

takes into account the synergies between them, especially the amplification effects linked to the additional ELVs collected under PO4 and the incentives provided through the EPR schemes under PO5. These synergies are also calculated when presenting the combination of the overall impact of the preferred package (section 8.2). The collection and EPR options PO4 and PO5 determine the amount of materials available for treatment (PO3) and the recycled amounts for the availability of materials for the recycled content target (PO2). They are therefore computed in that sequence. After selecting the preferred option for EPR, the influence of this on the other preferred options for collection and recycling is first determined individually **as an amplification to the preferred options**. After this step, the joint impacts, in particular the influence of increased collection **that multiplies the effect of improved treatment** are determined as illustrated in above Figure 4.1. Following this logic throughout is selected as the most careful way to prevent ‘circular references’. In all relevant tables, this two-step aggregation of joint impacts is labelled first as ‘preferred – individual’ versus secondly as ‘preferred – combined’.

The preferred package of options therefore takes into consideration the interlinkages between problems and options, is based on a careful balance in that respect and provides the most efficient, effective and consistent solution to all identified problems. The elements contained in section 7 on the comparison of options provide an assessment of each option and allow to perform calculations for a large number of combinations of options, which could be alternative to the preferred package. This impact assessment report does not provide for the assessment of the impacts of such alternative combinations of options, as this would not be proportionate and not required under the Commission better regulation guidelines. However, the information provided in section 7 is sufficiently comprehensive and transparent to allow stakeholders and policy-makers to perform such assessment, for example if they consider than one objective should be given higher importance compared to another one. As indicated above, the preferred package of options takes into consideration the interlinkages between problems and options and is based on a careful balance in that respect, so that alternative choices for a preferred option would not be as effective and efficient as the proposed preferred package.

4.3 Analysis of impacts

The economic, environmental and social impacts of the proposed measures were assessed in line with the better regulation guidelines.

4.3.1 Datasets

The methodology used to assist in the determination of impacts uses both quantitative data and analytical tools.

Data on the current and projected vehicle production and on the number of vehicles becoming ELVs are key in that regard. The initial life cycle stages of resource extraction, material processing and vehicle assembly were aggregated to the common process of ‘vehicle production’. Thus, the mass flows start with the ‘sales’ stage which includes the carbon footprint of the vehicle production (e.g. carbon footprint, x ton of CO₂eq per vehicle; material footprint, such as for example x kg copper per vehicle). The vehicle life cycle ends with recycling and recovery of secondary materials.

The model covers a period up to the year 2035. Results for the fleet of vehicles are available for the years 2020 to 2035. Not extending the modelling period beyond 2035 seems sensible in view of the unpredictable technical possibilities and developments, especially in the development of the vehicle fleet. As a starting point for comparison – mainly for developing, checking and adapting modelled vehicle mass flows – the time series used went back to the year 2009 for all applications except for ICEVs which have been modelled back to 1990. The most recent data from ACEA are available for the reference year 2020. The future perspective is based on data from the Euro 7 impact assessment⁶⁶.

For each individual life cycle stage, the mass flows are differentiated into the relevant engine types of ELVs. The following engine types are addressed in the model: Internal combustion engines (ICEs), battery electric vehicles (BEVs), Hybrid electric vehicles (HEVs) and Plug-in-Hybrid electric vehicles (PHEVs). Passenger cars with other propulsion systems, such as fuel cell vehicles (FCEV), were excluded from this study, as only very few of these vehicles are expected to be in use during the period considered in the scenarios. In the context of this study, natural gas vehicles are treated as ICEs as they are based on the same principles using a different fossil fuel. FCEV are comparable to BEVs since they also contain a battery and an electric motor, resulting in a very roughly comparable resource demand (when excluding the fuel cell itself).

4.3.2 Vehicle composition data

To model the material composition of passenger cars, data from JRC-RMIS⁶⁷ on the composition of passenger cars was used, supplemented by data from the Greet model (Argonne 2021). The percentage composition was calculated down to the average weight of ELVs in the EU according to Eurostat.

Table 4.1 Material composition of End-of-life vehicles (passenger cars) in kg after depollution⁶⁸.

Material	ICEV	HEV	PHEV	EV
Steel	653	660	621	642
Cast Iron	101	101	96	16
Wrought Aluminium	40	58	76	108
Cast Aluminium	79	91	93	77
Copper	14	20	23	35
Magnesium	5	5	5	1
Manganese	8	8	8	7
Glass	24	21	22	26
Average Plastic	159	129	143	166
Rubber	41	34	38	39
Glass-Fibre-Reinforced Plastic	9	4	5	5
Others	5	6	7	14

⁶⁶ Aeris Europe: Euro 7 Impact Assessment: The outlook for air quality compliance in the EU and the role of the road transport sector. 2021. Online available under <https://aeriseurope.com/papers-and-articles/euro-7-impact-assessment-the-outlook-for-air-quality-compliance-in-the-eu-and-the-role-of-the-road-transport-sector/>

⁶⁷ <https://rmis.jrc.ec.europa.eu/apps/veh/#/p/viewer>

⁶⁸ Source: Calculated with data from JRC-RMIS and Argonne 2021 and average weight according to Eurostat

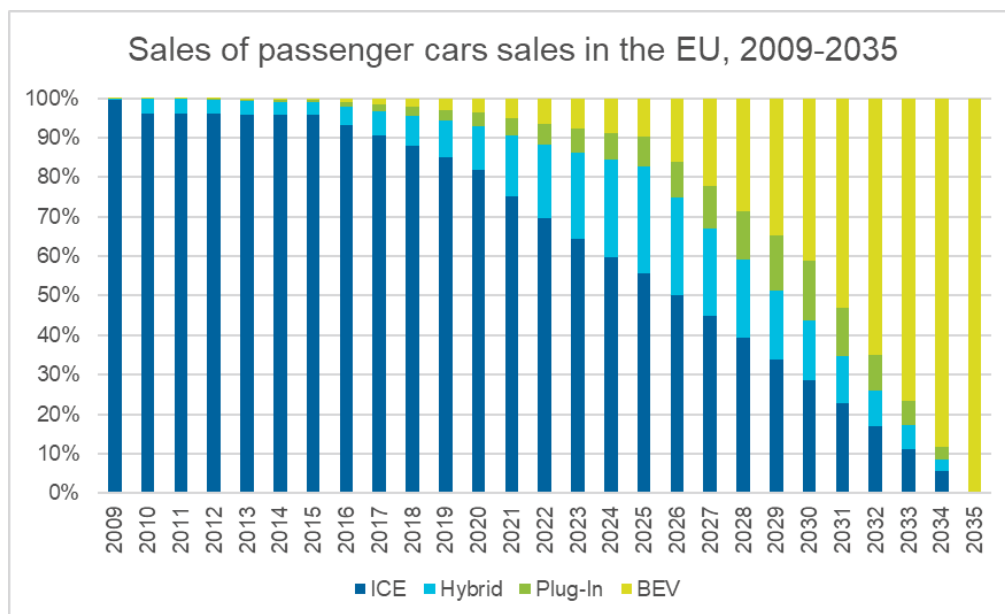
Total	1,137	1,137	1,137	1,137

The model delivers mass flows based on the development of different types of vehicles. It includes passenger cars with a variety of different propulsion types (internal combustion engine (ICE), hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV) and battery electric vehicles (BEV). Furthermore, the model also includes light commercial vehicles, heavy commercial vehicles and buses. The fleet model for all vehicles is based on the model used for the Euro 7 impact assessment⁶⁹. The data were supplemented by additional information from other sources. The overall development has been cross-checked with scenarios used by the JRC.

4.3.3 Number and types of vehicles entering and leaving the fleet

The table below shows the sales of passenger cars in the EU split by propulsion types according to statistical data from ACEA and the predicted forecast according to Euro 7 impact assessment.

Figure 4.2 Sales of passenger cars in the EU (2009-2035)⁷⁰



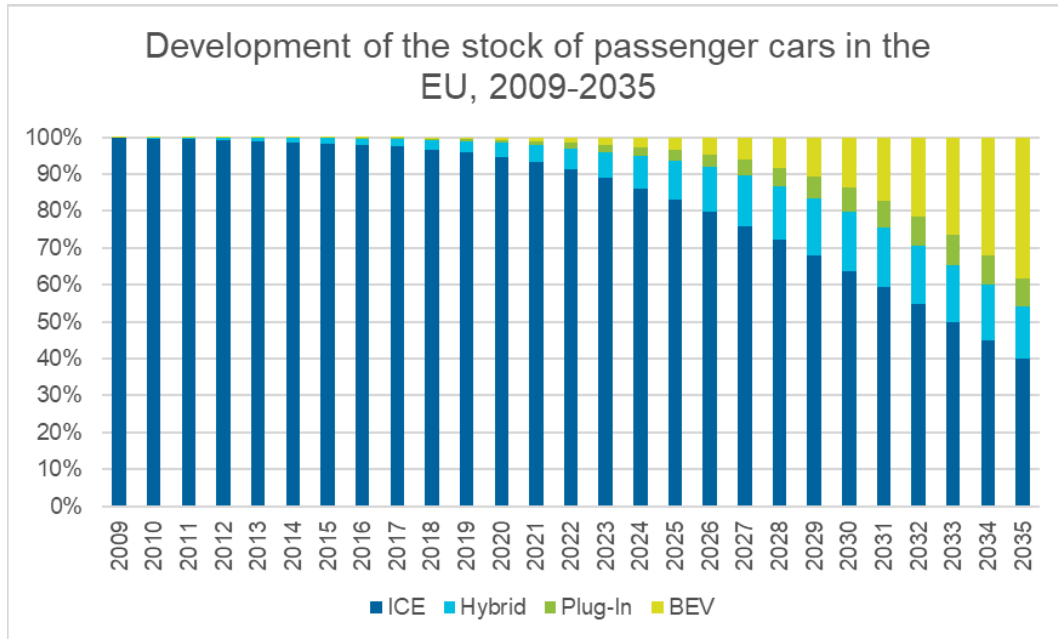
Since this only covers the fraction of newly registered vehicles, the vehicle stock had to be modelled. To cover the accurate number of vehicles in the stock, the model takes into account all registrations dating back to 1990 based on ACEA data (ACEA 2009-2019, OICA 2020).

The figure below shows the development of the stock of passenger cars in the EU split by propulsion types.

⁶⁹ Aeris Europe: Euro 7 Impact Assessment: The outlook for air quality compliance in the EU and the role of the road transport sector. 2021. Online available under <https://aeriseurope.com/papers-and-articles/euro-7-impact-assessment-the-outlook-for-air-quality-compliance-in-the-eu-and-the-role-of-the-road-transport-sector/>

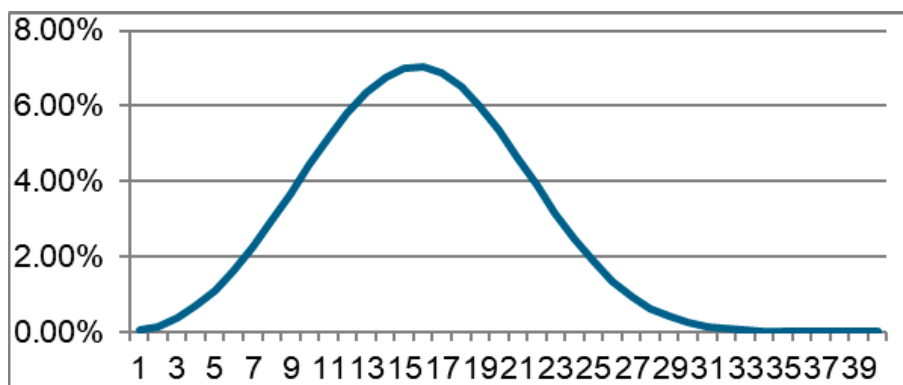
⁷⁰ Source: Own calculation on the basis of data from Aeris Europe 2021 and ACEA 2021

Figure 4.3 Development of the stock of passenger cars in the EU⁷¹



In order to determine the volumes of ELVs, it is necessary to estimate the duration of the use phase of the vehicles. To describe the probability of a vehicle reaching its end-of-life, a Weibull distribution has been used. Since no long-term data on the lifetimes of EVs are currently available, estimates based on literature, interviews with the automotive industry and own expert judgement have been used to determine reasonable assumptions for the lifetime of EVs (Ricardo 2015, Møller Andersen 2008, Buchert et al. 2017, Buchert et al 2019, Mehlhart et al. 2017). The figure below depicts the curve used for ICEs, EVs, PHEVs and HEVs. The distribution shows the probability of the number of years after which a newly registered vehicle reaches its end of life. Accordingly, e.g. 14% of all vehicles that have been registered 15 years ago will reach the EoL.

Figure 4.4 EoL Weibull distribution for vehicles⁷²



⁷¹ Source: Own calculation on the basis of data from Aeris Europe 2021 and ACEA 2021

⁷² Source: Own representation

The model calculates the volumes of ELVs for each year based on the lifetime distribution shown above. This represents the total volume of ELVs available for collection. The total volume available for recycling in the case of ELVs is reduced due to some losses. There are two main types of losses. Firstly, export losses and secondly, unknown whereabouts.

In the assessment report of the ELV directive, Mehlhart et al. (2017) pointed out that in 2014 app. 12 million vehicles were estimated to become ELVs in the EU, 51% of which were reported. App. 10 % of the used vehicles were exported (outside the EU) and 39 % had unknown whereabouts. It is assumed that half of the unknown were exported to non-Community countries and half were dismantled within the EU without reporting. This assumption leads to an estimated export rate of 35 % which has been used for the baseline for HEVs and PHEVs since these vehicles are similar to ICEVs. BEVs, on the other hand, are expected to be exported to a lesser extent, since they require a charging infrastructure which is not available in all countries outside the EU. Hence, the export rate applied for used BEVs is 10 %. The figure below shows the development of ELVs available for recycling in the EU split by propulsion types.

Figure 4.5 Development of ELVs available for recycling in the EU⁷³

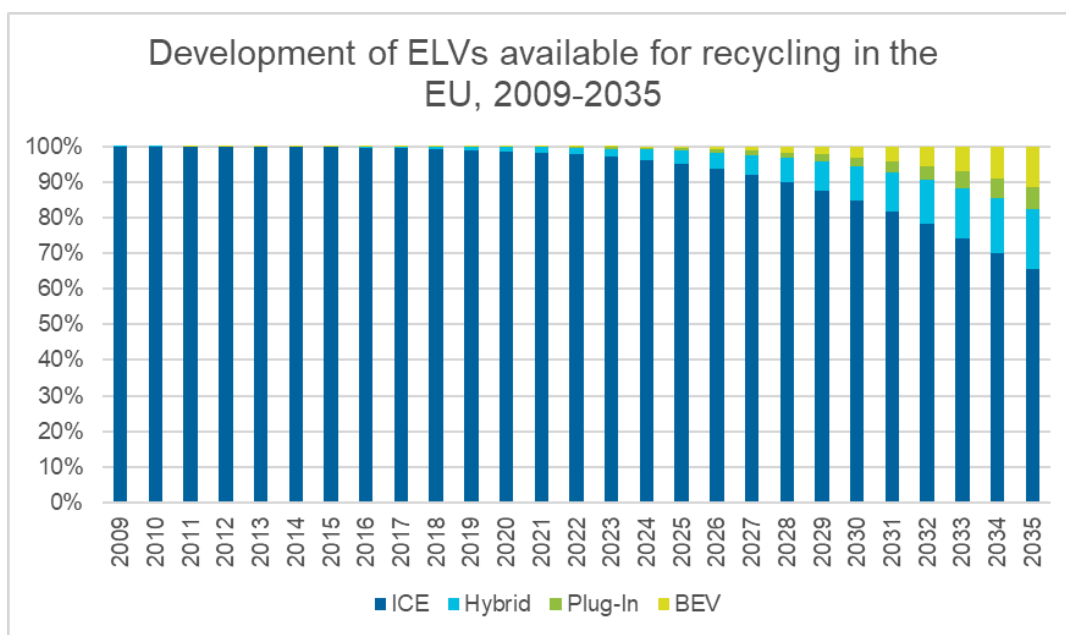


Table 4.2 ELVs available for treatment (PTW, lorries, buses, trailers)

Category	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
L	1,336,572	1,362,667	1,388,348	1,413,449	1,437,763	1,461,075	1,483,176	1,503,903	1,523,145	1,540,863	1,557,104
M2,M3	28,061	28,449	28,822	29,182	29,527	29,859	30,177	30,483	30,780	31,070	31,359
N2,N3	212,025	216,992	222,048	227,193	232,418	237,708	243,023	248,291	253,441	258,410	263,158
O	1,007,722	1,039,377	1,072,220	1,106,517	1,142,498	1,180,362	1,220,275	1,262,369	1,306,737	1,353,423	1,402,422

⁷³ Own calculation on the basis of data from Aeris Europe 2021 and ACEA 2021

Source: Calculated as M1 and N1 ELVs based on stock data from the PRIMES model for lorries and buses, calculated based on Eurostat and linear forecast according to development from 2015-2019 for trailers; calculated based on Eurostat using the trend in the EU Reference Scenario for PTW.

These numbers build the baseline for the analysis of the impacts for the policy options on scope extension. For L-category vehicles it is assumed that a) the major share is already currently taken back by dealers and then either sent to shredders or to dismantlers for further treatment, and b) the major share is not subject to exports at their EoL, i.e. there are no additional vehicles being treated at ATFs. For lorries and buses it is assumed that a) the majority of the above numbers is already treated in ATFs and b) they are subject to exports, i.e. only the share of EoL lorries and buses which will not get a roadworthiness certificate for export anymore will be new / in addition be treated at ATFs under policy option PO6.

The following methodology was applied to assess the share of vehicles which might not pass the future requirement of a valid roadworthiness certificate under PO6B:

The vehicle categories 870422, 870423, 870432, 871639xx and 8702 were assessed at the level of the 8-digit CN-codes with the following approach (for more details, see Oeko-Institut Impact Assessment support study⁷⁴):

1. Identification of the average value of the intra EU trade with new vehicles per CN code.
2. Definition of a function on the share of non-eligible vehicles, depending on the distance to the average value of a new vehicle as displayed in the Figure 2 1.
3. Calculation of the number of non-exportable vehicles with the above function.
4. Estimation for the economic impact.

4.3.4 Recycling

Since the model includes detailed information related to material compositions of the different vehicles, it allows for the estimation of recycling potentials. The recycling of the end-of-life vehicles is modelled in different steps: depollution, dismantling, shredding, post-shredder technologies (PST) and material specific recycling processes. The steps of depollution, dismantling and shredding were modelled using data from Sander et al. (2020). The PST was calculated using data from JRC. The following table shows the efficiency rates for different materials that have been used in the model. In the second column ('Recycling rate (ASR + PST)') recovery rates from shredder (ASR) and post shredder treatment (PST) from literature and interviews are given for different materials. In the third column ('Recycling rate (specific process)') recovery rates for the materials specific recycling processes are given, e. g. the recovery rate for steel recycling in an electric arc furnace. The percentages refer to the input that goes into the shredding process and the specific recycling process, respectively, not to the original composition of the ELVs. The efficiency rates here only include those quantities that were recovered as material, not of those quantities where, for example, glass was used for backfilling or aluminium was used as a reducing agent in steel recycling.

Table 4.3 Efficiency rates for different materials in ASP + PST and specific recycling processes⁷⁵

⁷⁴ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

Material	Efficiency rates (ASR + PST)	Efficiency rates (specific process)
Steel	99%	88.0%
Cast Iron	99%	88.0%
Wrought Aluminium	85%	94.5%
Cast Aluminium	85%	94.5%
Copper	85%	76.3%
Glass	0%	99.5%
Average Plastics	24%	95.0%
PP	40%	95.0%
PUR	0%	95.0%
Nylon	0%	95.0%
PE	40%	95.0%
ABS	37%	95.0%
PET	0%	95.0%

In the case of reused parts, an environmental credit is calculated based on the environmental burdens of primary production of the corresponding material.

4.3.5 Data and scenarios for the whereabouts of (used) vehicles

To assess the impacts of the diverse measures addressing the aspect of “missing vehicles” the IA support study of Oeko-Institut distinguishes different categories of whereabouts as follows:

- A. ELVs directed to ATFs and subsequently to shredders and reported by ATFs and MS (ATF, reported)
- B. ELVs directed to ATFs and subsequently to shredders but not reported (ATFs, not reported)
- C. ELVs directed to non-ATFs and subsequently to shredders, not reported (non-ATF)
- D. Used Vehicles exported (extra EU) and reported accordingly (Export, reported)
- E. Used Vehicles exported (extra EU) but not reported (Export, not reported)
- F. ELVs exported (extra EU), not reported (ELVs export, not reported)
- G. Missing vehicles = B) + C) + E) + F)

The following table displays the assumptions for the current situation (last data available for 2019) and the assumptions for the scenarios.

The total ELVs arising in Column 4 are taken from the sales of passenger cars in the EU (2009-2035)⁷⁵ and the EoL Weibull distribution for vehicles both displayed above. The 7 columns to the right of the table display the changes (shift) in % points compared to the percentage points for the current situation.

The environmental impacts are calculated with the data displayed for the material composition of the different types of vehicles and the environmental impacts and in the subsequent section.

⁷⁵ Recycling rates ASR: own estimations according to data from Sander et al. 2020; PST: JRC 2021; Recycling efficiency rates of the specific recycling process according to ecoinvent 3.8

⁷⁶ Source: Own calculation on the basis of data from Aeris Europe 2021 and ACEA 2021

Table 4.4 Vehicle fleet data, options refer to Impact Assessment study⁷⁷

	Year		total ELV arising	A) ATF, reported	B) ATFs, not reported	C) non-ATF	D) Export, reported	E) Export, not reported	F) ELVs export, not reported	missing vehicles	check	A	B	C	D	E	F	M
Data + assumptions regards the share for different reasons for "missing vehicles"	2019	10 ⁶ (EL) Vs	10.50	6.1	0.9	0.9	1.0	0.9	0.9	3.4	10.5	58.1%	25.0%	25.0%	9.5%	25.0%	25.0%	32.4%
			100%	58.1%	8.1%	8.1%	9.5%	8.1%	8.1%	32.4%	100.0%							
Shift in percentage points																		
Baseline change of domestically collected & reported ELVs by ATFs	2025	10 ⁶ (EL) Vs	12.39	7.2	1.0	1.0	1.2	1.0	1.0	3.9	12.4							
				58.5%	7.9%	7.9%	9.9%	7.9%	7.9%	31.6%	100.0%	0.4%	-0.2%	-0.2%	0.4%	-0.2%	-0.2%	-0.8%
	2030	10 ⁶ (EL) Vs	12.41	7.3	1.0	1.0	1.3	0.9	0.9	3.8	12.4							
				59.2%	7.8%	7.8%	10.1%	7.5%	7.5%	30.7%	100.0%	1.1%	-0.3%	-0.3%	0.6%	-0.6%	-0.6%	-1.7%
	2035	10 ⁶ (EL) Vs	12.85	7.6	1.0	1.0	1.3	1.0	1.0	3.9	12.8							
				59.4%	7.7%	7.7%	10.2%	7.4%	7.4%	30.4%	100.0%	1.3%	-0.4%	-0.4%	0.7%	-0.7%	-0.7%	-2.0%
	2040	10 ⁶ (EL) Vs	13.77	8.2	1.1	1.1	1.4	1.0	1.0	4.1	13.8							
				59.6%	7.7%	7.7%	10.3%	7.3%	7.3%	30.1%	100.0%	1.5%	-0.4%	-0.4%	0.8%	-0.8%	-0.8%	-2.3%
Policy Option 3A	2025	10 ⁶ ELVs	12.4	7.3	1.0	1.0	1.2	1.0	0.9	3.8	12.4							
				59.1%	7.8%	7.8%	10.0%	7.8%	7.3%	30.9%	100.0%	1.0%	-0.3%	-0.3%	0.5%	-0.3%	-0.8%	-1.5%
	2030	10 ⁶ ELVs	12.4	7.5	0.9	0.9	1.3	0.9	0.8	3.6	12.4							
				60.1%	7.6%	7.6%	10.5%	7.6%	6.6%	29.4%	100.0%	2.0%	-0.5%	-0.5%	1.0%	-0.5%	-1.5%	-3.0%
	2035	10 ⁶ ELVs	12.8	7.8	0.9	0.9	1.4	0.9	0.8	3.6	12.8							
				61.1%	7.3%	7.3%	11.0%	7.3%	5.8%	27.9%	100.0%	3.0%	-0.8%	-0.8%	1.5%	-0.8%	-2.3%	-4.5%
	2040	10 ⁶ ELVs	13.8	8.7	0.9	0.9	1.6	0.9	0.6	3.5	13.8							
				62.9%	6.9%	6.9%	11.9%	6.9%	4.5%	25.2%	100.0%	4.8%	-1.2%	-1.2%	2.4%	-1.2%	-3.6%	-7.2%
Policy Option 3B	2025	10 ⁶ ELVs	12.4	7.5	0.9	0.9	1.2	0.9	0.9	3.6	12.4							
				60.6%	7.6%	7.6%	10.0%	7.1%	7.1%	29.4%	100.0%	2.5%	-0.5%	-0.5%	0.5%	-1.0%	-1.0%	-3.0%
	2030	10 ⁶ ELVs	12.4	7.8	0.9	0.9	1.3	0.8	0.8	3.3	12.4							
				63.1%	7.1%	7.1%	10.5%	6.1%	6.1%	26.4%	100.0%	5.0%	-1.0%	-1.0%	1.0%	-2.0%	-2.0%	-6.0%
	2035	10 ⁶ ELVs	12.8	8.4	0.8	0.8	1.4	0.7	0.7	3.0	12.8							
				65.6%	6.6%	6.6%	11.0%	5.1%	5.1%	23.4%	100.0%	7.5%	-1.5%	-1.5%	1.5%	-3.0%	-3.0%	-9.0%
	2040	10 ⁶ ELVs	13.8	9.4	0.8	0.8	1.6	0.6	0.6	2.8	13.8							
				68.1%	6.1%	6.1%	11.5%	4.1%	4.1%	20.4%	100.0%	10.0%	-2.0%	-2.0%	2.0%	-4.0%	-4.0%	-12.0%
Policy Option 3C	2025	10 ⁶ ELVs	12.4	6.7	0.5	0.5	1.8	1.4	1.4	3.9	12.4							
				54.1%	4.1%	4.1%	14.5%	11.6%	11.6%	31.4%	100.0%	-4.0%	-4.0%	-4.0%	5.0%	3.5%	3.5%	-1.0%
	2030	10 ⁶ ELVs	12.4	8.3	0.9	0.9	1.2	0.6	0.6	2.9	12.4							
				67.1%	7.1%	7.1%	9.5%	4.6%	4.6%	23.4%	100.0%	9.0%	-1.0%	-1.0%	0.0%	-3.5%	-3.5%	-9.0%
	2035	10 ⁶ ELVs	12.8	9.0	0.8	0.8	1.1	0.5	0.5	2.7	12.8							
				70.1%	6.6%	6.6%	8.5%	4.1%	4.1%	21.4%	100.0%	12.0%	-1.5%	-1.5%	-1.0%	-4.0%	-4.0%	-11.0%
	2040	10 ⁶ ELVs	13.8	9.9	0.9	0.9	1.0	0.5	0.5	2.8	13.8							
				72.1%	6.6%	6.6%	7.5%	3.6%	3.6%	20.4%	100.0%	14.0%	-1.5%	-1.5%	-2.0%	-4.5%	-4.5%	-12.0%

⁷⁷ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

	Year		total ELV arising	A) ATF, reported	B) ATFs, not reported	C) non-ATF	D) Export, reported	E) Export, not reported	F) ELVs export, not reported	missing vehicles	check	A	B	C	D	E	F	M
Data + assumptions regards the share for different reasons for "missing vehicles"	2019	10 ⁶ (EL)Vs	10.50	6.1	0.9	0.9	1.0	0.9	0.9	3.4	10.5	58.1%	25.0%	25.0%	9.5%	25.0%	25.0%	32.4%
			100%	58.1%	8.1%	8.1%	9.5%	8.1%	8.1%	32.4%	100.0%							
Shift in percentage points																		
Preferred Policy Option	2025	10 ⁶ ELVs	12.4	6.8	0.6	0.3	2.0	1.3	1.3	3.5	12.4							
				55.1%	5.1%	2.1%	16.5%	10.8%	10.3%	28.4%	100.0%	-3.0%	-3.0%	-6.0%	7.0%	2.8%	2.3%	-4.0%
	2030	10 ⁶ ELVs	12.4	9.6	0.5	0.5	0.8	0.6	0.4	2.0	12.4							
				77.1%	4.1%	4.1%	6.5%	4.6%	3.6%	16.4%	100.0%	19.0%	-4.0%	-4.0%	-3.0%	-3.5%	-4.5%	-16.0%
	2035	10 ⁶ ELVs	12.8	10.5	0.4	0.4	0.7	0.5	0.3	1.6	12.8							
				82.1%	3.1%	3.1%	5.5%	3.6%	2.6%	12.4%	100.0%	24.0%	-5.0%	-5.0%	-4.0%	-4.5%	-5.5%	-20.0%
	2040	10 ⁶ ELVs	13.8	11.7	0.3	0.3	0.9	0.4	0.2	1.2	13.8							
				85.1%	2.1%	2.1%	6.5%	2.6%	1.6%	8.4%	100.0%	27.0%	-6.0%	-6.0%	-3.0%	-5.5%	-6.5%	-24.0%
additional effects from the combination with EPR elements	2025	10 ⁶ ELVs	12.4	7.1	0.8	0.3	2.0	1.1	1.0	3.3	12.4							
				57.6%	6.6%	2.6%	16.0%	8.8%	8.3%	26.4%	100.0%	-0.5%	-1.5%	-5.5%	6.5%	0.8%	0.3%	-6.0%
	2030	10 ⁶ ELVs	12.4	9.8	0.7	0.6	0.8	0.3	0.2	1.8	12.4							
				79.1%	5.6%	4.6%	6.5%	2.6%	1.6%	14.4%	100.0%	21.0%	-2.5%	-3.5%	-3.0%	-5.5%	-6.5%	-18.0%
	2035	10 ⁶ ELVs	12.8	10.9	0.5	0.4	0.6	0.3	0.2	1.3	12.8							
				84.6%	3.8%	2.8%	5.0%	2.1%	1.6%	10.4%	100.0%	26.5%	-4.3%	-5.3%	-4.5%	-6.0%	-6.5%	-22.0%
	2040	10 ⁶ ELVs	13.8	12.1	0.3	0.2	0.8	0.2	0.2	0.9	13.8							
				88.1%	2.3%	1.3%	5.5%	1.6%	1.1%	6.4%	100.0%	30.0%	-5.8%	-6.8%	-4.0%	-6.5%	-7.0%	-26.0%

4.3.6 Scope extension

The methodology for the scope extension is described in a dedicated Annex to the IA support study by Oeko-Institut.

4.4 Modelling environmental impacts

The environmental assessment is based on a life cycle approach. The entire life cycle of vehicles is taken into account: from the extraction of primary resources and energy sources, the production of the vehicles to the recycling processes of the ELVs and disposal of materials at the end of the life cycle.

A full range of impacts and thus a relevant share of the results of the policy options are directly linked and proportional to the mass flows. This applies especially to environmental impacts. Some economic data are as well directly linked to mass flows depending on the policy options that are selected for assessment.

The main environmental impact category that is given as a default by the model is the global warming potential (GWP in t CO₂eq) (CO₂-equivalents = CO₂eq).

A further 10 environmental impact categories can be called up via the model, including e.g. acidification potential, ozone layer depletion, photochemical oxidation or eutrophication. These impacts are linked to individual life cycle stages of the mass flows. Other life cycle stages with relevant environmental impacts are ‘recycling’ and a comparison of the production of primary and secondary materials (e.g. steel, aluminium, copper, plastics and glass).

LCA studies and LCA databases are the source for the calculation of the environmental impacts.

4.4.1 LCA data

The calculation of the environmental impacts of ELVs takes into account different life cycle stages, including upstream processes. Results are generated according to different environmental impact categories. The calculation presented in this study is based on the ecoinvent database (ecoinvent 3.8)⁷⁸, the “openLCA” (openLCA 2022) LCA tool⁷⁹ and further literature data. The quantification of environmental impacts of ELVs focuses on material production (incl. upstream processes such as mining and further processing, regardless of whether inside or outside the EU) and the recycling of the end-of-life vehicles.

The following sections describe the applied methodology and main assumptions used for quantifying the environmental impacts of vehicles. Although much literature is available addressing the environmental impacts of ELVs, its usability for the present calculation is limited for various reasons, including:

- the level of detail is not sufficient to extract relevant data;
- different functional units are applied;

⁷⁸ ecoinvent database, version 3.8, released on 21st September 2021, Online available on <https://ecoinvent.org/>, Last check on 10 February 2023

⁷⁹ Online available on <https://www.openlca.org/>, Last check on 10 February 2023

- relevant input factors are not compatible to the scope of the present calculation; and/or
- results are given in aggregated parameters instead of individual impact categories.

A full range of environmental impacts is directly linked to the mass flows in the model. The total environmental impacts are proportional to the mass flows and are calculated via the model for the different policy options. The main environmental impact category that was evaluated via the model and addressed in the report is climate change (global warming potential GWP in kg CO₂-eq.).

4.4.2 *Environmental impact categories*

A further 10 environmental impact categories can be called up via the model:

- Abiotic depletion potential of mineralic resources (ADP_{elem.} in kg Sb eq.)
- Abiotic depletion of fossil fuels (ADP in MJ)
- Acidification (AP in kg SO₂ eq.)
- Eutrophication potential (EP in kg PO₄---eq.)
- Fresh water aquatic ecotoxicity (FAET in kg 1,4-DB eq.)
- Human toxicity (in kg 1,4-DB eq.)
- Marine aquatic ecotoxicity (MAET in kg 1,4-DB eq.)
- Ozone layer depletion potential (ODP in kg CFC-11 eq.)
- Photochemical oxidation (POCP in kg C₂H₄ eq.)
- Terrestrial ecotoxicity (TET in kg 1,4-DB eq.)

The primary production of vehicles was calculated from the material composition of the vehicles with data for the primary production of these materials and the energy and material demand for the manufacturing of the vehicles.

The recycling was calculated from the energy and material demand for the recycling process and the refining of the recovered materials. Credits for the recovered materials were given for the avoided primary production.

The data for the primary production and the recycling was taken from the LCA database ecoinvent 3.8 and specific LCA studies and supplemented by information from the stakeholder surveys.

Detailed results of the calculations are presented for selected impact categories in the tables below.

Table 4.5 LCA data: Primary production of materials I⁸⁰

Impact category	Unit	Steel	Stainless Steel	Cast Iron	Wrought aluminium	Cast aluminium	Copper	Glass	Rubber	Carbon Fiber-Reinforced Plastic	Glass Fiber-Reinforced Plastic	PTFE	Silicon
Abiotic depletion	kg Sb eq	3.4E-05	1.6E-04	5.9E-06	1.9E-05	1.9E-05	2.4E-03	8.3E-06	4.9E-05	2.2E-04	3.5E-05	2.3E-04	2.5E-05
Abiotic depletion (fossil fuels)	MJ	1.9E+01	4.6E+01	1.8E+01	1.8E+02	1.8E+02	6.8E+01	1.0E+01	7.4E+01	8.9E+02	5.8E+01	1.3E+02	4.5E+01
Acidification	kg SO2 eq	7.3E-03	2.4E-02	6.3E-03	1.1E-01	1.1E-01	1.0E-01	8.4E-03	1.3E-02	4.0E-01	1.8E-02	5.5E-02	1.2E-02
Eutrophication	kg PO4--- eq	3.8E-03	7.6E-03	2.7E-03	2.7E-02	2.7E-02	3.8E-01	1.1E-03	3.8E-03	1.2E-01	5.7E-03	1.4E-02	4.0E-03
Fresh water aquatic ecotox.	kg 1,4-DB eq	6.0E+00	1.5E+01	1.4E+00	1.4E+01	1.4E+01	7.7E+02	2.5E-01	1.3E+00	3.6E+01	1.5E+00	7.8E+00	1.7E+00
Global warming (GWP100a)	kg CO2 eq	2.1E+00	4.4E+00	1.8E+00	1.9E+01	1.9E+01	6.5E+00	9.7E-01	2.7E+00	8.3E+01	3.9E+00	1.3E+02	2.9E+00
Human toxicity	kg 1,4-DB eq	3.2E+00	7.7E+01	1.6E+00	1.2E+01	1.2E+01	1.2E+03	3.7E-01	1.8E+00	3.2E+01	4.7E+00	3.0E+01	1.6E+00
Marine aquatic ecotoxicity	kg 1,4-DB eq	7.0E+03	1.7E+04	2.7E+03	5.6E+04	5.6E+04	8.7E+05	1.4E+03	2.9E+03	1.1E+05	4.4E+03	2.6E+05	7.4E+03
Ozone layer depletion (ODP)	kg CFC-11 eq	9.2E-08	1.9E-07	8.7E-08	5.8E-07	5.8E-07	4.0E-07	9.3E-08	5.3E-07	2.0E-06	3.5E-07	4.3E-03	1.9E-06
Photochemical oxidation	kg C2H4 eq	9.5E-04	1.1E-03	8.1E-04	6.7E-03	6.7E-03	2.0E-03	2.7E-04	7.0E-04	1.8E-02	1.1E-03	4.4E-03	7.1E-04
Terrestrial ecotoxicity	kg 1,4-DB eq	2.3E-03	7.5E-02	6.6E-02	3.5E-02	3.5E-02	1.5E-01	6.6E-04	3.8E-03	2.5E-01	5.6E-03	2.0E-02	5.1E-03

Table 4.6 LCA data: Primary production of materials II

Impact category	Unit	ABS	Liquid Epoxy	GPPS	HIPS	HDPE	LDPE	LLDPE	Nylon 6	Nylon 66	PC	PET	PP
Abiotic depletion	kg Sb eq	2.8E-06	5.5E-05	4.4E-07	4.4E-07	1.4E-05	1.4E-05	1.5E-05	6.5E-05	3.0E-06	1.7E-06	3.7E-05	1.4E-05
Abiotic depletion (fossil fuels)	MJ	8.7E+01	8.0E+01	7.8E+01	7.8E+01	7.1E+01	7.3E+01	7.0E+01	1.0E+02	1.1E+02	9.2E+01	6.8E+01	7.3E+01
Acidification	kg SO2 eq	1.3E-02	1.7E-02	1.1E-02	1.2E-02	7.8E-03	8.7E-03	7.5E-03	3.0E-02	2.9E-02	2.5E-02	1.1E-02	7.6E-03
Eutrophication	kg PO4- eq	2.2E-03	6.9E-03	9.4E-04	9.9E-04	2.0E-03	2.6E-03	2.0E-03	6.8E-03	7.7E-03	2.5E-03	3.1E-03	1.9E-03
Fresh water aquatic ecotox.	kg 1,4-DB eq	4.7E-01	3.6E+00	6.8E-01	6.7E-01	6.3E-01	7.5E-01	6.4E-01	3.0E-01	2.5E-01	2.2E-01	1.2E+00	6.1E-01
Global warming (GWP100a)	kg CO2 eq	4.5E+00	4.6E+00	3.6E+00	3.6E+00	2.3E+00	2.5E+00	2.2E+00	9.1E+00	8.1E+00	8.1E+00	3.1E+00	2.3E+00
Human toxicity	kg 1,4-DB eq	4.1E-01	8.0E+00	3.5E-01	3.8E-01	8.4E-01	9.4E-01	9.8E-01	4.6E-01	4.2E-01	4.2E-01	2.1E+00	7.9E-01
Marine aquatic ecotoxicity	kg 1,4-DB eq	1.6E+03	4.7E+03	3.7E+03	3.6E+03	1.5E+03	1.9E+03	1.4E+03	1.4E+03	1.1E+03	9.0E+02	2.7E+03	1.4E+03
Ozone layer depletion (ODP)	kg CFC-11 eq	7.5E-08	6.5E-07	2.9E-09	3.4E-09	5.2E-08	4.7E-08	6.0E-08	1.2E-08	7.4E-09	1.7E-08	1.0E-05	3.9E-08
Photochemical oxidation	kg C2H4 eq	7.5E-04	2.3E-03	7.5E-04	7.3E-04	6.8E-04	1.4E-03	5.6E-04	1.4E-03	1.4E-03	1.4E-03	6.8E-04	4.4E-04
Terrestrial ecotoxicity	kg 1,4-DB eq	1.3E-03	6.4E-03	5.4E-04	6.7E-04	1.5E-03	2.1E-03	1.5E-03	9.6E-04	7.0E-04	2.7E-02	4.0E-03	1.3E-03

Table 4.7 LCA data: Primary production of materials III

Impact category	Unit	PUR Flexible Foam	PUR Rigid Foam	PVC	Zinc	Magnesium	Nickel	Platinum	Gold	Silver	Tin	Brass	Palladium
Abiotic depletion	kg Sb eq	1.4E-05	6.8E-05	3.7E-05	1.5E-03	5.2E-05	2.2E-03	3.6E+00	6.1E+01	8.5E-01	2.7E-02	9.4E-03	8.9E-01
Abiotic depletion (fossil fuels)	MJ	8.2E+01	9.8E+01	5.0E+01	3.1E+01	1.1E+03	2.3E+02	1.0E+06	5.7E+05	5.8E+03	1.2E+02	8.0E+01	1.9E+05
Acidification	kg SO2 eq	2.2E-02	2.6E-02	8.9E-03	2.2E-02	2.3E-01	1.8E+00	4.1E+03	3.8E+02	4.9E+00	9.8E-02	3.4E-01	2.0E+03
Eutrophication	kg PO4- eq	5.5E-03	1.1E-02	3.2E-03	1.3E-02	1.6E-01	6.4E-02	4.5E+02	5.8E+02	4.8E+00	9.1E-02	1.1E-01	6.9E+01
Fresh water aquatic ecotox.	kg 1,4-DB eq	1.5E+00	3.0E+00	1.3E+00	1.2E+01	2.9E+01	1.6E+02	2.8E+05	7.5E+05	5.6E+03	8.1E+01	1.9E+02	5.0E+04
Global warming (GWP100a)	kg CO2 eq	5.2E+00	5.0E+00	2.4E+00	2.7E+00	4.5E+01	1.8E+01	6.9E+04	4.9E+04	5.0E+02	1.0E+01	6.6E+00	1.3E+04
Human toxicity	kg 1,4-DB eq	9.7E-01	4.2E+00	1.8E+00	1.1E+01	8.3E+01	1.2E+02	2.3E+05	6.7E+05	4.9E+03	6.8E+01	3.4E+02	3.9E+04
Marine aquatic ecotoxicity	kg 1,4-DB eq	6.6E+03	7.1E+03	2.8E+03	3.6E+04	6.6E+04	1.5E+05	3.9E+08	1.2E+09	7.3E+06	9.2E+04	2.3E+05	6.6E+07
Ozone layer depletion (ODP)	kg CFC-11 eq	2.6E-08	8.2E-07	1.1E-06	1.7E-07	5.9E-06	1.7E-06	3.3E-03	2.9E-03	5.2E-05	5.8E-07	9.8E-07	3.0E-03
Photochemical oxidation	kg C2H4 eq	1.0E-03	4.9E-03	5.0E-04	7.1E-04	3.4E-02	8.5E-02	1.4E+02	1.2E+01	1.6E-01	2.9E-03	1.3E-02	7.9E+01
Terrestrial ecotoxicity	kg 1,4-DB eq	5.5E-03	1.4E-02	3.8E-03	1.8E-02	4.1E-02	3.1E-01	2.5E+02	9.7E+02	3.8E+00	7.4E-02	2.2E-01	4.6E+01

Table 4.8 LCA data: Secondary production of materials

Impact category	Unit	Steel	Aluminium wrought alloy	Aluminium cast alloy	Glass	HDPE	PET	Platinum
Abiotic depletion	kg Sb eq	1.1E-05	1.9E-04	7.5E-05	4.2E-08	7.0E-06	6.1E-06	7.2E-01
Abiotic depletion (fossil fuels)	MJ	6.6E+00	3.6E+01	6.4E+01	1.6E-01	4.7E+00	8.0E+00	2.0E+05
Acidification	kg SO2 eq	2.6E-03	1.6E-02	3.0E-02	3.5E-05	1.9E-03	2.5E-03	1.5E+02
Eutrophication	kg PO4--- eq	1.6E-03	7.2E-03	8.4E-03	5.8E-05	4.1E-03	2.3E-03	4.1E+01
Fresh water aquatic ecotox.	kg 1,4-DB eq	1.9E+00	5.0E+00	3.3E+00	1.1E-02	2.1E+00	8.1E+00	9.4E+04
Global warming (GWP100a)	kg CO2 eq	6.4E-01	3.5E+00	4.2E+00	1.4E-02	4.9E-01	8.2E-01	1.8E+04
Human toxicity	kg 1,4-DB eq	1.5E+00	4.3E+00	3.7E+00	7.5E-03	1.4E+00	1.6E+00	8.4E+04
Marine aquatic ecotoxicity	kg 1,4-DB eq	2.3E+03	1.1E+04	6.0E+03	2.4E+01	9.5E+03	4.2E+04	6.4E+07
Ozone layer depletion (ODP)	kg CFC-11 eq	4.8E-08	1.7E-07	2.1E-06	1.2E-09	3.7E-08	6.6E-08	1.6E-03
Photochemical oxidation	kg C2H4 eq	1.4E-04	2.8E-03	1.4E-03	1.4E-06	1.2E-04	1.5E-04	8.8E+00
Terrestrial ecotoxicity	kg 1,4-DB eq	2.3E-03	2.1E-02	5.6E-02	3.4E-05	1.2E-02	4.9E-03	6.6E+01

4.4.3 Data for the modelling of environmental impact from coolants

According to the EU ELV rules, ELV must be depolluted and inter alia the coolants for air conditioning must be separated to avoid that the coolant is discharged to the air. As the coolants are very volatile, this requires special extraction systems. If only a limited number of vehicles is depolluted it is economically not viable to invest in such extraction systems. A German study assessed the potential impact and concluded that the coolant R12 (with a GWP100 of 10.890 CO₂eq), which was phased out the latest 1995, are not relevant anymore. However, the coolant R134a (phased out the latest in 2017) is relevant⁷⁷.

- 1) Global warming potential (GWP-100) of the air conditioning cooling agent R134a: 1,430 kg CO₂eq
- 2) Average filling of a vehicle with R134a at the end-of-life: 0.6 kg per vehicle
- 3) Vehicles placed on the market and share of new vehicles equipped with R134a.⁸¹ The time series ends in 2021 as the application of R134a is phased out.

Table 4.9 GWP impacts of air conditioning coolant removal

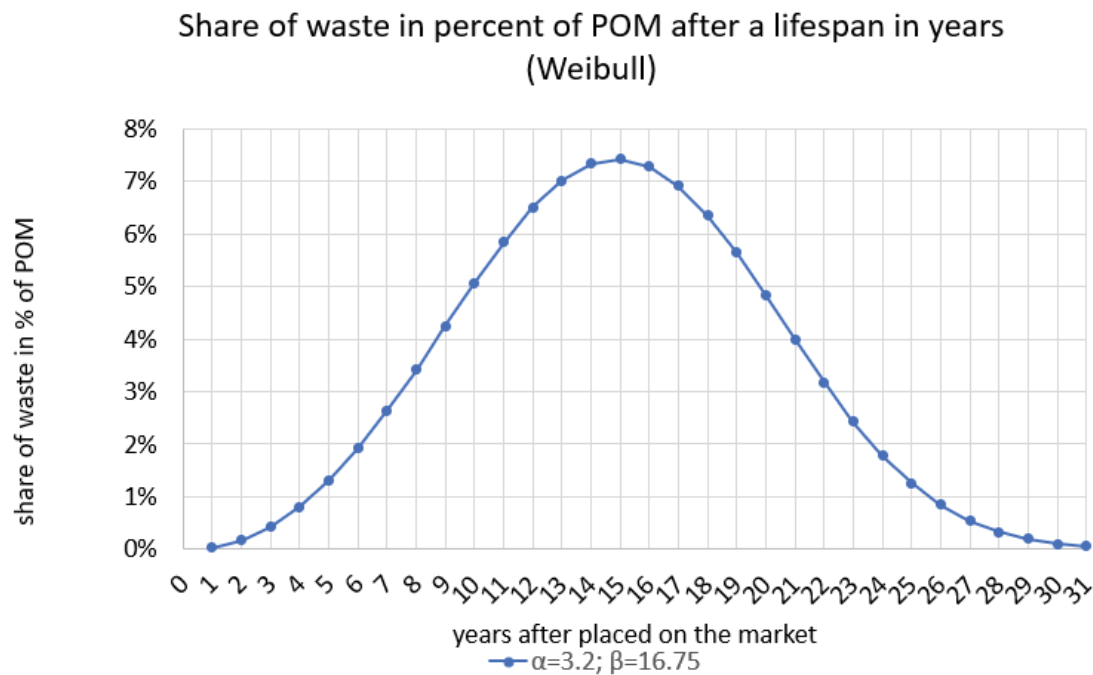
	total,M1,+,N1,PoM	Share,R134a
1991	12,591,233	25.7%
1992	12,701,341	25.7%
1993	10,061,079	25.7%
1994	10,632,622	31.7%
1995	10,687,789	37.8%
1996	11,401,688	43.9%
1997	11,908,142	50.0%
1998	12,852,409	56.1%
1999	13,667,723	62.2%
2000	13,296,470	68.3%
2001	13,126,889	74.3%
2002	12,578,688	80.4%
2003	13,337,197	86.5%
2004	13,613,138	92.6%
2005	13,652,647	94.2%
2006	14,374,710	95.7%
2007	14,474,905	95.8%
2008	13,409,195	95.9%
2009	13,368,260	96.0%
2010	12,667,065	96.1%
2011	12,651,986	96.6%
2012	12,636,906	97.0%

⁸¹ Source: Zimmermann, T.; Sander, K.; Memelink, R.; Knode, M.; Freier, M.; Porsch, L.; Schomerus, T.; Wilkes, S.; Flormann, P. (2022): Auswirkungen illegaler Altfahrzeugverwertung, [Impacts of illegal treatment of ELVs]. Texte 129/2022; Publisher: Umweltbundesamt, Dessau, Germany, November 2022; ISSN 1862-4804;

2013	12,621,827	93.7%
2014	12,606,748	90.4%
2015	12,591,668	66.3%
2016	12,283,340	42.1%
2017	11,975,012	22.9%
2018	11,666,683	3.6%
2019	11,358,355	2.3%
2020	11,050,026	0.0%
2021	11,791,238	0.0%

4) Weibull parameters for the lifetime of a vehicle (same as for the other model calculations)

Figure 4.6 Lifetime distribution of vehicles



5) Loss rate for the different destinations of the vehicle

As addressed in other sections (on “missing vehicles”) we distinguish different locations where the vehicles become an end-of-life vehicle. We distinguish the following cases:

With

- A) ELVs directed to ATFs and subsequently to shredders and reported by ATFs and MS
- B) ELVs directed to ATFs and subsequently to shredders but not reported
- C) ELVs directed to intra-EU non-ATFs and subsequently to shredders, not reported
- D) Used Vehicles exported (extra EU) and reported accordingly
- E) Used Vehicles exported (extra EU) but not reported
- F) ELVs exported (extra EU), not reported

As outlined in the German report mentioned earlier⁷⁷ it is expected that a certain proportion of the coolant from the air-conditioning system of ELVs is not extracted in accordance with the regulations but is released uncontrolled to the air.

Transposing these assumptions to the 6 categories above, we consider for the calculation of the impact that the following share of coolant is not extracted in accordance with the regulations but is released uncontrolled to the air (=loss rate)

Destination where vehicles become ELVs and their loss rate

- (A) ELVs directed to ATFs: 10%
- (B) ELVs directed to ATFs but not reported: 70%
- (C) ELVs directed to intra-EU non-ATFs: 70%
- (D), (E) and (F): extra EU export: 100%

6) The above-mentioned data / assumptions are finally combined with the total numbers of ELVs directed to the 6 different destinations as calculated for the different scenarios under “missing vehicles”.

4.5 Modelling the economic impacts

4.5.1 Main indicators

The main indicators used for the modelling of the economic impacts are the following:

For the economic impacts on ATFs the following aspects are of relevance under the current depollution and dismantling requirements:

- revenues of components and spare parts removed by Authorised Treatment Facilities (ATFs) for re-use or recycling,
- revenues for recyclates and the remaining hulk of ELVs sent by ATFs to shredders,
- costs for management of ELVs including the (current) obligatory depollution and dismantling management,
- cost for ATFs to buy ELVs

These aspects are assessed in detail in a German report, published in 2022⁸². For the EU Impact assessment, the IA support study of the Oeko-Institut did not refer to the separated cost and revenues but refers to the aggregated profit of 200 € per each ELV treated at ATFs. As the sources refer to the conditions in Germany, the situation might differ in other EU Member States. However, the mentioned profit is, in absence of other data, considered for the entire EU. As the size of the ATFs is very diverse no impacts of “economies of scale” are considered.

The IA support study of the Oeko-Institut further assumed that the profits of exporting used vehicles are higher compared to the profits from ELV treatment. In absence of qualified sources an estimated profit for the exporter of 400 € per exported used vehicle is considered.

⁸² Zimmermann, T.; Sander, K.; Memelink, R.; Knode, M.; Freier, M.; Porsch, L.; Schomerus, T.; Wilkes, S.; Flormann, P. (2022): Auswirkungen illegaler Altfahrzeugverwertung, [*Impacts of illegal treatment of ELVs*]. Texte 129/2022; Publisher: Umweltbundesamt, Dessau, Germany, November 2022; ISSN 1862-4804

Regards the economic impacts for shredders the IA support study of Oeko-Institut considers a profit 20 € per ton additional ELVs directed to shredders in the EU, with the assumption that a depolluted and dismantled ELV has a weight of 700 kg.

The dismantling of Batteries from EV falls under the obligation of ATFs and is regulated under the ELV legislation and not under the Battery Regulation⁸³. Considering that each of the 12,000 ATFs will sooner or later need training in handling of high-voltage batteries, such training, including missed work time, easily costs each ATFs more than €5,000, which would add up to € 60 million for the entire EU. Considering that such training needs to be completed in a period of 5 years and taking into account 63 million new passenger cars registered in the previous 5-year period (2017 – 2021) this would account for around 1 € per each new vehicle in that period. Other trainings e.g. regards the separation / dismantling of additional parts is not considered in the economic impact assessment,

The economic impacts from the more extensive dismantling and separation are built upon analysis of economic impacts for various materials: steel, copper, aluminium (cast and wrought), glass, plastics, and electric and electronic components (EEC). The analysed economic impacts in Oeko-Institut's IA support study considered inter alia the following parameters:

4.5.2 Revenues for spare parts removed by ATFs for reuse or separate recycling;

- Revenues for recyclates (shredders/PSTs, and recyclers);
- Dismantling costs (labour cost) for additional manual dismantling;
- Investment costs by all relevant economic actors (except for plastics, qualitative analysis).

The economic impacts were analysed qualitatively and quantitatively. The following table provides an overview of the quantitative analysis of economic impacts that was performed for each material in Oeko-Institut's IA support study.

Table 4.10 Economic impact categories

Impact category	Material			
	Steel, Copper, Aluminium	Glass	Plastic	EEC
Change in revenues (decrease or increase) for recyclates				
ATFs	x	x	x	x (also for reuse sales)
Shredder/PSTs	x	x	x	
Recyclers	x	x	x	
Dismantling costs (labour costs) at ATFs	x	x	x	x
Operating costs at shredder/PSTs			x	
Compounding costs at recyclers			x	

⁸³ Regulation of the European Parliament and the Council of [date] 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (OJ L [...]).

Investment costs			x	

All quantitative analysis were done for baseline and further scenarios developed for each material separately. These scenarios considered different routes of treatment of materials as well as shares (in %) of total material stream. All considered routes of treatment were:

- In components for reuse/remanufacturing
- Recycled material of potentially higher-quality (directly recycled, no shredding)
- Dismantled --> shredded --> recycled (not relevant for copper, plastics, and EEC)
- Shredded --> recycled (no dismantling) (not relevant for cast aluminium)
- Recovery (backfilling in case of glass and energy recovery in case of aluminium, or for plastics and EEC either backfilling or energy recovery)
- Recycled removed copper from steel scrap (relevant only for copper)
- Losses/process inefficiencies

For the analysis at hand, the model developed for this study specifies the tonnage of each analysed material that will be contained in ELVs to be collected in years: 2025, 2030, 2035, and 2040. These calculations also consider a weight of each material per vehicle depending on the type of vehicle. Based on above calculations and the assumed shares for each route of treatment for material, the tonnage of analysed material treated in different routes for each scenario/policy option was calculated.

The calculations of revenues for ATFs, shredders/PSTs, and recyclers considered the tonnage of analysed material treated in different routes for each scenario multiplied by the unit price of the analysed material. For aluminium and glass, different unit prices based on the recyclate quality were used in the calculations. In the qualitative analysis of Oeko-Institut's IA support study, it was noted that increased quality of recyclates resulted in a unit price increase. Obtained results, which can be found in the Final Report, refer to a baseline scenario and express the difference of revenues compared to the baseline scenario. Below is a table that contains all assumed unit prices for recyclates of the analysed materials.

Table 4.11 Economic impacts, price of recyclates and reusable parts

Material	Unit prices (in Euro/tonne)	
	Recyclates	Reuse sales
Steel	187.08 ⁸⁴	
Copper	6,286 ⁷⁹	
Aluminium		
Cast	967.39 ⁷⁹	
Wrought	1,160.87 ⁸⁵	
Glass		
For ATFs	10.00 ⁸⁶	
For shredder/PSTs	10.40 ⁸⁷ 1,50 ⁸⁸	

⁸⁴ <https://www.letsrecycle.com> data for 2021, calculated averages converted to €

⁸⁵ 20% higher price assumed for wrought Al alloy than for Al alloy cast

⁸⁶ Unit price of glass sold by ATFs to recyclers directly

⁸⁷ Unit price for recycled material after shredding (not backfilled)

⁸⁸ Unit price for output from shredders

For recyclers	18.32 ⁸⁹	
Plastics	400.00 ⁹³	
Inverter (EEC)	10.35 ⁹⁰	12.20 ⁸⁶

The calculation of dismantling costs⁹¹ for steel, copper, aluminium, and EEC was based on time required for dismantling of selected parts and the costs of an hour work or unit. As already stressed above, the model developed for the Oeko-Institut's IA support study, specifies the amount of ELVs to be collected in years: 2025, 2030, 2035, and 2040. Based on these values and the assumed shares for each route of treatment for material, the number of dismantled parts for each scenario/policy option was calculated. For steel, aluminium, and copper, to calculate dismantling costs, removal of an engine was considered⁹². Additionally for copper, the removal of cables was calculated⁹³. For the analysis of these costs for EEC the removal of inverter was considered.

The calculation of dismantling costs for plastics and glass based on the total mass of these materials in ELVs collected in years: 2025, 2030, 2035, and 2040.

The following tables contains unit costs for dismantling (labour costs at ATFs) as well as additional unit costs at shredder/PSTs and recyclers.

Table 4.12 Dismantling costs

Route of treatment	Material (various units)			
	Steel, Copper, Aluminium (€/hour)	Glass (€/tonne)	Plastic (€/tonne)	EEC (€/unit)
Dismantling costs at ATFs	51,00 ⁹⁴	223,00 ⁹⁵ 49,00 ⁹⁶	80,00 ⁹⁷	2,20 ⁸⁵
Operating costs at shredder/PSTs			110,00 ⁹³	
Compounding costs at recyclers			300,00 ⁸⁵	

⁸⁹ <https://www.letsrecycle.com> data for 2021, calculated averages converted to €

⁹⁰ Optimierung der Separation von Bauteilen und Materialien aus Altfahrzeugen zur Rückgewinnung kritischer Metalle (ORKAM); Groke, M.; Kaerger, W.; Sander, K.; Bergamos, M.; Umweltbundesamt 2017

⁹¹ For steel, copper, and aluminium expressed as labour costs

⁹² In the calculations dismantling time of engine to the steel and aluminium scenarios are allocated 50:50 and time for deep-dismantling of engines is allocated 33:33:33 to Fe:Cu:Al scenarios. Additionally, the percentage of dismantled and deep-dismantled engines variate among scenarios and depends also on the vehicle's type. Allocation of calculated dismantling time to three materials allows avoiding double counting. Also, dismantling times vary for components removed for reuse (20 min) and for recycling (10 min).

⁹³ 12 minutes were assumed for removal of cables.

⁹⁴ Base on the information from EGARA.

⁹⁵ Costs of dismantling per vehicle for the ATF

⁹⁶ Costs of post shredder recycling per vehicle for the ATF

⁹⁷ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

4.6 Modelling the social impacts

Regards the employment the following indicators are applied:

- 1.5 FTE per 1000 additional ELVs treated at ATFs (at current dismantling conditions)
- Additional job positions calculated for ATFs for increased dismantling of parts and components (for enhanced dismantling and separation at ATFs).
- The calculations of additional jobs for ATFs considered additional number of parts removed from an ATFs prior shredding assumed for each scenario/policy option. For instance, the calculations for steel, aluminium, and copper scenarios/policy options were based on the removal of engines and time required to remove them.
- Additional job positions calculated for recyclers to operate new machines required by shredder/PST (for enhanced separation at recyclers).

Employees will be needed for the operation of new machines in shredder/PST and additional employees for hand picking/sorting in shredder facility. In Europe there are about 300 shredders/PST. It is expected that relevant investments would be done by facilities from middle up to big size, thus not in all existing facilities. There is no precise data on shredder/PST and also if shredders have a PST in house, therefore rough assumptions are done: 60% of existing plants are middle or bigger size, for the new technological solutions there will be need for 2 employees that could operate new machines. It would mean that for scenarios/policy option, in which investment in new technologies are planned, would be required in total to hire additional 360 employees.

4.7 Methodological approach for recycled content plastics

The analysis is based on the JRC plastics recycled content study⁹⁸. The main scenarios included in the study are displayed in Table 4.13.

Table 4.13: Main scenarios evaluated for proposed targets for minimum recycled plastics content in new vehicles sold (Options 3 series) compared to newly type approved (Option 4 series) of the JRC study⁹⁹.

Application date	All new vehicles sold (M1)			Newly type approved vehicles (N1 and M1)	
	JRC3a	JRC3b	JRC3c	JRC4b	JRC4c
2030	6%	15%	25%	25%	30%
2035	10%	20%	30%	25%	30%

⁹⁸ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008.

⁹⁹ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

4.7.1 Literature review

Literature research is first performed to compile relevant secondary data dealing with the use of plastics in vehicles, the structure of the value chain of virgin and recycled plastics, as well as on the quantitative (*i.e.* mass) and qualitative (*i.e.* polymer types) properties of the material flows within.

Hence, general statistics proposed by the professional associations such as PlasticsEurope or ACEA are analysed, providing a first overview of the characteristics of plastics materials embedded in cars. In addition, technical or impact assessment studies funded by the European commission or professional associations and related to the ELV directive are also analysed because of the direct link with the scope of the present work. This is also the case of “position papers” released by professional organisations to present their views on revision of the ELV directive or EU plastics strategy. In addition, more generic scientific literature such as peer-reviewed scientific articles and specialized website pages are also consulted to complement the data previously collected when needed.

The Circular Plastics Alliance (CPA) deliverables¹⁰⁰ are also providing valuable inputs to understand the current state of play and untapped potential of recycled plastics uptake, offering a specific focus on the automotive sector *via* its dedicated working group. The following available reports were carefully analysed and used to enrich the knowledge and datasets gathered:

- i. CPA, 2020. Work plan on state of play collection and sorting - Automotive working group. (CPA, 2020)
- ii. CPA, 2021. Guidance on Waste Definitions. (CPA, 2021a)
- iii. CPA, 2021. Roadmap to 10 Mt recycled content by 2025, untapped potential report (CPA, 2021b)
- iv. CPA, 2021. Work plan on recycled content - Automotive WG (draft version). (CPA, 2021c)
- v. CPA, 2022. Supporting greater uptake of recycled plastics in Europe: Circular Plastics Alliance’s assessment of the legal, economic and technical requirements and solutions. (CPA, 2022)

However, it should be noted that the CPA pursues a different goal compared to the current work carried out in the frame of the revision of the ELV directive. Indeed, CPA initiative is based on industry voluntary pledges within various sectors to reach 10 million tonnes of recycled plastics in 2025, which correspond to a short-term development. Hence, the CPA outcomes offer technical elements to feed the current reflection on the feasibility and ambition level of potential recycled content target for plastics materials within revision of the ELV directive. In other words, CPA results constitute a first step, but are not sufficient to anticipate what could be the situation in the current decade and beyond dealing with both (i) plastics demand for automotive manufacturing and (ii) ELV and plastic waste treatment operations

¹⁰⁰ CPA commitments and deliverables are publicly available on:

https://ec.europa.eu/growth/industry/strategy/industrial-alliances/circular-plastics-alliance/commitments-and-deliverables-circular-plastics-alliance_en

and recycling processes. Therefore, the goal of the current study is to provide robust insights about which quantity of recycled plastic materials is suitable to integrate in new cars. Such uptake is regulated thanks to recycled plastic content target policy measure. The evaluation of the uptake potential of recycled plastic by the automotive value chain is performed through supply-demand balance, life cycle-based methodology and an economic assessment.

4.7.2 Selected approach for stakeholders' targeted consultations

One important objective of the present study is to consolidate data and knowledge regarding production and integration of high-quality recycled plastics in new vehicles. For such purpose, it is proposed to enrich data collected in the literature or through the CPA initiative by contacting several experts and key industrial players in the field, following the approach initially presented in Mathieux and Brissaud (2010). This experts' elicitation process allows to reach a finer understanding of stakeholders' interactions within this industrial ecosystem as well as to gather their views on the current and future practices dealing with recycled plastics uptake in the sector. This consultation appears as an important step when assessing the feasibility to set recycled content targets (and associated threshold values) for plastics in new vehicles, by getting first hand feedback also from front-runners.

Consequently, the present study proposes to collect primary data through semi-structured interviews with relevant stakeholders along the value chain described below (see §2.3 of the JRC study). It includes some selected vehicle manufacturers (OEMs), parts and components direct suppliers of the automotive manufacturers (Tier 1), plastics compounders and recyclers which supply the primary and secondary plastics raw materials (Tier 3 suppliers). Independent experts and industrial sector associations are also covered in the scope of the consultation.

The goal of such consultation is to understand the industrial state of play dealing with plastic recycling in the automotive sector and gain knowledge regarding both qualitative and quantitative data (facts and figures) from a wide panel of stakeholders who may have contradicting views on this topic.

4.7.3 Identification of relevant stakeholders (front-runners and professional associations)

The author team developed interview-guide material for each category of stakeholder (see Annex 1 of the JRC study. Questionnaires sent to stakeholders during the targeted consultation). This written document includes a written list of questions related to the value chain, the quantitative and qualitative features of its material flows, the drivers and barriers, as well as a preliminary sketch of the value chain based on the literature sources.

First, we focused our consultation on companies identified as front-runners, *i.e.* companies previously involved in large-scale research projects and/or having already announced ambitious public commitments in the field of plastic recycling / use of recycled plastics (see section §2.2.2 of the JRC study). This recognised front-runner position in the field allows to anticipate what could be the situation of the overall sector in the near future (between 5 and 7 years). For such stakeholders, two hours of bilateral guided discussions are carried out including also validation of some assumptions and forecasts made for the system under study.

Going further, broader consultations, *i.e.* participatory interactive workshops, were organized with the relevant industry associations and a panel of their members to capture a representative state of play of the sector regarding the integration of recycled plastics in vehicles. In other words, the exercise allows to understand the average position of a sector and its degree of preparedness to anticipate a potential change in the legislation. It is also seen

as an appropriate way to collect consensual views on the current practices and “averaged” quantitative data which can be used to design a *baseline scenario*.

These workshops were organised during 2.5-3 hours. First, it is proposed a presentation by the JRC team about the current context, the goal and scope of the present study and the expectations in term of qualitative and quantitative inputs to be collected during this consultation (or for potential sensitive topics during follow-up discussions). Then, the representative of the association and some volunteers within the panel present their positions on the following topics followed by an open discussion with the JRC.

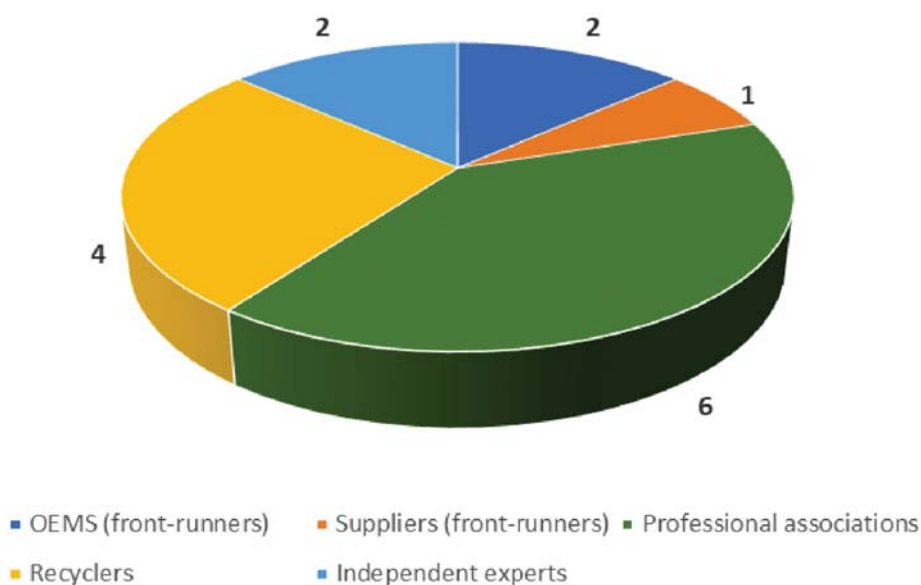
- i. Current practices regarding recycled plastic integration (*quantity/type of polymers etc.*) and outlook (*2025? 2030?*)
- ii. What make further integration of pre/post recycled plastics challenging? (*e.g. qualification process for plastic parts; sourcing, lead times, and technical constraints*)
- iii. Reliable audit/traceability scheme (*e.g. potential contribution of IMDS, close loop in automotive or intersectoral exchange, EU/non-EU sourcing*)

Each session lasts around 40 minutes with a good balance between presentations and discussions involving members of the panel, association and JRC teams. The workshop ends by a wrap-up and follow-up session managed by both the representative of the association and the JRC team.

4.7.4 Interviews state-of-play

During the study timeline, we interviewed a number of representative stakeholders during at least a 2h session of semi-structured interviews or during half day sectoral workshops with professional associations. Several follow-up discussions, data collection and validation took place with some stakeholders. The list of typical questions sent beforehand to the stakeholders are detailed in Annex 1. The distribution per type of stakeholders is also presented in Figure 3. Despite the pandemic conditions, the study also benefited from the visit/analysis of an ELV plastic recycling plant.

Figure 4.7: Distribution of the selected stakeholders for bilateral discussions



4.7.5 *Adaptation for plastics recycling content to fit within the type-approval framework*

After the initial JRC study focusing on the entire fleet of vehicles placed on the market, the importance of integrating the recycled content target within the EU type approval (TA) legislative framework was highlighted. Because the TA procedure addresses environmental properties of the vehicles placed on the EU market, and because it already addressed circularity aspects through the recyclability, reusability and recoverability provisions (Directive 2005/64/EC), it is likely to be an appropriate and effective instrument to implement the recycled plastics targets provisions. Therefore, additional scenarios were added to base the target solely on newly type-approved vehicles from a certain data and then while more and more type approvals are granted more steadily increase the uptake of plastics recycled content in new vehicles production. The resulting additional scenarios are displayed in Table 4.14.

The chapter 5 of the JRC report describes the policy options proposed to increase recycled plastics uptake in new vehicles. These options series 1, 2 and 3 are developed at vehicle level, in line with the description of the criteria ⑥ described in chapter 5 (scope of application for the potential targets). As showed in Annex 8.1.2, the environmental and recyclability provisions of the TA apply to passenger cars (M1 category), and light commercial vehicles (N1 category). Consequently, the N1 category is additionally included in the scope of the analysis and this will modify the amount of recycled plastics demand (demand side) as well as the amount of ELV to be collected and treated in ATF (production side of ELV plastic recyclates). The policy options thus apply to an updated fleet model of newly registered vehicles gathering N1 and M1 categories, presenting a new dynamic regarding the penetration of BEV within the fleet of newly registered vehicles and also providing an increased amount of ELV to be collected per year.

Besides, the harmonisation of the potential recycled content targets with TA procedure implies an important change in the modelling of the recycled plastics demand. In Chapter 5 of the JRC study, the target compliance is applied to all new vehicles sold at a given year. The use of the type approval legislation for recycled content targets (i.e., making the target applicable to new vehicle types brought into the EU market after a certain date) delays the compliance of a certain share of the newly registered vehicles fleet. Indeed, it is estimated that a period of 6 to 7 years is on average needed to renew or launch a new type approval for which the compliance with environmental provision should be proven only after the application date of the measure. This should postpone by several years the demand in term of plastic recyclates, while allowing more flexibility to car manufacturers to align with the provisions.

4.7.6 *Material & Methods*

This section highlights how the additional option 4 series are impact assessed, focusing on materials flow modelling (and associated supply/demand balance of recycled plastics) that is largely updated. It further compiles estimates regarding environmental and economic impacts, through an adaptation of the modelling of chapter 5 of the JRC study

a) Identification of relevant new targets thresholds considering the Type approval instrument

In line with what has been developed in section §5.1.3, new thresholds are defined for the year 2030. The application date of the target for 2030 implies that all new types approved vehicles in 2030 and beyond will need to comply with a minimum recycled plastics content. Analysis of recent records show that the **type-approval procedure** is usually distributed over **a certain period** (typically 6 years per type on average), that will delay the full compliance of the newly registered fleet. It has been decided to keep a **unique mandatory threshold** for the first application year, i.e., from 2030 onward. To do so, the options, numerated “**Opt.4**” **keeps similar levels (a,b,c) of recycled plastics compared to the options 3** previously defined for ‘All new vehicles sold’ fleet (see Table A5.1). This approach allows greater flexibility for manufacturers to perform their product planning, while maintaining a comparable level of overall ambition in the long run (e.g., in 2035). The date of introduction of the first target (2030) allows sufficient lead time for vehicle type developments.

In absolute value, Option 4.b (TA2030 - 25%) represents an intermediate case compared to previous 3.b and 3.c options in term of demand for recycled plastics while option 4.c (TA2030 - 30%) corresponds to the previous option 3.c in 2035.

b) Definition of archetypes and fleet renewal dynamics

The features of the TA procedure and the time needed to generalise provisions should be captured in the growth of recycled plastics content within the fleet of newly registered vehicles. An annual growth rate is applied to the reference value for the year 2022, i.e., 2.5% recycled plastic content in vehicles. **The average lifetime of a TA for M1 and N1 type is assumed to be 6 calendar years**, meaning that, if the target is introduced in 2030, a vast majority of newly registered vehicles will comply with “option 4” target only by 2035.

To capture the diversity of situations among the OEMs, already described in section 4.2 of the JRC study, seven archetypes have been defined according to the time that each car manufacturer will take to fulfill the targets (each one with a given annual growth rate). For each year, the average recycled plastics content for new vehicles registered is computed.

Among the archetypes, a **normal distribution** is applied to characterise the dynamics of the fleet regarding the compliance with the target. This **baseline scenario** represents the case where most of the manufacturers act following the *archetypes 3 and 4* (each one representing 34% of the fleet of newly registered vehicles). Front-runners (*archetypes 1 and 2*) represent 16% of the fleet while the remaining 16% covers less advanced manufacturers (*archetypes 5 and 6*). The considered distribution among archetypes is depicted in Figure A5.1 for baseline, early adoption and late adoption scenarios in the JRC study.

Based on these scenarios modelling, **weighted averages** for baseline, early and late adoption (with weight being the share of each archetype) are then calculated to obtain S-curves representing the **average recycled plastics content of newly registered vehicles** for each TA policy option (4.a, 4.b., 4.c.). The results are presented in section §A5.3.a) of the JRC study.

c) Application to an extended fleet model including passenger cars (M1) and light commercial vehicles (N1)

In the main body of the JRC study, the fleet model used to forecast annual newly registered vehicles focuses exclusively on the M1 category, i.e., passenger cars. Since the TA and the

ELV directives also cover the light commercial vehicles, **the N1 category is included** in the scope of the assessment of this annex. This represents a notable change in terms of vehicles covered with an increase by ca. 5% of the number of vehicles included in the scope. With an average weight of 1800 kg out of which the share of plastics is 13%, an average amount of plastics of 234 kg per each N1 vehicle is assumed. The total mass of plastics per vehicles for other categories remains the same: 208 kg for ICEV and hybrid, 204 kg for BEV.

In addition, the share of the zero emission vehicles within the fleet is updated to reach 100% of the vehicles sold in 2035. This is in line with the new ‘zero emission vehicles’ policy objective agreed under the EU ‘Fit for 55’ legislative framework.¹⁰¹

To estimate the quantity of recycled plastics demand in the EU, the number of vehicles manufactured in the EU (not the number of newly vehicles sold) should be considered. We estimated that 30% of the sales come from vehicles manufactured outside the EU (and thus does not enter in the EU plastics demand calculations) while 46% of the vehicles manufactured in the EU are exported.¹⁰² Based on these figures and the expected number of sales in the coming years, a system of equations is set up to forecast the total number of EU vehicles manufactured each year until 2035. It is found that the amount of manufactured vehicles equals 1.3 times the number of vehicles sold in the EU annually, i.e., 19.3 million in 2030 and 19.5 million in 2035 (vs. 14.9 and 15.0 millions of EU sales respectively).

Finally, the forecast for **the ELV collection number is updated** to be aligned with the baseline of the impact assessment of the ELVD revision. This baseline proposes a total ELV collection of 9.6 million in 2035. A linear regression is applied to link this number with the current amount of collected ELV, estimated to be 7.08 million. The estimated production of recycled plastics coming from ELV sources is then computed by multiplying the amount of ELV with the plastic recycling rate after dismantling, similarly to the calculations presented in section 5.2.1 and Figure 19. **Three recycling rates** are applied to estimate the quantity of ELV recycled plastics produced, i.e., 18%; 26%; and 35% corresponding respectively to: (i) the average scenario (AES), (ii) the front-runner's scenario (FRS), both already used in section §3.3.1 of the JRC study and (iii) the case where a 35% mandatory recycling rate is applied after dismantling.

4.8 Methodological approach for recycled content steel

The analysis of impacts of setting a steel recycled content builds on the Oeko-Institut impact assessment support study¹⁰³ related to problem definition and drivers, technical constraints in the recycling of steel and the types, numbers and compositions of vehicles in the EU fleet.

¹⁰¹ EC press release (28/10/2022) - Zero emission vehicles: first ‘Fit for 55’ deal will end the sale of new CO2 emitting cars in Europe by 2035 (https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6462)

¹⁰² ACEA pocket guide 2020/21, average trade datasets on the 2015-2019 period:
https://www.acea.auto/files/ACEA_Pocket_Guide_2020-2021.pdf

¹⁰³ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

This work is complemented with analysis of the economic and environmental impacts when more post-consumer scrap would be included into new vehicle production.

For this, the following main modelling assumptions and data sources of Table 4.15 apply.

Table 4.14 Modelling assumptions and sources

Parameter	Value	Source
Steel weight% in new vehicles	56%	- Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023 - Driving down the impurity levels: See Slide 13, ELV dismantled+shredder to 0.10% - Arcelor Mittal - IARC 5.07.2022 Scrap for Decarbonized Steels presentations - JRC Raw Materials Information System: https://rmis.jrc.ec.europa.eu/apps/veh/#/v/components
Share of long products in ELV steel	21%	- Driving down the impurity levels: See Slide 13, ELV dismantled+shredder to 0.10% - Arcelor Mittal - IARC 5.07.2022 Scrap for Decarbonized Steels presentations - RMIS - Raw Materials in Vehicles (europa.eu)
Average weight new vehicle	1.4	- Driving down the impurity levels: See Slide 13, ELV dismantled+shredder to 0.10% - Arcelor Mittal - IARC 5.07.2022 Scrap for Decarbonized Steels presentations
1 ton of crude long steel requires	1.10	per ton of ELV scrap
1 ton of crude flat steel requires	1.07	per ton of ELV scrap

The GHG savings are estimated per ton of **high-quality scrap utilised better by taking the difference** between the impacts per ton of the EAF scrap compared to the average global production mix which is increasingly expected to decarbonise over time.

Table 4.15 Environmental impact assumptions and sources

Environmental impacts (ton of CO ₂ per ton of crude steel)	2025	2030	2035	2040
Average global production mix	2.04	1.78	1.59	1.49
EAF scrap	0.43	0.43	0.43	0.43
Source:	- Making net-zero steel possible, an industry backed, 1.5C aligned transition strategy - The mission possible partnership, page 54 and 55			
Production share%				
EAF scrap	29%	30%	31%	32%
EAF -DRI H2 50%	0%	6%	7%	9%
EAF-DRI natural gas	10%	4%	2%	0%
BOF - DRI melt	0%	5%	9%	13%
BF - DRI H2	0%	9%	16%	22%
BF – Best Available Technology	19%	23%	27%	20%
BF Average 2020	43%	23%	9%	5%

Source:	- Making net-zero steel possible, an industry backed, 1.5C aligned transition strategy - The mission possible partnership

For the economic assessment, the costs for improving scrap utilisation are estimated to be below other conversion investments. The highest share of costs are related to the improvement of scrap quality that are already covered under the policy options 3 and not taken into account here to avoid double counting. Additional sampling costs however, are connected to verification and included as specified below. The ‘revenues’ side would specifically relate to reduced future ETS compliance costs. For 2035 when free allowances under ETS have phased out, the conservative estimate for the external costs per ton of CO₂eq is taken for this ‘revenue potential’.

Table 4.16 Economic impact assumptions and sources

Economic impacts				
Avoided ETS costs	2025	2030	2035	2040
Default scenario: Low	84	108	132	156
Medium	142	185	227	269
High	266	344	421	498
Source:	European Commission, Directorate-General for Mobility and Transport, Essen, H., Fiorello, D., El Beyrouty, K., et al., Handbook on the external costs of transport: version 2019 – 1.1, Publications Office, 2020, https://data.europa.eu/doi/10.2832/51388			
Sampling costs shredders	8 EUR/ ton			
Source:	- R. Su, A. Assous, Starting from scrap, the key role of circular steel in meeting climate goals, Sandbag study - Improve the EAF scrap route for a sustainable value chain in the EU Circular Economy scenario, ESTEP, 2021			

Table 4.17 Shifts in the energy mix per production route

Energy mix global production per ton of crude steel	Electricity	Nat. gas	H₂	Coal	Iron ore
	MWh	m3	ton	ton	ton
EAF - scrap	0.600	15	-	0.020	0.08
EAF - DRI H₂ 50%	0.680	120-151		0.020	1.66
EAF- DRI natural gas	0.680	240-300	0.024	0.020	1.66
BOF - DRI melt	-	158		0.235	1.22
BF - DRI H₂	-		0.024	0.235	1.22
BF – BAT 2020	-			0.470	1.22
BF - Average	-			0.635	1.22
Sources	- R. Su, A. Assous, Starting from scrap, the key role of circular steel in meeting climate goals, Sandbag study, page 52 - Z. Fan, S.J. Friedmann, Low-carbon production of iron and steel: Technology options, economic assessment and policy, Joule 5, 829-862, April 21, 2021, Elsevier Inc. - Making net-zero steel possible, an industry backed, 1.5C aligned transition strategy - The mission possible partnership, page 54 and 55				
Conversions to MWh	m3 natural gas to MWh			0.011	MWh
	ton to MWh			33	MWh
	ton coal to MWh			2.46	MWh

With above values, per ton of high-quality scrap utilised better, the following shift in the (fossil fuel) energy replacements compared to the global production mix are computed. Obviously, the EAF scrap route means more electricity demand and reduced demand in the other energy types dependent on the production mix changing over time.

Table 4.17 Shifts in the energy mix per ton of scrap utilised better

Energy type	2030				2035				2040			
Electricity	+0.51	MWh	+0.51	MWh	+0.51	MWh	+0.51	MWh	+0.51	MWh	+0.51	MWh
Natural gas	-23.61	m3	-0.25	MWh	-29.68	m3	-0.31	MWh	-34.27	m3	-0.36	MWh
Hydrogen	-0.004	ton	-0.14	MWh	-0.006	ton	-0.20	MWh	-0.007	ton	-0.25	MWh
Coal	-0.40	ton	-0.98	MWh	-0.33	ton	-0.81	MWh	-0.29	ton	-0.71	MWh
Iron ore	-1.20	ton			-1.19	ton			-1.19	ton		
Making net-zero steel possible, an industry backed, 1.5C aligned transition strategy - The mission possible partnership, page 54 and 55												

4.9 Methodological approach for the CRM assessment – JRC

The methodological approach for the CRM assessment is included in Annex 15.1

4.10 EPR and compliance cost scenarios

The proposed measures would generate important transfer of revenues and costs between the different actors in the supply chain. They have been estimated to the extent that this is possible with a detailed assessment on which economic actor would be expected to bear the costs and, or valorise the revenues, but this depends on a range of variables.

This is the case especially for the calculation of the economic impact linked to the adoption of measures on “extended producer responsibility” under the preferred option (**PO5B**). The implementation of measures under **PO4C** aimed at improving high quality recycling and a higher recovery of waste, is likely to increase the operating and investment costs of dismantlers and shredding operators. When these costs offset the revenues for these operators, EPR schemes would require that vehicle manufacturers compensate them via appropriate financial support.

Projections have been made in this impact assessment on the additional costs for manufacturers generated by the “EPR-related” measures. The costs would depend on the profitability of dismantlers and shredders, which will be determined to a large extent by:

1. The evolution of prices of components and spare parts removed by Authorised Treatment Facilities (ATFs) for re-use or recycling, the evolution of prices of recyclates (notably compared to virgin products),
2. The value of the remaining hulk of ELVs sent by ATFs to shredders, as well as by the investments needed and economies of scale realised by ATFs, shredders and recyclers. Due to reduction in revenues from dismantled materials at ATFs, the value of remaining hulks is accounted for the economic impact tables presented in Annex 8.2.

The two other main costs for vehicle manufacturers would be linked to the measures on recycled content for plastics and steel (**PO2B**), and to a lesser extent for the measures the circular design of vehicles (**PO1C**).

3. For plastics recycled content, the main elements affecting these future ‘rebalances’ are the value of plastic recyclates where it assumed that due to increased availability, two-thirds of the revenues are for the recyclers and one-third for the manufacturer due to improved economies of scale and related price reductions.
4. A similar situation applies to the costs and revenues for improving ELV steel scrap quality. The sampling costs are attributed to the shredders, whereas the revenues are expected to be shared between the steel industry and the shredders.

Finally, a significant effect related to the reduction of revenues from used vehicles at exporters and increased number of vehicles collected and dismantled at ATFs.

5. Some of the revenue potential will be recovered by increased sales of spare parts and the material value that ATF will pay out to the car dealers involved.

Based on these 5 elements, a sensitivity analysis is conducted to understand better which cost and revenues levels per actor are possible, as specified in below Table

The projections have taken into account situations ranging from one where all the costs linked to the new measures on waste treatment would be passed on from the dismantlers/shredders to the vehicle manufacturers (in which case the contribution by vehicle producers to EPR schemes would be in the order of 41€/vehicle) to the other scenario where these new costs for dismantlers and shredders would all be offset under normal market conditions (in which case the contribution by vehicle manufacturers would be around 5€/vehicle, linked to measures designed to increase the collection of ELVs essentially).

Table 4.18 Sensitivity analysis EPR compliance cost range

Expected cost/ revenue redistribution (2035, compared to baseline)			
Revenues plastic recyclates	Min	Default	Max
To recyclers	40%	67%	100%
To manufacturers (price rebalance)	100% - value above		
Costs steel recycled content	Min	Default	Max
Steel industry (cost HQ scrap)	25%	50%	75%
Manufacturers (premium RC steel)	100% - value above		
Revenues steel recycled content	Min	Default	Max
Shredders (revenues HQ scrap)	25%	50%	75%
Steel industry (reduced process cost)	100% - value above		
Reduced revenue dismantled hulks	Min	Default	Max
Reduced revenue ATFs	80%	90%	100%
Reduced costs shredders	100% - value above		
Revenues improved vehicle collection	Min	Default	Max
To ATFs	0%	75%	100%
Remains with car dealers	100% - value above		

It should be noted that the impact will differ between Member States, notably between those which have already advanced EPR schemes (like the Netherlands, where producers paid a fee of 22.5€/vehicle in 2023 and 30€ in 2022 to the competent PRO) and those for which have not set up any particular EPR mechanism. The contributions of vehicle manufacturers will be expected to be higher in Member States which have not set up any EPR scheme so far. The differences in costs between the Member States could not be quantified. A detailed sensitivity analysis per member state is however not feasible due to lack of detailed information.

ANNEX 5: FIT FOR FUTURE PLATFORM OPINION

Topic title	Revision of the end-of-life vehicles directive and the directive on the type-approval of motor vehicles
	AWP 2022 ¹⁰⁴ .
	Directive 2000/53/EU on end-of-life vehicles ¹⁰⁵ and Directive 2005/64/EC on 3R type-approval ¹⁰⁶ . <i>Legal reference</i>
Date of adoption	05 December 2022
Opinion reference	2022/SBGR2/05
Policy cycle reference	b Contribution to ongoing legislative process
	CWP 2022, Annex II ¹⁰⁷ , revision of the end-of-life vehicles Directive and the Directive on the type approval of motor vehicles with regard to their reusability, recyclability and recoverability <i>Commission work programme reference</i>
	The revision will promote a more circular approach by linking design issues to end-of-life treatment, considering rules on mandatory recycled content for certain materials of components and improving recycling efficiency. The merging of the two Directives into a single instrument, covering the whole life-cycle of the automotive sector, would provide legal clarity to economic operators and administrations, compared to the current situation which relies on a fragmented approach: cars are covered by Directive 2005/64/EC when they are put on the market, while end-of-life cars are covered by Directive 2000/53/EC. A move to online tools and the use of digital solutions would help to reduce avoidable administrative burden, notably related to the reporting obligations or other procedures, e.g. vehicle (de-) registration and notification systems. In this regard, the revision of the Directive will aim to improve the operational feasibility and implementation of the Directive, and optimize administrative burden through better

¹⁰⁴ AWP 2022, <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

¹⁰⁵ Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles - Commission Statements (OJ L 269, 21.10.2000, p. 34–43).

¹⁰⁶ Directive 2005/64/EC of the European Parliament and of the Council of 26 October 2005 on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability and amending Council Directive 70/156/EEC (OJ L 310, 25.11.2005, p. 10–27).

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32005L0064&qid=1643133503005>

¹⁰⁷ European Commission, Annexes to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Commission work programme 2022. Making Europe stronger together (COM(2021) 645 final).

	use of digital solutions and coherence with other sectoral policies and legislation based on a life-cycle approach. Planned adoption: Q2, 2023
	☐ Contribution to the (ongoing) evaluation process
	- <i>Title of the (ongoing) evaluation</i>
	No
	☐ Included in Annex VI of the Task force for subsidiarity and proportionality
	No
	☐ Other
	No
Have your say: Simplify!	<i>No relevant suggestions on this topic have been received from the public.</i>

5.1. Suggestions summary

Suggestion 1:	Consider a digital vehicle passport including details on used materials
Suggestion 2:	Refine the definitions for end-of-life vehicles and used vehicles/ parts of vehicles
Suggestion 3:	Consider full digitalisation of the registration system and (2) installation of a central registration system and/or interoperable systems or ensuring the compatibility and coordination of the registration systems across and within Member States
Suggestion 4:	Enforce the certificate of destruction (COD) necessary for deregistration and implement a systemic differentiation between temporary and permanent deregistration
Suggestion 5:	Improve implementability of the ELV-Directive's requirements through a reward system for deregistration and/or dismantling
Suggestion 6:	Ensure coherence with other legislation, e.g., the Batteries Directive 2006/66/EC and the REACH Regulation
Suggestion 7:	Improve compliance and enforcement possibilities through more realistic targets, common methodologies, and increased producer responsibility

5.2. Short description of the legislation analysed

The Directive 2000/53/EU on end-of-life vehicles¹⁰⁸ (ELV) aims to prevent waste from vehicles and at the reuse, recycle end-of life vehicles and their components to reduce the disposal of waste and the improvement in the environmental performance of all of the economic operators involved in the life cycle of vehicles. While harmonising environmental requirements, the Directive also seeks to ensure the smooth operation of the internal market and to avoid distortions of competition in the EU through an EU-wide framework in order to ensure coherence between national approaches. Since its adoption in 2000, the Directive has not undergone any substantial revision.

Directive 2005/64/EC on the type-approval of motor vehicles is the main piece of EU legislation linking the design of new vehicles and their reusability, recyclability and recoverability¹⁰⁹. It lays down administrative and technical rules to ensure that a vehicle's parts and materials may ultimately be reused, recycled and recovered as much as possible. It makes sure that the reused components do not cause any safety or environmental risks. This legislation applies to new models and models already being produced of cars and light commercial vans to be placed on the EU market. It requires that manufacturers recommend strategies in place to properly manage the reusability, recyclability and recoverability requirements of the legislation.

Further sources of evidence:

- Have your say¹¹⁰
- Legislative framework website¹¹¹.
- Public consultation¹¹².
- Evaluation SWD of the on end-of-life vehicles directive¹¹³.
- RegHub consultation on the implementation of the end-of-life vehicles Directive¹¹⁴.

5.3. Problem description

Existing evidence suggests the following issues:

The production of vehicles has undergone significant changes since the adoption of the Directive 20 years ago. These transformations have been influenced by the increasing use of

¹⁰⁸ Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles (OJ L 269, 21.10.2000, p. 34–43).

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0053&qid=1643133192245>

¹⁰⁹ Directive 2005/64/EC of the European Parliament and of the Council of 26 October 2005 on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability and amending Council Directive 70/156/EEC (OJ L 310, 25.11.2005, p. 10–27).

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32005L0064>

¹¹⁰ European Commission, Have your say, End-of-life Vehicles, https://environment.ec.europa.eu/topics/waste-and-recycling/end-life-vehicles_en.

¹¹¹ European Commission, Have your say, End-of-life Vehicles, https://environment.ec.europa.eu/topics/waste-and-recycling/end-life-vehicles_en.

¹¹² European Commission, End-of-life Vehicles – revision of EU rules, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-Revision-of-EU-legislation-on-end-of-life-vehicles/public-consultation_en.

¹¹³ European Commission, Commission Staff Working Document, Evaluation of Directive (EC) 2000/53 of 18 September 2000 on end-of-life vehicles (SWD(2021) 60 final), <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SWD:2021:0060:FIN:EN:PDF>.

¹¹⁴ European Committee of the Regions, *Fit for Future opinion on End-of-life vehicles and 3R-type approval* <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>.

new technologies and components in cars, such as plastics, carbon fibre or electronics, causing specific challenges for their recovery and recycling from ELVs.

Based on stakeholders' consultation¹¹⁵, the evaluation reports that with regard to regulatory burdens or complexities, the most common response¹¹⁶ on this point concerned **the overlaps between the ELV Directive and Batteries Directive**, as collection and recycling of batteries is already regulated by the latter. **Burdensome reporting** was another issue highlighted by some Authorised Treatment Facilities (ATF) due to the existing duplicated reporting obligations at the national level.

Respondents also specifically asked **to simplify the reporting obligations deriving from the ELV Directive by using online tools**.

Secondly, changes were also proposed in **the vehicle (de-) registration and notification systems**, with the suggestion that vehicle registrations could be cancelled directly by authorised dismantlers, which would reduce the workload for authorities and represent an effective measure to reduce the number of untracked exports and unregulated ELVs.

Findings of the survey on the administrative specific costs contribute also to the overall assessment of the administrative burden¹¹⁷. Although the responses received vary between Member States and should be treated with caution, the data collected show the tendency that companies, e.g., recyclers and ATFs, on average spend more resources on technical compliance than other stakeholder types. It also appears that public authorities seem to have higher costs across most categories, but particularly for data collection, and technical compliance.

The digitalisation of procedures linked to the implementation of the ELV Directive can potentially contribute to reducing administrative burden. However, regarding the other aspects, there is no clear evidence that the ELV Directive leads to unnecessary administrative burden or complex procedures for stakeholders, including private sector and public authorities.

Regarding coherence, there are also fairly numerous of discrepancies between the ELV Directive and other pieces of legislation. For example, the definitions of the terms “reuse” and “recycling” are different in the ELV Directive and in the Waste Framework Directive (WFD). The Waste Shipment Regulation establishes the rules governing the transboundary movement of waste vehicles, which are classified as “hazardous waste” for shipments inside and outside the EU. There is however a difficulty in distinguishing between a “used vehicle” and an “ELV” for export purposes. This is not specifically defined by the legal instruments, but guidance documents, such as the Waste Correspondents' Guidelines No 9¹¹⁸ on waste

¹¹⁵ European Commission, End-of-life vehicles – evaluating the EU rules, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1912-End-of-life-vehicles-evaluating-the-EU-rules_en.

¹¹⁶ It should be noted however that the majority of stakeholders who were consulted in the course of the evaluation did not know (52%), with a relatively even split between yes (35%) and no (33%).

¹¹⁷ Stakeholders were asked to provide information on their hours and costs necessary to administer ELV Directive issues, including data collection, reporting, monitoring and technical compliance issues.

¹¹⁸ European Commission, Environment, Waste Shipments, https://environment.ec.europa.eu/topics/waste-and-recycling/waste-shipments_en.

vehicles, have been developed. **These guidelines have however proven difficult to use in practice.** Another guidance document on the end-of-life vehicles provides the general rule on clarifying the links of the ELV Directive with the Directive on Waste Electrical and Electronic Equipment (WEEE) and the RoHS Directive on restriction of the use of certain hazardous substances in electrical and electronic equipment: “if the ELV Directives applies, the WEEE and RoHS Directives are not applicable”. Clearer distinction on defining which components are under the scope of the ELV Directive and which are under the scope of the RoHS/WEEE Directives would facilitate an ELV operator in attributing devices or parts of them to the correct waste stream.

In some instances, **the wording used in the Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability lacks precision and leaves room for interpretation.**

(Source: ELV Evaluation¹¹⁹)

While embracing the objectives of the ELV Directive, the respondents **to the RegHub consultation consider an update necessary**, due to, e.g., changes in vehicle production (e.g., the use of new technologies and components), the **increased production and use of electric vehicles, remaining unsolved problems like the handling of the certificate of destruction (COD) or a de facto absence of an extended producer responsibility for car manufacturers** in many Member States. In line with the evaluation's findings, **missing vehicles and illegal dismantling in unauthorised treatment facilities are a persistent problem and still constitute a major issue for the development and competitiveness of the authorised waste treatment sector** and require new solutions to enable high-quality recycling.

Many respondents agree that **the current ELV does not reflect sufficiently the importance of manufacturing components and materials in a way that they are easier to dismantle, reuse, recycle, and recover, and further to limit the use of non-recoverable components and hazardous substances.** Only if design requirements ensure that the respective components can be removed, recycled, and/or reinstalled (in particular regarding **electronics currently being blocked**), can ATFs effectively work and increase their revenue and viability. The creation of recovery/disposal value chains is another prerequisite.

The large majority of respondents to the RegHub consultation expect a revision of Directive 2005/64/EC (3R type approval) and Directive 2000/53/EC on end-of-life vehicles to **clarify definitions of reusability, recyclability, and recoverability** and align them with the ELV Directive and eventually increase legal certainty, transparency and avoid misinterpretation of provisions.

The **absence of reliable and comparable data** is seen as a major hurdle to appropriately determine both targets i.e., for recycling and recovery, and measures to counteract the

¹¹⁹ European Commission, Environment, End-of-life vehicles: evaluation of the ELV Directive published, https://environment.ec.europa.eu/news/end-life-vehicles-evaluation-elv-directive-published-2021-03-16_en.

phenomenon of missing vehicles and illegal export and dismantling. A common EU methodology for the calculation of the reuse and recycling targets is therefore largely supported, because it can avoid misinterpretation and create more reliable and realistic benchmarks and processes. According to the respondents, the **current regulation by Decision 2005/293/EC is not precise enough, manipulatable, and would need to be transposed into a reviewed ELV Directive.**

Most respondents would further support the Commission's proposal for direct cancellations of vehicle registrations by ATFs, given a solution is found for temporary deregistered vehicles' verifiable whereabouts, for which the last holder/owner should remain responsible. Moreover, **only if final de-registrations are linked to an obligation to hand over to an ATF, direct cancellation makes sense** (finally deregistered vehicle = waste). Another caveat is made with regard to vehicles deregistered for export: here, ATFs are not involved and some respondents argue, that therefore the final deregistration should remain with the vehicle registration authority.

Most respondents support a harmonised and **fully digitalised deregistration process to simplify the flow of information** and eventually lead to a creation of a European database that makes vehicle tracking possible and thereby tackling the issue of missing vehicles. They further advocate a harmonisation and digitalisation of CODs in order to increase their enforcement and make illegal dismantling more difficult across the EU.

Regarding the coordination with other legislation, the respondents underline the need to harmonise limit values and definitions in order to prevent contradictions, delineate responsibilities for market authorities, facilitate controls and enforcement, and simplify waste assessment.

Beyond the aforementioned levers to lift administrative burden and facilitate the implementation of the ELV, the RegHub respondents have made suggestions on how **an updated ELV Directive could be better aligned with core environmental principles such as the polluter-pays principle and the principle of waste hierarchy**. These measures are believed to address market and regulatory failures, increase the overall implementability of the Directive, better support the objectives of a circular economy, increase the viability of ATFs, adapt to new (technological challenges), and decrease burden in the long run:

- Adapt recycling and recovery targets to actual recoverability, and introduce material-specific targets – both taking into account new vehicle types and technologies;
- Introduce a European harmonised Extended Producer Responsibility (EPR);
- Privilege the use of materials in the vehicle design that increase the recyclability and durability of vehicles.

(Source: RegHub consultation¹²⁰)

¹²⁰ European Committee of the Regions, *Fit for Future opinion on End-of-life vehicles and 3R-type approval*, <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>.

The Fit for Future Platform has acknowledged the issues raised by the legislation concerned as follows:

Despite an overall positive assessment of the ELV Directive's objectives and implementation after more than 20 years, it is considered not to be future proof and therefore requiring an update in line with technological change, economic and environmental requirements, as well as in alignment with sectoral legislation.

The current Directive, guideline and practices do not sufficiently provide for clarity, transparency and comparability regarding definitions, targets, and methodologies. Moreover, the harmonisation and digitalisation of tools and processes, such as vehicle (de-)registration, and exchange of information between waste management operators and licensing authorities, including on certificates of destruction, is not complete, which makes the management of end-of-life vehicles burdensome. Insufficient information by vehicle manufacturers about materials and components used in vehicles contributes to the economic unviability of authorised treatment facilities. Current obligations to include recyclability and durability criteria in vehicle design and production are also not conducive to achieving ELV objectives and improve recyclability, recoverability and reusability of end-of-life vehicles.

The focus of the review should therefore be on the clarification, harmonisation and extension of existing definitions, targets and methodologies across Member States and in alignment with sectoral legislation. It should provide more clarity and transparency about vehicle composition and recyclability, in particular for waste management operators and authorities. Likewise, such clarity and transparency are needed for the deregistration of end-of-life vehicles, in order to be able to tackle the problem of missing vehicles and illegal dismantling. The inclusion of reviewed and new recycling and recovery targets, as well as an incentive system to improve waste reduction and recovery along the life cycle of a vehicle, from design to production to recovery, should be aimed at to effectively address new challenges.

The merge of Directive 2005/64/EC (3R type approval) and Directive 2000/53/EC on end-of-life vehicles was announced in the Commission Work Programme 2022 with a public consultation having taken place in summer/autumn 2021. While this opinion makes suggestions for the regulatory content, it does make any suggestions regarding a possible merge of the Directives.

5.4. Suggestions

Suggestion 1: Consider a digital vehicle passport including details on used materials

Description: In recent years, new vehicles have become increasingly difficult to dismantle and recycle as new substances are being used and the different parts of those vehicles as well as the way they are built into the vehicle have become more complex. Yet, dismantlers are still being provided only insufficient and legally uncoordinated information by vehicle manufacturers (for instance in most Member States via the IDIS-System [International

Dismantling Information System])¹²¹ regarding the presence, localisation, composition and re-use potential of components in ELV and regarding the presence of (hazardous) materials hampering high quality recycling.¹²²¹²³

Therefore, it is recommended to consider a mandatory digital "vehicle passport" that automobile manufacturers have to provide to dismantling facilities for every new vehicle model that enters the market and in line with the applicable requirements of related regulation, such as the expected EU battery regulation.¹²⁴ Similar procedures as for the repair and maintenance information in Annex X of the Regulation (EU) 2018/858 could be considered. This "vehicle passport" should include detailed information on the presence and localisation of vehicle parts and materials used as well as notices regarding their recyclability and references to parts for re-use.¹²⁵ Such "product passports" already exist for other products (cf. EU Ship Recycling Regulation or Proposal for Eco-design for Sustainable Products Regulation), especially technological devices, and have become common practice in these product areas.¹²⁶

In order to keep possible additional administrative burdens (e.g., through ICT-development) at acceptable levels, it is important to analyse the expected impacts of the vehicle passport on manufacturers, registration authorities, and other stakeholders in advance, and to develop any suggested system based on the experiences made with the existing systems, such as IDIS for dismantling, IMDS/GADSL/SCIP for material declarations/ SVHC declarations or individual platforms for tracking spare part availabilities (Catena-X, B-parts from individual groups of manufacturers). The simplification and reduction potential could be achieved through a targeted extraction of key information from existing platforms to respective end-users (consumers, garages, dismantlers, shredders, etc.) with different data needs.

Expected benefits: The electronic provision of such information would firstly facilitate the dismantling, re-use and recycling of vehicles and thus lower the costs of these measures. This would first and foremost decrease the burdens for dismantling facilities linked to the identification of the different materials used in the specific car type, their location inside the vehicle and the connections between the different vehicle components. Hence, the vehicle passport will lead to an easier and accelerated dismantling and recycling procedure. While the passport will increase the burdens for vehicle producers and the administration in terms of enforcing this passport, it will potentially also reduce some of the burdens for the administration in terms of the enforcement and control regarding the attainment of recycling goals by vehicle producers and dismantling facilities.

¹²¹ [Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014](#), 27.02.2017, (COM/2017/098 final), p. 5.

¹²² [Tesla response](#) to European Commission Inception Impact Assessment: Revision of Directive 2000/53/EC on end-of-life vehicles, Nov. 2020.

¹²³ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

¹²⁴ ELV IA: Improve circularity in the design, production and end-of-life treatment of vehicles (objective 2), 03.2022, p. 89.

¹²⁵ [European Environment Bureau feedback to the EU's road map the review of the End-of-Life Vehicles Directive, 19 November 2020](#), p. 4.

¹²⁶ [European Environment Bureau feedback to the EU's road map the review of the End-of-Life Vehicles Directive, 19 November 2020](#), p. 4.

The information provided would also allow more re-use and recycling and namely more "high-quality" recycling, preserving valuable materials. This would then not only have a beneficial economic impact due to the materials and components retrieved but also environmental benefits.

Suggestion 2: Refine the definitions for end-of-life vehicles and used vehicles/ parts of vehicles

Description: One of the largest issues with regards to the implementation of the ELV-Directive has been the illegal export of vehicles outside of the EU that are within the scope of the ELV-Directive and therefore should be disposed of within EU borders.¹²⁷¹²⁸ Amongst others, one of the central issues here has been the false labelling of end-of-life vehicles as "used vehicles" in order to bypass the provisions of the ELV Directive.¹²⁹

In order for authorities to have a clear guidance on which vehicles should be allowed for export as "used vehicles" and which vehicles should be prohibited from getting exported as "end-of-life vehicles", the definitions for these categories should be specified, as it has already (at least partially, but not legally binding) been done in the Correspondents' guidelines No. 9 on the disposal of ELV, adopted by the Member States,¹³⁰ which however are not deemed sufficient.¹³¹¹³²

Special attention should be given to export situations in which the differentiation between vehicle 'labels' is not straightforward (e.g., hobby cars vs. end-of-life vehicles), but requires additional measures to properly supervise ELV vehicles. The implementation in Italy can be considered a favourable example for such differentiation: While the Highway Code¹³³ allows deregistration for exports only if the vehicle complies with the Periodical Technical Inspection (PTI) and if no order for an extraordinary PTI has been issued by policy authorities, special cases, such as an owner selling a vehicle in another country, can be settled if the owner proves the re-registration in that country by submitting a copy of the corresponding registration certificate.

Likewise, a revised Directive should provide clear definitions for "re-use" and "preparing for re-use", since these are essential regarding the re-use of parts of ELVs and determine whether parts for re-use are put newly on the market and need to fulfil the respective requirements.

¹²⁷ Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014, 27.02.2017, (COM/2017/098 final), p. 10.

¹²⁸ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

¹²⁹ [Umweltbundesamt: Altfahrzeuge; German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 10.

¹³⁰ [Umweltbundesamt: Altfahrzeuge; Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014](#), 27.02.2017, (COM/2017/098 final), p.12, 13.

¹³¹ [Assessment of the implementation of Directive 2000/53/EU on end-of-life vehicles \(the ELV Directive\) with emphasis on the end of life vehicles of unknown whereabouts](#), December 2017, p. 19, 60.

¹³² RegHub consultation on the implementation of the End-Of-Life Vehicle Directive, 2022.

¹³³ Art. 103 of the Highway Code (Legislative Decree 285/92).

Regarding damaged vehicles, it should be ensured that technically repairable vehicles and parts of vehicles can only be resold to automotive professionals. (Parts of) vehicles that cannot be technically repaired must be sold for destruction to approved centres.

Expected benefits: This would lead to more certainty with regards to which cars have to be kept within EU borders for public authorities and potentially simplify administrative processes.¹³⁴

Countries outside of the EU, in which those vehicles are generally sold and disposed of, will benefit from a stricter EU export policy in two ways, if the latter is accompanied by a stricter supervision of exports of used vehicles and spare parts: First, a reduced intake of (parts of) inappropriately dismantled end-of-life vehicles, will reduce the number of disposed of vehicles and consequently the level of pollution caused by environmental dumping. Second, a reduction of the use of older, often more polluting, vehicles in the destination countries would reduce the level of air pollution in those countries¹³⁵

Furthermore, the materials retrieved from those end-of-life vehicles stopped from export can be reused within the EU which leads to their value staying within the EU as well.¹³⁶

Suggestion 3: Consider full digitalisation of the registration system and (2) installation of a central registration system and/or interoperable systems or ensuring the compatibility and coordination of the registration systems across and within Member States

Description: Currently, the degree of digitalisation of the registration system for vehicles varies between countries and still has not been fully achieved. This issue is also linked to the lack of a central common registration system and/or lack of compatibility and full coordination between the existing registration systems.¹³⁷ This leads to challenges occurring for vehicle owners and public authorities, especially when a car needs to be re-registered or deregistered in another region or Member State and the registration information is not available.¹³⁸ Such obstacles may lead to vehicle owners forgoing the deregistration procedure altogether and also to mistakes and system malfunctions happening regarding the registration and deregistration.¹³⁹

¹³⁴ [Umweltbundesamt: Altfahrzeuge](#); Stakeholder opinion [Czech Republic](#);

¹³⁵ [Umweltbundesamt: Altfahrzeuge](#); [German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 6.

¹³⁶ [Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014](#), 27.02.2017, (COM/2017/098 final), p.12.

¹³⁷ [German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 7.

¹³⁸ [Assessment of the implementation of Directive 2000/53/EU on end-of-life vehicles \(the ELV Directive\) with emphasis on the end of life vehicles of unknown whereabouts](#), December 2017, p. 58.

¹³⁹ [German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 8.

The lack of digitalisation and coordination thus makes it difficult in some cases to determine a vehicle's status with certainty, which also facilitates the illegal dismantling and disposal of vehicles at unauthorized treatment centres and the export to countries outside of the EU.¹⁴⁰

Therefore, it is recommended, that the Commission analyses the advantages and disadvantages of a common EU digital registration system¹⁴¹ and thoroughly assesses its impacts. Should the expected administrative burden for setting up a central system exceed its expected benefits, it should at least be ensured that the different Member States' registration systems are made compatible with each other and/or are being coordinated, e.g., by harmonising the terms, data, and impact of de-registration and by requiring a harmonised digital registration of information to enable the EU-wide exchange of information, e.g., by using the EUCARIS-System,¹⁴² and expanding the e-CoC concept.

Expected benefits: While these adaptations will require additional administrative efforts in the beginning, from a long-term perspective they will simplify the administrative work and decrease the administrative burden that is linked to the registration process, as seen in Portugal or Italy, where a central digital registration system is already in place.¹⁴³ In Italy, registration procedures both for export and scrapping are fully digitised and allow authorities and qualified private companies to access a fully telematic registry.¹⁴⁴

With these improvements regarding the registration and deregistration process, these procedures will be more time-efficient and thus will also present an advantage to car owners that want to re- or deregister their vehicle in another Member State.

Moreover, this would allow for better control of the vehicles' status and strengthen the ability of enforcement authorities to carry out more stringent checks on compliance. This would potentially decrease the loss of vehicles as it would improve the vehicles' traceability.¹⁴⁵ This again would help against the loss of raw materials that could otherwise be recycled in the EU (as seen above).

¹⁴⁰ [European Environment Bureau feedback to the EU's roadmap the review of the End-of-Life Vehicles Directive](#), 19 November 2020, p. 1.

¹⁴¹ [Tesla response](#) to European Commission Inception Impact Assessment: Revision of Directive 2000/53/EC on end-of-life vehicles, Nov. 2020.

¹⁴² [German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 7; Oeko-Institut e.V., Institute for Applied Ecology: [Assessment of the implementation of Directive 2000/53/EU on end-of-life vehicles \(the ELV Directive\) with emphasis on the end of life vehicles of unknown whereabouts](#), December 2017, p. 17.

¹⁴³ [Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014](#), 27.02.2017, (COM/2017/098 final), p. 11.

¹⁴⁴ Legislative Decree No. 98/2017 establishes the "Single Registration and Ownership Document"; services are provided through a telematic motorist information point.

¹⁴⁵ [Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014](#), 27.02.2017, (COM/2017/098 final), p. 10.

Suggestion 4: Enforce the certificate of destruction (COD) necessary for deregistration and implement a systemic differentiation between temporary and permanent deregistration

Description: In most Member States, the deregistration is currently handled by public authorities while the dismantling is carried out by private dismantling facilities. At the same time, not all countries require the vehicle's last owner to provide a COD upon deregistration, which is serving as a proof that the vehicle has been properly dismantled, as it is required by the directive. This is due to the circumstance that some countries (e.g., Germany) do not differentiate between short-term deregistration and final deregistration or deregistration for final disposal or other purposes.¹⁴⁶

Thus, due to the lack of coordination, a destructed car is not necessarily also deregistered (which some Member States, e.g., Portugal, have tried to avoid by setting up a tax that only is dropped if the car is properly deregistered),¹⁴⁷ and a deregistered vehicle does not necessarily need to be destructed, leading to uncertainty regarding the vehicles' status.¹⁴⁸

Hence, it is recommended, that the Member States should be required to implement a system that requires every car owner to provide a COD issued by an authorized dismantling facility before permanent deregistration¹⁴⁹¹⁵⁰ and, therefore, if not already practiced, systematically differentiate between temporary and permanent de-registration.¹⁵¹ Such system could further be harmonised across the EU, because otherwise an illegal dismantling shadow economy in one Member State may undermine the efforts in another Member State.

In order to decrease the workload for authorities regarding the vehicle deregistration, make it more effective and easier to enforce, the use of digitalised CODs and the strengthening of internet-based exchanges between the vehicle registration authority and the recovery facilities are seen as indispensable.¹⁵²

In addition to the differentiated process for deregistration, Member States could be encouraged to introduce systems of incentives that ensure that a vehicle's status is known and that temporarily deregistered vehicles are re-registered with specified time-limits. Depending

¹⁴⁶ [German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 9, 10.

¹⁴⁷ [Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014](#), 27.02.2017, (COM/2017/098 final), p. 10.

¹⁴⁸ [Tesla response](#) to European Commission Inception Impact Assessment: Revision of Directive 2000/53/EC on end-of-life vehicles, Nov. 2020; [German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 6, [Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the period 2014-2017](#), 30.01.2020, (COM/2020/33 final), p. 10.

¹⁴⁹ [Tesla response](#) to European Commission Inception Impact Assessment: Revision of Directive 2000/53/EC on end-of-life vehicles, Nov. 2020; [German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 8.

¹⁵⁰ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

¹⁵¹ [German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 9.

¹⁵² RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

on the national situation, such system may – besides de-registration time-limits – include measures such as reporting duties for car owners, or rewards for deregistration and dismantling (see suggestion 5).¹⁵³¹⁵⁴ Other examples for incentives for vehicle owners to properly return end-of-life vehicle to ATFs, include the linking of the COD for an end-of-life vehicle to the insurance premium (as in place in the Czech Republic) or to specific taxes (e.g., road taxes in Spain).¹⁵⁵

In the absence of incentives, vehicle owners might bypass the destruction obligation by temporarily deregistering an end-of-life vehicle, not having to fear any follow-up on the re-registration. The introduction of such measures should follow common guidelines to be introduced by the European Commission in order to assure a coherent treatment of temporarily deregistered vehicles. Provisions regarding time limits for temporary deregistration should be designed in a way that the administrative burden for registration authorities is kept to a minimum.

Direct vehicle deregistration by ATFs can be envisaged if it can be ensured that final deregistration is equivalent with the handing-over to a recovery facility (i.e., deregistered vehicle = waste).¹⁵⁶

Expected benefits: This would ensure that only dismantled cars are permanently deregistered and that authorities have an oversight on the vehicles' status, i.e. whether it has been destructed or just temporarily deregistered.

In the latter case of temporary deregistration, the reporting duties of car owners on the vehicle's status and limitation of the time period, during which a vehicle can be temporarily deregistered, can act as a tool for public authorities to control the implementation of the ELV-Directive's objectives but also to ensure the tracking of vehicles even after deregistration. Likewise, can a system of (dis-)incentives encourage timely reregistration and increase the number of vehicles actually dismantled in line with the ELV Directive.

With the deregistration procedure thus being designed more comprehensively by better streamlining the vehicle (de)registration procedures with the ELV specific provisions, this would potentially discourage car owners from illegally selling their end-of-life vehicles or letting them be dismantled at unauthorized dismantling facilities. Hence, it would also have a positive environmental and economic (due to the materials' values) impact.

Suggestion 5: Improve implementability of the ELV-Directive's requirements through a reward system for deregistration and/or dismantling

Description: With one of the biggest challenges in the implementation of the ELV-Directive being the loss of end-of-life vehicles due to illegal exports or illegal disposal,¹⁵⁷ it has been

¹⁵³ [German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 9.

¹⁵⁴ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

¹⁵⁵ EuRIC (2022) EuRIC Position Paper: EPR schemes for ELV.

¹⁵⁶ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

observed that financial incentives have helped increase the number of cars dismantled and deregistered and therefore have helped with the implementation of the ELV-Directive.¹⁵⁸¹⁵⁹

There are two major ways in which Member States have created such financial incentives, one being the introduction of rewards for dismantling (e.g. the "Abwrackprämie" (=scrapping premium) in Germany and similar initiatives in France, Italy and Spain in 2008/09¹⁶⁰) and the other one being a reward system for the deregistration for example in Portugal and Denmark.¹⁶¹ If scrapping premiums are used, they should be designed in a way that ELV recyclers are not passed over and put at a disadvantage compared to shredder companies, i.e. that the provisions allow the transfer of end-of-life vehicles to parts recyclers.

Negative financial incentives for non-compliance with current regulations, such as fines for last owners/holders who dispose of their vehicle illegally or transfer only incomplete end-of-life vehicles to ATFs, and penalties for illegal dismantlers might be considered as well.¹⁶²

Therefore, it is recommended that the Commission encourages Member States to establish such reward systems for deregistration and/or dismantling, taking into account the country-specific situation.¹⁶³ A potential reward system for dismantling could include the condition that the reward is used for more sustainable transportation alternatives (including electric cars), while a reward system for deregistration could be such that charges are levied for the duration of the temporary deregistration, which should be lifted if the car is permanently deregistered.

Expected benefits: This will potentially reduce the number of vehicles that are being illegally exported or disposed, thus improve implementability of the ELV-Directive.¹⁶⁴ With the incentive to dispose of vehicles correctly, a reward system will also have environmental benefits due to proper recycling in authorised facilities and economic benefits due to the materials recovered.¹⁶⁵

¹⁵⁷ [European Environment Bureau feedback to the EU's roadmap the review of the End-of-Life Vehicles Directive, 19 November 2020](#), p. 1.

¹⁵⁸ RegHub consultation on the implementation of the ELV Directive 2022: All of the respondents agree or rather agree that financial incentives such as insurance premiums or fines help enforce the certificate of destruction.

¹⁵⁹ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

¹⁶⁰ [Umweltbundesamt: Altfahrzeuge; Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014](#), 27.02.2017, (COM/2017/098 final), p. 7.

¹⁶¹ [Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014](#), 27.02.2017, (COM/2017/098 final), p. 10, 11.

¹⁶² RegHub consultation on the implementation of the End-Of-Life Vehicle Directive, 2022.

¹⁶³ Cf. propositions by [German Environment Agency: Scientific opinion paper: Effectively tackling the issue of millions of vehicles with unknown whereabouts](#), 2020, p. 7; Oeko-Institut e.V., Institute for Applied Ecology: [Assessment of the implementation of Directive 2000/53/EU on end-of-life vehicles \(the ELV Directive\) with emphasis on the end of life vehicles of unknown whereabouts](#), December 2017, p. 118.

¹⁶⁴ As seen in Portugal, cf. [Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014](#), 27.02.2017, (COM/2017/098 final), p. 10.

¹⁶⁵ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

Suggestion 6: Ensure coherence with other legislation, e.g., the Batteries Directive 2006/66/EC and the REACH Regulation

Description: Currently, treatment facilities are subject to various different provisions stemming from different directives with some of their obligations being redundant or not well aligned in certain constellations, e.g., regarding the Batteries Directive and the ELV-Directive in the case of electric vehicles.¹⁶⁶ With the growth of the electric vehicle market, the revision of the ELV-Directive should therefore be closely aligned with the revision of the Batteries Directive.¹⁶⁷

Likewise, a revision of the ELV Directive should take into account inconsistencies and gaps currently found with regard to the REACH Regulation. In this context, special attention should be given to ensure the re-use of parts from the circular economy. While a merging of the two legislations is considered difficult, for at least limit values regarding the hazardousness of waste should be consistent.¹⁶⁸

It is therefore recommended, to examine the reporting obligations imposed by related directives and find a clearer differentiation with regards to the applicability of the directives in order to avoid doubled reporting obligations.¹⁶⁹ Moreover, contradictory definitions, limit values and targets should be assessed and streamlined.¹⁷⁰

Expected benefits: This will significantly increase definitory clarity, decrease the workload with regards to reporting obligations and thus potentially lead to reporting obligations being complied with more frequently. Consistent definitions and limit values will also facilitate controls and enforcement for market surveillance authorities and simplify waste assessment with regard to its hazardousness.

Suggestion 7: Improve compliance and enforcement possibilities through more realistic targets, common methodologies, and increased producer responsibility

Description: The current design of the ELV Directive leaves the treatment of end-of-life vehicles behind its possibilities. While country-specific circumstances need to be taken into account and accurate cost-benefit analyses need to be the basis of any revision that includes new procedures and measures, some adjustments could be considered in order to sharpen the targeting of the Directive and to address situations of market and regulatory failure. Such opportunities can currently be identified with regard to better definitions, better specifications for pre-treatment removal and post-treatment shredding, minimum quality requirements, recycled content targets, and material-specific targets for some materials. If cost-effective

¹⁶⁶ Input from stakeholders; [Tesla response](#) to European Commission Inception Impact Assessment: Revision of Directive 2000/53/EC on end-of-life vehicles, Nov. 2020.

¹⁶⁷ [European Environment Bureau feedback to the EU's road map the review of the End-of-Life Vehicles Directive, 19 November 2020](#), p. 4.

¹⁶⁸ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

¹⁶⁹ Input by stakeholders.

¹⁷⁰ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

solutions are found, they can help to reduce the currently disproportionate regulatory burden faced by ATFs, and ultimately to achieve reuse, recycling and recovery targets in line with the polluter pays principle and the principle of waste hierarchy.

Common definitions and methodologies can enable more realistic targets and improve recycling and recovery

In the absence of a common methodology for the calculation of reuse and recycling targets, a desirable cross-EU comparison of results and performance regarding the achievement of ELV targets is impossible.¹⁷¹ A common methodology could further inform a more realistic and reliable setting of benchmarks and processes. The current regulation of calculation methods in Decision 2005/293/EC is considered not to be precise enough and therefore manipulatable. It is therefore recommended to propose a common methodology in a reviewed Directive 2000/53/EC.¹⁷²

A common definition of Post Shredder Treatment (PST) in the revised Directive could have advantages, because standardised separation and clearly defined treatment processes after shredding, leave less room for different interpretations, and eventually improve recovery and reduce environmental impact, e.g., by better management of 'fluff'.¹⁷³ Likewise, a minimum PST quality requirement on how to perform a shredder campaign – taking into account sectoral and country specific conditions – can improve recycling quality. A common definition of PST and common methodologies must not hinder innovation and competitiveness of ATFs with regard to shredding and post-shredding technologies, and should leave sufficient room to account for national conditions.¹⁷⁴ Test shreddings on randomly selected vehicles carried out in accordance with the Directive's provision could not only inform a common methodology as such, it could also help to review and establish standards for both combustion and electric vehicles.¹⁷⁵

Expected benefits: To introduce a binding common methodology for the calculation of reuse and recycling targets makes target values more transparent, realistic and achievable. It is thus expected to facilitate benchmarking and increase compliance with ELV targets.

A common definition of PST and a common methodology on how to perform a shredder campaign is expected to facilitate and improve recovery and reduce environmental impact, if it can be ensured that national conditions are taken into account and if new dismantling obligations are informed by comprehensive cost-benefit analyses.

Adapted and more realistic recycling targets can improve dismantling and high-quality recycling

The adaptation to technological development, including the increasing production and use of electric vehicles, the potential introduction of new vehicle types into the reviewed ELV Directive, and the continuous introduction of new (hazardous) substances to the vehicle

¹⁷¹ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

¹⁷² RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

¹⁷³ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

¹⁷⁴ EuRIC (2022) EuRIC Position Paper: EPR schemes for ELV.

¹⁷⁵ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

production process, as well as the economic necessity to recover critical raw material, make a review of recycling targets necessary.¹⁷⁶

As mentioned before with regard to common calculation methods for recycling targets, any change or the creation of new (material-specific) targets should be based on reliable data and tests for different vehicle types, investigating the balance of materials and products, as well as the cost of management. To account for differences across Member States, varying fleet age and the actual capacity of dismantlers have to be considered, when determining calculation and finally targets.¹⁷⁷

It is therefore recommended to review the currently existing combined reuse and recycling targets based on weight and introduce material-specific targets, i.e., for low-volume critical raw material, where manageable and based on real data. To enable compliance, country-specific conditions have to be taken into account and waste management facilities should be supported to ensure their sustainability and competitiveness.

Further, to contribute to higher rates of reuse parts to make the removal of vehicle parts before shredding mandatory under the revised Directive for a list of components that can be updated is largely supported by the RegHub network.

Expected benefits: A higher contribution to circular economy objectives, more realistic targets, and material-specific targets based on real data will increase compliance, improve dismantling and separation, enable the recovery of critical raw material and overall increase high-quality recycling.

Including recyclability and durability criteria in vehicle design can facilitate dismantling and lift implementation burden from ATFs

The principle of waste hierarchy favours waste prevention as most effective mean to reduce negative impact and improve resource efficiency. Vehicle manufacturers are in a good position to prevent waste, when designing their vehicles, taking into account criteria favouring the recyclability and durability of materials and components. Vehicles currently on the market are less and less easy to reuse, recycle and recover, because such criteria are not sufficiently respected. The extensive use of electronic components and the development of proprietary software or hardware also has repercussions on the vehicle design and risks to hamper cross-brand services including dismantlement. This contributes substantially to the economic unviability of ATFs, difficult and insufficient recovery, and to higher levels of pollution.

In line with the polluter-pays principle, it is therefore recommended to consider the creation of incentives for vehicle manufacturers to comply with eco-design criteria, including through the introduction of a European harmonised Extended Producer Responsibility (EPR), specifically tailored to end-of-life vehicle recycling. Such measure could include a financial contribution of vehicle manufacturers to compensate the average loss per vehicle for ATFs,

¹⁷⁶ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

¹⁷⁷ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022.

with a particular focus on concepts that are not economically viable (e.g., plastics, glass, batteries)¹⁷⁸. Should EPR schemes be considered for the revision of the ELV Directive, it should be ensured that well-functioning recycling processes are not disrupted. Existing effective relationships between manufacturers and ATFs should not be jeopardised by new requirements¹⁷⁹. Further discussions could also consider the role of circular VAT rates, favouring the repair and reuse of (parts of) vehicles.

Furthermore, the suggested "vehicle passport" will only have real consequences, if the materials and components used are actually removable, reusable, recyclable and recoverable. Therefore, it is suggested to introduce design requirements and liability schemes that further facilitate dismantling and improve waste management. Modular design, standardisation, higher recovery rates, and use of recycled material and reuse of components should be encouraged, including by the setting of (new) targets, such as recycled content targets.

Additional measures such as mandatory life cycle analyses, where appropriate, for each vehicle and the obligation to ensure that only such materials, for which a reuse or recycle value chain is in place, are being used, can support this.

Expected benefits: All measures are expected to incentivise vehicle manufacturers to produce better recyclable vehicles, i.e., by using less heterogeneous components and improving removability, and invest more resources to develop more sustainable products and processes. Both, design requirements and financial contributions by manufacturers, will facilitate the work of ATFs, reduce their costs and increase their revenues from better management.

¹⁷⁸ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022; EuRIC (2022) EuRIC Position Paper: EPR schemes for ELV.

¹⁷⁹ EuRIC (2022) EuRIC Position Paper: EPR schemes for ELV.

ANNEX 6: PROBLEMS AND DRIVERS

6.1. Introduction

The Impact Assessment addresses four main problem areas, which are partially inter-related:

1. The design and production of new vehicles do not sufficiently contribute to the ambitions of the Green Deal for a climate-neutral, clean and circular economy (“**design**” problem area);
2. The treatment of vehicles at the end of their life is suboptimal compared to its potential to contribute to a climate-neutral, clean and circular economy (“**end-of-life treatment**” problem area);
3. An important share of vehicles subject to the ELV Directive are not collected to be treated in sound environmental conditions in the EU, contributing to the EU external pollution footprint in third countries (“**collection**” problem area);
4. There is no EU level playing field for the design, production and end-of-life treatment of vehicles which are outside the scope of the ELV Directive, resulting in a situation where the contribution of these vehicles to the objectives of the Green Deal and circular economy objectives is under-exploited (“**scope**” problem area).

Presentation of the problems, drivers and consequences has been framed taking into account the further structuring of the policy options, as some of these options are directly related to a single main problem, whereas others are indirectly related to multiple problems, especially in the case of extension of vehicle category scope and extended producer responsibility.

Figure 6.1 Overview of problems, drivers and consequences

Problems	Drivers	Consequences
Lack of integration of circularity in design and production	Market failures: - Externalities of primary raw materials not priced in at design. - Use of new and difficult to recycle materials - Limited availability of secondary raw materials of sufficient quality to meet modern standards - Lack of financial incentives to increase recycled content Legislative failures: - Imprecise formulation of ELV requirements - Imprecise and theoretical 3RTA requirements - Lack of adequate dismantling information - Inconsistent and outdated hazardous substance restrictions	Increased dependency on primary raw materials and limited decarbonisation potential in supply chains
Lack of quality and quantity in reuse and recycling at end-of-life treatment	Market failure: - High costs for dismantling and economies of scale - Costly PST treatment of automotive shredder residues - Lack of quality of ELV scraps like steel and aluminium - Lack of incentive to provide targeted dismantling information Regulatory failure: - Too ‘broad’ ELV definition of recycling allowing backfilling - Lack of reuse incentives	Insufficient reuse and recycling and loss of valuable resources Damage to the environment and human health from unsound treatment
‘Missing vehicles’ cause environmental impacts	Market failure: - Higher revenues from informal and illegal treatment activities - Higher revenues export used vehicles than EU recycling Regulatory failure: - Lack of traceability ELVs - No systemic exchange of registration information - Insufficient monitoring and enforcement - Guidelines used vs. waste vehicles non-legally binding	35% of total vehicles are “missing” causing loss of resources and pollution in third countries.
No EU level playing field to improve circularity for trucks, buses + motor-cycles	Market failure: No economic incentives to improve design Regulatory failure: Lack of clarity on responsibilities Market failure: Information availability Regulatory failure: motorcycles, trucks, buses, lorries ‘not in scope’	Restrained circularity potential of vehicles currently out of scope

The aim of the following sections of this Annex is to provide a descriptive overview of the problem areas, key drivers, developments and their interlinkages

6.2. Problem area No.1: Lack of integration of circularity in vehicle design and production

This is a dedicated section to overview all the relevant circularity specific problems emerging in the automotive sector that prevent the design, production of road vehicles be consistent with the levels of recycling and reuse necessary to contribute to the ambitions of the Green Deal to create a climate-neutral, clean and circular economy.

The evaluation of the End-of-Life Vehicle Directive and the 3R type-approval Directive¹⁸⁰ identified areas where the current legislation lies behind in terms of promoting a truly circular approach for the automotive sector due to the missing links between design and end-of-life treatment stages. Therefore, this review is looking into the shortcomings of both the End-of-Life Vehicle Directive and its mirror type approval Directive on vehicle reusability, recyclability and recoverability, which prescribe the requirements for the vehicle placement on the market with the rules for the end-of-life.

The following subsections provide an overview of the core circularity-related problem areas, their key drivers and consequences.

6.2.1 What is the key problem?

The EU is among the world's biggest producers of motor vehicles. The automotive sector provides direct and indirect jobs to 13.8 million Europeans, representing 6.1% of total EU employment. In 2021, 12 million motor vehicles (cars, vans, lorries, buses) were manufactured in the EU and 11.5 million were placed on the EU market¹⁸¹. **The production of new vehicles represents a significant impact in terms of use of raw materials. Europe's automotive sector is responsible for 19% of the demand of the EU's steel industry (over 7 million tonnes/year¹⁸²), 10% of the overall consumption of plastics (6 million tonnes/year¹⁸³), as well as a significant share of the demand for aluminium (42% for all transport equipment, around 2 million tonnes/year¹⁸⁴), copper (6% for automotive parts¹⁸⁵), rubber (65% of the production of general rubber goods¹⁸⁶) and glass (1,5 million tonnes of flat glass produced at the EU¹⁸⁷).**

The electrification of the automotive sector, combined with the increasing integration of electronics in vehicles, will lead to a growing use of copper, critical raw materials including rare earth elements. Rare earth elements (REEs) are mainly used for permanent magnets in EVs (average weight of 1-2 kg of permanent magnets per EVs), platinum group metals (PGMs) for catalytic converters (77% use share in autocatalysts) and printed circuit boards, gallium for lighting equipment and integrated circuits, magnesium (50% use share in automotive sector) and

¹⁸⁰ published in March 2021 https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1912-End-of-life-vehicles-evaluating-the-EU-rules_en

¹⁸¹ <https://www.acea.auto/figure/key-figures-eu-auto-industry/>

¹⁸² More information available at: <https://www.eurofer.eu/publications/economic-market-outlook/economic-and-steel-market-outlook-2022-2023-third-quarter/>

¹⁸³ Based on JRC study report on recycled content of plastics in the vehicles.

¹⁸⁴ https://rmis.jrc.ec.europa.eu/uploads/CRM_2020_Factsheets_critical_Final.pdf

¹⁸⁵ https://rmis.jrc.ec.europa.eu/uploads/CRM_2020_Factsheets_non-critical_Final.pdf

¹⁸⁶ More information available at: <https://www.etrma.org/rubber-goods/>

¹⁸⁷ More information available at: <https://glassforeurope.com/the-sector/key-data/>

niobium (23% use share in automotive steel) for metal alloys, and natural rubber for production of tyres. Electric and electronic systems in vehicles also contain e.g., precious metals, gallium, tantalum, and REE.

The market demand has also resulted in a steady rise in sales of Sport Utility Vehicles (SUVs). SUVs represented around 40% of annual car sales of vehicles in Europe in 2020, compared to 10% in 2010¹⁸⁸. SUVs are heavier than conventional cars and their production requires the supply of a higher amount of primary materials, which increases considerably their environmental footprint. The relevance of these aspects is also recognised in terms of fuel efficiency. As noted in the EEA report on Monitoring CO₂ emissions from passenger cars and vans in 2018¹⁸⁹, an increase in sales of Sport utility vehicles (SUVs) was observed in recent years. In Europe, one out of three cars newly registered in 2018 were SUVs. Compared to regular cars (as hatchback or sedan), SUVs are typically heavier and have more powerful engines and larger frontal areas – all features that increase fuel consumption. On the broader terms, the EU is on the track to strengthen the CO₂ emission reduction requirements¹⁹⁰. These should incentivise an increasing share of zero-emission vehicles being deployed on the Union market whilst providing benefits to consumers and citizens in terms of air quality, strengthening energy security and efficiency, and the associated energy savings, as well as ensuring that innovation in the automotive value chain can be maintained. Within the global context, also the EU automotive chain is seen as a leading actor in the on-going transition towards zero-emission mobility.

All these considerations led to the fact that the production of vehicles represents a considerable environmental footprint, primarily due to the GHG emissions linked to the energy required for the extraction and processing of primary materials such as coal and iron ore (for steel), bauxite (for aluminium), copper or oil (for plastics). The extraction and processing of metals represent about 10% of global greenhouse gas emissions globally¹⁹¹. In the EU, the steel industry represents 5% of CO₂ emissions while the aluminium industry accounts for 2% of global CO₂ emissions. The EU consumption linked to the raw material supply chains also has a social impact in third countries and is deemed to account for 14% of imported GHG emissions¹⁹².

¹⁸⁸ More information is available at: <https://www.iea.org/commentaries/growing-preference-for-suvs-challenges-emissions-reductions-in-passenger-car-market>, <https://www.iea.org/commentaries/carbon-emissions-fell-across-all-sectors-in-2020-except-for-one-suvs>, <https://www.iea.org/commentaries/carbon-emissions-fell-across-all-sectors-in-2020-except-for-one-suvs>, and <https://www.eea.europa.eu/publications>

¹⁸⁹ <https://www.eea.europa.eu/publications/co2-emissions-from-cars-and-vans-2018>

¹⁹⁰ See the EP position on the Commission Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/631 as regards strengthening the CO₂ emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition (PE-CONS No/YY - 2021/0197(COD)).

¹⁹¹ <https://www.resourcepanel.org/reports/global-resources-outlook>

As indicated in <https://www.iea.org/reports/iron-and-steel-technology-roadmap> “Among heavy industries, the iron and steel sector ranks first when it comes to CO₂ emissions, and second when it comes energy consumption. The iron and steel sector directly accounts for 2.6 gigatonnes of carbon dioxide (Gt CO₂) emissions annually, 7% of the global total from the energy system and more than the emissions from all road freight.1 The steel sector is currently the largest industrial consumer of coal, which provides around 75% of its energy demand. Coal is used to generate heat and to make coke, which is instrumental in the chemical reactions necessary to produce steel from iron ore”.

¹⁹² See UN Sustainable Development Solutions Network report: Tracking forced labour, accidents at work and climate impacts in the EU's consumption of fossil and mineral raw materials (2022), available at <https://irp.cdn-website.com/be6d1d56/files/uploaded/56690-1%20-%20SDSN%20Study%20-%20v3.pdf>

The dependence on primary materials is also making the supply chain for the automotive industry more vulnerable, compounding the challenges observed recently with disruptions for semi-conductors or magnesium and the hike in energy prices consecutive to the war in Ukraine.

While the automotive industry is undergoing profound changes towards climate-neutrality when it comes to the use phase of vehicles through the electrification of the vehicle fleet, it is only starting to embrace the full transition to a circular economy. This aspect is however central for the efforts of the automotive industry to move towards the decarbonisation of their production process. In the current situation, the integration of circular models in the design, production and end-of-life stages of the vehicle lifecycle remains insufficient to attain the objectives of the Circular Economy Action Plan to “*promote more circular business models by linking design issues to end-of-life treatment, consider rules on mandatory recycled content for certain materials, and improve recycling efficiency*”. As a result, millions of tonnes of resources (including CRMs) are lost for the environment and the economy.

Closely linked to this problem is that of the use of hazardous substances in vehicles and its component parts. A large variety of chemicals, some of them classified as hazardous, are used in vehicles to provide different functionalities to coatings, alloys, electrical and electronic components, lubricants, hydraulic fluids and rubber, plastic, composite and textile elements used in the different parts that ultimately constitute a vehicle. Depending on their nature, use and location in the vehicle such hazardous substances can potentially pose a risk during vehicle manufacture and its subsequent service life and will remain therein once the vehicle reaches its end-of-life. The presence of such substances in materials that result from the disassembly, shredding and subsequent processing of the different vehicle fractions can pose a risk to the operators involved in the recycling operations and, if they remain present in the recovered materials (e.g. recovered alloys, plastic, etc) may make them unsuitable for their use as secondary raw materials. This is due to risks in their subsequent processing and use and from commercial and reputational risks that make them unattractive to the market due to quality and legal constraints brought about by the presence of these substances.

The presence of hazardous substances, especially of substances of concern¹⁹³, in vehicles and in the materials subsequently recovered from them, may hinder the circularity of materials in vehicles, reducing their uptake into the economy and can potentially be a risk to human health and the environment during their whole life cycle. In turn this can have clear consequences in terms of adverse human and environmental health effects (due to exposure / releases of substances) and reduce the amounts of materials recovered from vehicles, thereby putting greater stress on primary resources, requiring additional waste disposal capacities and increasing the overall amount of greenhouse gas emissions typically associated to the use of primary materials (which have to replace material that would otherwise be recycled).

6.2.2 What are the key problem drivers?

The **drivers** for this problem are a combination of market and regulatory failures which result in a lack of integration of circularity in the design and production phase of vehicles.

- *Market failure - the price of primary materials is not competitive to the price of secondary materials*

¹⁹³ As defined in Article 2(28) of the Commission proposal on a Regulation establishing a framework for setting ecodesign requirements for sustainable products. COM(2022) 142 final.

The prices of primary materials do not integrate the environmental externalities linked notably to their extraction and processing and have been usually lower than the prices of secondary materials due to economies of scale. Competitive price of recycled vs. virgin is highly dependent on the oil price which also hinders investments. Integration of recycled plastics is often considered as less straightforward by the automotive stakeholders due to the potential difference in mechanical or aesthetics properties and substances composition between virgin and recycled materials. The automotive industry has therefore not been incentivised to change its supply chain to source its products from recycled materials. The lack of demand for secondary materials from the automotive industry has in turn not encouraged the recycling sector to invest and increase the supply and quality of recyclates for their integration into new vehicles.

- *Market failure - insufficient quality and market availability of secondary materials*

The automotive industry relies heavily, for the production of new vehicles, on the supply of primary raw materials and uses very little recycled materials. One reason is that the automotive industry requires materials like steel or aluminium alloys with a high level of purity and/or specific properties, which are not commonly available from recycling processes. Primary raw materials are also often cheaper and produced in larger volume than recyclates. The incorporation of recycled materials in new vehicles depends on the ability to guarantee a stable supply for suitable quality and volume of materials. Absence of legally mandatory recycled content targets for vehicles at the EU level have also contributed to this situation. This is the case for plastics, which explains why the share of recycled plastics used by the automotive sector is very low (2-3% on average¹⁹⁴), where uptake of the recyclates is carried primarily on voluntary basis.

- *Regulatory failure - the current EU rules have not been effective enough to improve the eco-design of vehicles*

Regulatory requirements have focused on the use phase of vehicles (rather than production and end-of-life stages). In addition, the growing use of new techniques to assemble parts (typically gluing elements instead of using screws) makes their disassembly more challenging and costly when vehicles reach the end of their life. It also hampers recycling as it prevents the division of shredded elements. **On the other hand, the provisions in the ELV Directive¹⁹⁵ on the design of cars to facilitate dismantling, re-use, remanufacturing and recycling, as well as the uptake of recycled materials, are too vague and general.** The most ambitious, specific and measurable provisions of the ELV Directive concern the “waste stage” of the vehicle, rather than its design and production. Article 4(1) obliges the Member States to take certain actions contributing to waste prevention, however, it is not clear how they should encourage vehicle manufacturers at the EU level to design and produce new vehicles which take into full account and facilitate the dismantling, reuse and recovery, in particular the recycling, of end-of-life vehicles, their components and materials. Moreover, the EU rules do not explain if they aim to ensure how the actions taken by the manufacturers should be coordinated and harmonized at the EU.

¹⁹⁴ Average recycled content for post-consumer materials in vehicle ranges from 2 to 3% of the total mass of plastics). However, this range can reach 6% to 8% for some front-runner OEMs. More information available at Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008.

¹⁹⁵ Article 4(1)(b) and (c)

The provisions in the 3R type-approval Directive also lack precision and leave room for interpretation. Article 6(3) of the Directive states: *“For the purpose of paragraph 1, the manufacturer shall recommend a strategy to ensure dismantling, reuse of component parts, recycling and recovery of materials. The strategy shall take into account the proven technologies available or in development at the time of the application for a vehicle type-approval.”* Generally, the manufacturer submits the strategy for dismantling etc. during the preliminary assessment. Certificate of compliance, granted during the type-approval process, shall describe this strategy recommended by the manufacturer (Article 6(5)). For this purpose, a ‘strategy’ is defined as a large-scale plan consisting of coordinated actions and technical measures to be taken as regards dismantling, shredding or similar processes, recycling and recovery of materials to ensure that the targeted recyclability and recoverability rates are attainable at the time a vehicle is in its development phase. Though, the ‘strategies of the vehicle manufacturers are approved by type approval authorities’, in practice this strategy does not go beyond commitments to certain strategic goals of the company and is not specific to the vehicles to be type approved. There are no explicit requirements as to the content of the strategy, except for that it “shall take into account the proven technologies available or in development at the time of the application for a vehicle type-approval”. The reference to proven technologies “in development” also creates some uncertainty as to the fact that these technologies will be available when the cars in question will become ELVs. Therefore, the effectiveness of the current provisions of the 3R type-approval Directive setting the obligation for the manufacturers to “recommend the strategy” is not clear enough to prove the compliance of a vehicle with the design related requirements prior the vehicle placement on the market.

3R-type-approval Directive is not effective enough to demonstrate that vehicles placed on the market are reusable, recyclable and recoverable, particularly when it comes to (i) verifying that the reuse, recycling and recovery targets in ELV Directive are met and (ii) incentivising a more sustainable vehicle design and production. For example, the definitions of “reusability”, “recyclability” and “recoverability” in 3R type-approval Directive refer to the “potential” for “reusability”, “recyclability” and “recoverability”¹⁹⁶. Potential recycling is quite different from actual recycling (which takes place for the vehicles concerned many years later) and it is not clear how this potential is calculated. Overall, the verification of how car manufacturers meet their obligations on “reusability”, “recyclability” and “recoverability” is largely built on an ISO standard which contains very limited elements and does not take into account the degree of development in recycling technologies. Declarations on fulfilment of the reuse, recycling and recovery targets submitted by vehicle manufacturers and checked by approval authorities, through the technical services/competent bodies, as part of the 3R Type Approval process do not reflect the achievable rates of these targets at end-of-life. In this regard, the evaluations of the ELV Directive and 3R Type-approval Directive have found minor inconsistencies between the two legislations.

According to Article 6(1) of Directive 2005/64/EC “Member States shall not grant any type-approval without first ensuring that the manufacturer has put in place satisfactory arrangements and procedures, in accordance with point 3 of Annex IV, to manage properly the reusability, recyclability and recoverability aspects covered by this Directive. When this preliminary

¹⁹⁶ See article 4 of the Directive.

assessment has been carried out, a certificate named ‘Certificate of Compliance with Annex IV’ (hereinafter the certificate of compliance) shall be granted to the manufacturer”.

The Directive 2005/64/EC provides a number of obligations that need to be complied with by the Member States and car manufacturers on how to demonstrate that new models comply with the relevant obligations under EU law on reusability, recyclability and recoverability. Current calculation requires the specification of the vehicle material breakdown to separate materials (e.g., glass, metals, etc.) and also an estimation of the share of material that is reusable, recyclable, recoverable or both. For this purpose, a component part is “considered as reusable, recyclable or both based on its dismantlability, assessed by: accessibility, fastening technology, and proven dismantling technologies”. A part is considered recyclable based on its material composition, and proven recycling technologies. This does not differentiate however between different qualities of recycling. Thus, for example, as observed in the case of glass used in vehicles, the existing method enables referring to glass towards the calculation of recyclability as in principle it can be dismantled and there are techniques that would allow its recycling. However, in practice, glass is usually separated from other materials through shredding activities, leading to only a low-quality recycling (e.g., backfilling) being possible.

To conclude whether a material is recyclable, as specified in the ISO, OEMs use a list of “proven recycling technologies”. In line with the ISO 22628: 2002, technologies that have been successfully tested on a laboratory scale or above are considered to be “proven”. The list is managed by the automotive association. The ISO standard refers to additional lists of “proven technologies for fastening” and “proven technologies for dismantling”. OEMs probably have an idea of relevant technologies; however, such lists are not used in the type-approval process to conclude on the dismantlability of a part and its potential for reuse. The reuse of parts is not considered towards the calculation and in that sense though it can be concluded that the process may facilitate recycling and recovery, it is not clear why it is assumed to facilitate reuse. Though the 3R type-approval process requires manufacturers to specify recycled amounts separately, it does not require a differentiation between qualities of recycling (high quality vs. downcycling). Insofar it cannot be considered effective in facilitating recycling of components and material parts to their highest recycling potential. For instance, Article 6(5) of the 3R type-approval Directive clarifies that competent bodies acting in the name of type-approval authorities and issuing a Certificate of compliance for a manufacturer, need to “[...] describe the strategy recommended by the manufacturer [...]”. Annex I(8) of the 3R type-approval Directive further requires that Type approval authorities checking the 3R calculation in a type approval submission “shall ensure that the data presentation form referred to in point 2 [the completed Annex A to standard ISO 22628: 2002] is coherent with the recommended strategy annexed to the certificate of compliance referred to in Article 6(1) of this Directive.” Though the latter article seems to clarify that the strategy needs to apply at least in part at vehicle level, according to stakeholders ¹⁹⁷strategies developed by manufacturers in this respect are quite general. Manufacturers explain that the information provided in such strategies on the dismantling of vehicle components at EoL is different from dismantling information provided to IDIS and quite general in nature. However, the information provided to IDIS only concerns components addressed under Annex I (3 & 4) of the ELV Directive and in consequence dismantling of other materials and components is not always

¹⁹⁷ Stellantis 2022; VW/Porsche 2022.

economically feasible and thus not necessarily performed. This affects the level of circularity of vehicles.

In addition, there is no reporting obligation for the Member States and the Commission on the implementation of the 3R type-approval Directive and no regular monitoring has been carried out on this point. Therefore, it is not completely clear to what degree the way that the end-of-life requirements are linked to the 3R type-Approval Directive supports the placement on the market of vehicles that will fulfil the waste management obligations. Another important regulatory failure is that, while the overall type-approval framework has been considerably strengthened in 2018 in the aftermath of the ‘dieselgate’ with a focus on controlling emission standards, the 3R type-approval Directive has not yet been amended to reflect these changes, leaving significant legal uncertainties.

Another example on the insufficient link between the aims of the ELV Directive and Directive 2005/64/EC is the fact that the latter considers that “tyres should be considered as recyclable” for the purpose of calculating the recyclability of cars. There is no justification for this consideration, while available data show that, despite the potential, a large part of end-of-life tyres are actually not recycled. Declarations on fulfilment of the reuse, recycling and recovery (3R) targets submitted by vehicle manufacturers and checked by approval authorities (through the technical services/competent bodies) as part of the 3R type-approval process do not always reflect the achievable rates of the 3Rs at end-of-life. It shows that the current 3R type-approval process, as the procedural tool, lacks dynamic link with the ELV Directive and the flexibility to adjust to the changes of the legislation, such as increase the ambition level of targets, introduction of material specific recycling targets, etc. It shows that the current mechanism would not be able to guarantee a market surveillance of the vehicles not being able to comply with the development of the EU legislation.

- Regulatory/market failures – Lack of incentives to uptake secondary materials in manufacturing new vehicles

There is no obligation in EU law that financial incentives are provided to manufacturers when they design vehicles which contain recycled materials or are composed of materials and parts which can be easily repaired, dismantled, re-used, remanufactured or recycled¹⁹⁸. The aspects of repairability, remanufacturing, reusability and recyclability are not considered so far in the of the Green Public Procurement criteria for road transport¹⁹⁹.

It is also relevant to the increased use of lightweight materials, such as composite plastics, carbon-fibre, and fibre- reinforced materials, often used to reduce the vehicle weight with the aim to curb the CO₂ emissions in use, are not addressed in the ELV Directive. With the trend towards lightweight materials, this could even further affect the achievability of the circularity targets.

The 3R type-approval Directive does not sufficiently differentiate between non-recyclable and recyclable materials. De facto this allows vehicles making use of high volumes of non-recyclable to be placed on the market for which currently the EU is lacking recycling capacities.

¹⁹⁸ Such incentives are being established at the EU level for batteries and packaging, based on the provisions of the waste framework Directive (Article 8a) on the “modulation of fees” foreseen for “extended producer responsibility schemes”, in line with the polluter pays principle set out in Article 191(2) of the Treaty on the Functioning of the European Union (TFEU).

¹⁹⁹ Commission Staff Working Document: EU green public procurement criteria for road transport; SWD (2021) 296 final; Brussels, 18.10.2021.

– Regulatory and behavioural failures – insufficient information on dismantling

Decisions taken during the design phase of a vehicle have a direct impact to the material recovery levels of an end-of-life vehicle. This relationship between the two stages is acknowledged by the ELV Directive, which Article 4(1), first, requires manufacturers to produce the vehicles with the aim to facilitate their dismantling – one of the most decisive criteria determining the potential and actual levels of reuse, recycling and recovery of the end-of-life vehicles and their parts. However, the problem is that current provisions do not explain on how manufacturers should apply these obligations. This lack of clarity in decision making at the early stage of designing and assembling a vehicle has a significant impact on low quality of end-of-life treatment. Article 8 of the ELV Directive provides some guidelines by obliging the producers to “*use component and material coding standards, in particular to facilitate the identification of those components and materials which are suitable for reuse and recovery*”. Commission Decision 2003/138/EC²⁰⁰ specifies which nomenclature of ISO component and material coding standards should be used for identification of certain plastic and rubber parts. However, as in the case of Article 8, the decision only requires identification of some material parts (plastic and rubber). While this information may facilitate identifying the parts of a certain composition and above a certain size, it does not facilitate their dismantling in terms of time and tools required for supporting this process.

– Regulatory failure – inconsistent and outdated provisions to restrict hazardous substances in vehicles

The ELV Directive, in its Article 4, requires vehicle manufacturers, in liaison with material and equipment manufacturers, to limit the use of hazardous substances in vehicles and to reduce them as far as possible from the conception of the vehicle onwards, so as in particular to prevent their release into the environment, make recycling easier, and avoid the need to dispose of hazardous waste. These generic provisions are embodied into specific limitations established for four substances (lead, mercury, cadmium and hexavalent chromium) and their associated exceptions in Annex II of the Directive. There is no defined or established mechanism in the Directive to restrict further substances in vehicles and no other substances have been limited in vehicles since the adoption of the Directive in September 2000.

Consequently, there are no specific means in the Directive to address the adverse effects of additional hazardous substances in vehicles, beyond the four substances already regulated. Furthermore, the purpose of the Directive, as regards hazardous substances, as explained in its recital 11 and its Article 4, is that of reduction and control of hazardous substances in vehicles, in order to prevent their release into the environment, to facilitate recycling and to avoid the disposal of hazardous waste. The approach in the ELV Directive is not in line with the current life cycle thinking embedded in the Circular Economy Action Plan and in the Chemicals Strategy for Sustainability, which requires a full life-cycle approach in chemicals management (through one or several legislative tools) and where impacts on human health, and not only on the environment, have to be addressed.

²⁰⁰ Commission Decision 2003/138/EC of 27 February 2003 establishing component and material coding standards for vehicles pursuant to Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles (Text with EEA relevance) (notified under document number C(2003) 620)

6.2.3 *How would the problem evolve?*

New automotive technologies will continue to develop impacting the design and production of the vehicles. Transition to circularity of the sector is based on the voluntary initiatives taken by the frontrunners. It leads to another circularity weakening prognosis upon which the incentives, to design and produce vehicles in a way which limits the use of primary materials and prefers secondary ones, will remain limited and fragmented. As a result, the dependency of the automotive industry on the use of primary materials would remain high while use of secondary materials is expected to be limited due to the absence of material specific targets on the EU rules. As regards the concrete material streams, there is expected to be a high competition of metals in the market of secondary materials, due to the increased demand linked to the more intensive production of e-vehicles. Without setting recycled content targets, demand for recyclates in cases where there is no market e.g. plastic, will not be stimulated.

E-mobility²⁰¹ is expected to experience significant and rapid growth over the coming decades leading to 45% of the total fleet share by 2035²⁰². The presence of CRMs used in vehicles are expected to increase proportionally. This growth and changes of the fleet composition will come with a number of additional challenges for the repair, dismantling, recycling and recovery of the materials, including composite ones. The current framework of the ELV Directive and 3R-type-approval Directive will not be able to ensure the sustainability and competitiveness of the future vehicles and the development of e-mobility value chains, in the context of the circular economy, addressing the social, environmental and health impacts generated, in particular given the expected growth in demand. Therefore, over time, the contribution of the circular economy objectives of reuse, repair and recycling is expected to decrease.

These areas of problems are also highlighted in the findings of F4F platform, signalling that recently, new vehicles have become increasingly difficult to dismantle and recycle as new substances are being used and the different parts of those vehicles as well as the way they are built into the vehicle have become more complex²⁰³. With the intensive electrification of vehicles and the expected increase in the use of electric components and parts, restricted access to the locked parts in the future will lead to a limited availability of valuable materials to be retrieved from these parts and components. Yet, dismantlers will continue being provided a limited information by vehicle manufacturers²⁰⁴ regarding the presence, localisation, composition and re-use potential of components in ELV and regarding the presence of (hazardous) materials hampering high quality recycling. Moreover, the digitalisation potential, such as development of digital product passport will remain unexploited in this area, thus maintaining the burden for dismantling facilities in identifying of the different materials used in the specific car type, their location inside the vehicle and the connections between the different vehicle components.

²⁰¹ EVs, Hybrid EVs, Fuel Cell Evs..

²⁰² Based on the fleet modulation provided in the Commission Euro 7 proposal.

²⁰³ For more information see Suggestion 1 of F4F opinion: <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

²⁰⁴ E.g. through IDIS-System [International Dismantling Information System Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of Directive 2000/53/EC on end-of-life vehicles for the periods 2008-2011 and 2011-2014, 27.02.2017, (COM/2017/098 final), p. 5.

It means that without the intervention, the current regulatory framework would not be sufficient to adapt future trends and development of the electrification of road transport, as an integral part of the Clean Mobility package²⁰⁵ and the Commission's ambition to decarbonise the EU economy, improve the competitiveness of strategic value chains in the context of "Fit for 55" package²⁰⁶ to enable the automotive industry to contribute to the EU increased climate ambition for 2030 and climate neutrality target for 2050.

6.3. Problem area 2: Lack of quality and quantity in reuse and recycling at end-of-life treatment

6.3.1 What is the problem?

The management of vehicles reaching the end of their life does not currently take place in optimal conditions. Based on the reports from the Member States, about 6,1 million ELVs (58%) are reported as collected at ATFs in the EU every year, representing 6,9 million tonnes of waste²⁰⁷. Based on the average material composition of ELVs, this represents a material flow of 66% (4 million tonnes) of ferrous metals, 11% (0,7 million tonnes) of non-ferrous metals, 2% (0,1 million tonnes (glass)) and 14% (1 million tonnes²⁰⁸) of mixed plastics²⁰⁹.

Article 7 of the ELV Directive sets out 85% target for the re-use and recycling and 95% target for re-use and recovery of ELVs. Member States reports show a high degree of compliance with both targets at EU-level: 88% for the reuse/recycling and 94% for re-use/ recovery based on an average weight of an ELV.

Figure 6.2 Reuse/recovery and reuse/recycling rate for end-of-life vehicles, 2019

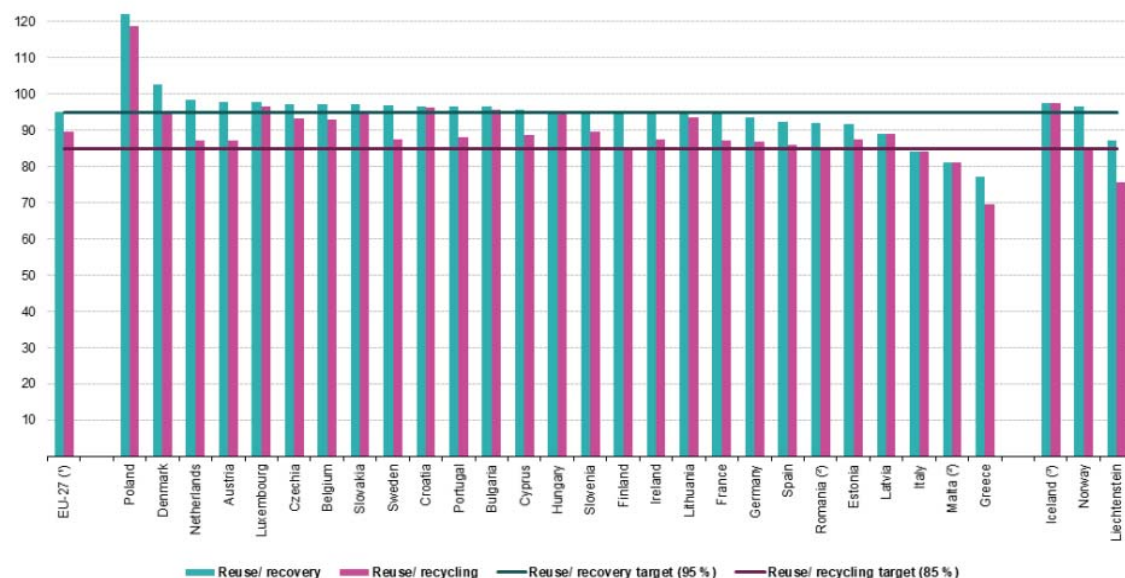
²⁰⁵ https://ec.europa.eu/commission/presscorner/detail/en/ip_19_6279

²⁰⁶ More information on the package is available at:
https://ec.europa.eu/commission/presscorner/detail/en/IP_21_3541

²⁰⁷ in 2019, the average weight of an ELV was estimated 1137 kg (based on Eurostat data and report by Member States for 2019), to be compared with the average vehicle weight in the EU of 1300 kg (CPA, 2020; ICCT Europe, 2020: average weight calculation based from around 1100 kg corresponding to small vehicle to around 1750 kg for an average upper-medium segment vehicle.

²⁰⁸ collected at the authorized treatment facilities (ATFs).

²⁰⁹ These figures exclude tyres, battery casings and the plastic sheathing of wiring harnesses.



Note: Countries are ranked in decreasing order by reuse/recovery.

(*) Eurostat estimate.

(*) 2018 data instead of 2019.

(*) 2017 data instead of 2019.

Source: Eurostat (online data code: env_waselm)

eurostat

While overall statistical reporting shows a positive trend, a significant amount of materials from end-of-life vehicles (ELVs) is still being sent to landfills or incinerated, generating negative environmental externalities. The share of spare parts and components from ELVs which are re-used or remanufactured remains very low.

The management of plastic waste from ELVs poses particular challenges. The share of plastics in the composition of vehicles has considerably increased, and today range from 14 to 18% of the total weight of new passenger cars. This increase is linked to the attempts by the automotive industry to reduce the greenhouse gas emissions linked to the use of vehicles, through a decrease in the weight of the materials contained in vehicles, and the replacement of heavy ones like steel with lightweight ones like plastics. **Only 19% of plastics or 0,2 million tonnes from ELV is currently going to recycling and 0.1 million tonnes effectively recycled, while around 0.8 million tonnes of plastic waste ends up every year in landfills (40%) or is sent to waste-to-energy facilities (41%).** Carbon fibres and most of all, glass fibres reinforced plastics are other lightweight materials more and more integrated in new vehicles, and which cannot currently be recycled. In addition to this, **the generalisation of electronics in new vehicles also poses considerable challenges when vehicles reach the end of their life, as most of the critical raw materials including rare earth elements that they contain are currently not recycled²¹⁰.** Finally, **while the recycling rates of metals like steel (88%) or aluminium (95%) from ELVs are high, the quality of the scrap is often suboptimal due to contamination with other materials during the shredding process** (typically high level of copper content in steel scrap and unsorted aluminium alloys with zinc, copper, silicon and magnesium alloying elements accumulating in cast aluminium).

²¹⁰ This is also the case of other CRM (e.g. niobium or magnesium) that are integrated as alloying elements in basic metals (steel or copper) and are not currently targeted in the recycling processes.

Beyond its environmental impact, the **suboptimal management of waste from ELVs represents a loss of resources for the industry in the EU**, either because waste is not recycled back into the economy (especially for plastics or glass) or because the quality of the scrap is often too low (especially for steel and aluminium), so that it cannot be used for future applications, low carbon production and requires the mixing with an important share of primary raw materials when it is further processed.

6.3.2 What are the problem drivers?

The potential for higher quantity and quality of materials from ELVs to be re-used, remanufactured and recycled remains underexploited, due to the following regulatory, market and behavioural failures:

- *Regulatory failure - definitions are not aligned with the sectoral legislation*

The definition of “recycling” in the ELV Directive is broader than the definition of recycling which applies to all other types of waste, pursuant to the Waste Framework Directive. Indeed, “backfilling”²¹¹ is accounted for as recycling under the ELV Directive, which is not the case under the later Waste Framework Directive. In some Member States, considerable amounts of wastes from ELVs, especially inerts, glass particles, mixed plastics, rubbers, fibres and textiles are destined to backfilling, which is accounted as recycled.

While the Waste Framework Directive distinguishes between ‘reuse’ and ‘preparing for reuse’, the ELV Directive establishes its own definition of ‘reuse’. Under Article 2(6) of the ELV Directive ‘reuse’ means any operation by which components of end-of-life vehicles are used for the same purpose for which they were conceived.

The Waste Framework Directive (WFD)²¹² (Article 3(13)) adopts a different approach. Here ‘**re-use**’ means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived. Therefore, the WFD includes a definition for “Preparing for re-use” as checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing. The ELV Directive does not provide the definition on “preparation for reuse”, which means that components of a vehicle that has reached the waste phase are reused. There is a lack of clear definition on the status of these components as if they shall be considered as waste or not. If yes, the definition of “reuse” according to ELV Directive is not aligned with the WFD, thus the components that have reached the waste phase can be used for reuse, whereas in the WFD this is enabled through their “preparing for reuse”. Components that are considered as waste, their shipment for re-use or remanufacturing is more challenging (e.g., higher transport costs, higher administrative burden).

²¹¹ The Waste Framework Directive defines backfilling as “any recovery operation where suitable non- hazardous waste is used for purposes of reclamation in excavated areas or for engineering purposes in landscaping. Waste used for backfilling must substitute non-waste materials, be suitable for the aforementioned purposes, and be limited to the amount strictly necessary to achieve those purposes”.

²¹² Consolidated text: Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (02008L0098 — EN — 05.07.2018 — 003.002).

Removal of parts from ELVs prior to shredding is a precondition for increasing their rate of reuse of. It also supports higher quality recycling notably, in cases where it is not feasible to recycle a certain fraction after shredding (e.g., neodymium magnets) or where such recycling is limited in the quality of secondary raw material that it can achieve due to a high level of impurities (e.g., aluminium). The ELV Directive sets out minimum technical requirements for treatment of ELVs to promote reuse and recycling (Article 6(1) and (3) and Annex I(4)) that are not sufficiently precise and thus have limited effect on reuse; the list of parts/materials to be removed before shredding is rather limited. Stakeholders have mentioned additional parts for which removal prior to shredding enables reuse or higher quality recycling. These are primarily the electric components which have become prevalent in supporting new functions and boosting performance of a vehicle. However, current legislation does not contain clear requirements, for instance, obliging such components, as printed circuit boards, be removed from the vehicle prior to shredding as it is required for example under the Waste Electric and Electronic Equipment (WEEE) Directive. Moreover, electric components are often intensive in various valuable and critical raw materials and their recycling would likely improve were they removed and sent to separate treatment or reuse.

Due to the lack of legal clarity, a decision to remove certain parts is rather motivated by different economic considerations, such as market prices for materials, available dismantling equipment and labour costs, but not the fact the functionality of a part itself.

- *Regulatory/market failures - no incentive for economic operators to increase the re-use and remanufacturing rates of spare parts from used vehicles or ELVs*

The ELV and 3R type-approval Directives do not contain specific provisions designed to boost the re-use of such parts, as re-use is considered together with recycling (for example there is a joint “re-use and recycling” target) and they do include definitions for (preparing for) remanufacturing and clarity on the ‘end-of-waste’ status of reused, repurposed or remanufactured parts. The absence of definitions creates an unlevel playing field which penalises the market for used spare parts. The low market demand for used/remanufactured spare parts is also due to the absence of clear guarantees on their traceability and safety, as well as the limited interest by most economic operators to adapt their business models and stop relying on new parts and in case remanufactured, the provision of a limited warranty for its second use.

It means that a vehicle part will be removed and offered for reuse only if the market demand is met and external costs including dismantling, verification, tests, labour, storage and handling do not exceed profit of selling used part on the market. This explains why the price of used components cannot cover the costs of dismantling and any operations which are essential to enable reuse/remanufacturing.

As in the case of secondary materials, today reuse, remanufacturing is carried mainly by the frontrunners. For example, BMW claims that “*by choosing remanufacture – the industrial processing of used parts to bring them up to the same standards as new parts – over the manufacturing of new parts, reductions of 85 percent of the raw material and 55 percent of energy can be made*”²¹³.

²¹³ See: <https://www.bmwgroup.com/en/responsibility/sustainable-stories/popup-folder/circular-economy.html>

Though various components have a high potential for re-use and remanufacture, ATFs (as also repair shops and garages) will only dismantle and prepare for reuse components for which they observe there to be a sufficient market demand. In some cases, the demand is related to the quality of a component (e.g., there is low demand for components that have very few malfunctions as they do not need to be repaired and for components that have many malfunctions as the ATF cannot guarantee minimum warranty). But for most components, demand could be increased by ensuring that consumers are aware of the option of reused and remanufactured components as alternatives to new ones and as to their related advantages (reduced costs).

As part of its Circular Economy legislation²¹⁴, France established an obligation to increase the demand for reused/remanufactured components in 2018: car repair shops must make an offer to repair a vehicle with used components in parallel to the offer to repair it with new components. There are also a few examples of insurance companies, which voluntarily opted for a proactive policy for a sustainable management of ELVs. This includes, for example, the establishment of partnerships between an insurance company in France and a network of qualified ATF and repair companies, to increase application of reused/remanufactured components. For this purpose, the insurance company has been requesting every partner to systematically dismantle economically irretrievable vehicles older than 8 years and vehicles technically irretrievable (i.e., classified by the insurance company as a “total loss” after an accident). Dismantled used components from these vehicles can then be proposed by the company to its insurance policy holders to repair their vehicles in cases that the repair is performed under an insurance policy. The procedure assumes that the partners dismantle mainly economically valuable components. Since the majority of irretrievable vehicles are vehicles after collision accidents, the insurance company mainly deals with components such as bodywork, doors, and optical elements. Since 2012, the insurance company managed to increase the application of used components systematically every year, so that the initial target to repair 10 % of the 300,000 insured vehicles with re-used components by 2022 was already achieved in 2020. Aside from the environmental benefits of this practice, it has additional economic and social advantages, as it allows offering lower insurance policy costs to vehicle owners that agree to repair their cars with used spare parts (in cases of insured repairs).

Currently, there are no legal restrictions on the online sales of used components. Lack of such restrictions promotes illegal facilities, since the used components from non-legal operators can be offered for sale at lower prices than those offered by authorised facilities²¹⁵. The EU law does not set the basis to take incentives and take enforcement measures towards protecting legal operators. This is in particular relevant for online sales, when the used components are not only sourced from licensed ATFs²¹⁶. It results in competition of alternative markets, where same components are offered on the market by un-authorised dismantlers at lower prices than those of ATFs.

- *Regulatory failure – reporting of Members States on their reuse and recycling targets is not harmonised*

Provisions in the ELV Directive are not material-specific and measurable. In addition, **the methodology to calculate that the recycling/re-use targets are met is not sufficient to provide**

²¹⁴ https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000032226565/2018-01-19

²¹⁵ ATFs must comply with the ELV minimum standards which increases the operating costs of such facilities.

²¹⁶ Example between the UK authorities and eBay: [Environment Agency joins forces with eBay to stop illegal vehicle breakers](#)

clear evidence that the recycling rates have been effectively achieved. This is firstly due to shortcomings in the reporting foreseen in Commission Decision 2005/293/EC²¹⁷. Lack of sufficiently clear reporting obligations undermined the effectiveness of the ELV Directive by hindering the proper monitoring the implementation of re-use, recycling and recovery targets by the relevant economic actors across the Member States. For instance, the quality reports that accompany the Eurostat standard questionnaire for Member States on the quality and validity of the data are voluntary. As a result, the content of these reports varies across the Member States, creating a barrier for the Eurostat to validate the data.

Another reason is that this methodology has not been adapted to reflect the improvements introduced at the EU level for other waste streams²¹⁸, designed to ensure that only waste which enters recycling is counted towards the achievement of the targets. There is no clear methodology under the ELV Directive that ensures that losses of materials which occur before the waste enters the recycling operation, for instance due to sorting, shredding or other preliminary operations, are excluded from the calculation of recycling rates. The current ELV Directive allows two different calculation methods which cause significantly different amounts of reuse reported by the Member States. Member States not using the metal content assumption (MCA) shall calculate reuse on the basis of the subtraction method, while Member States using the MCA shall determine reuse (excluding the metal components) on the basis of declarations from the authorised treatment facilities. The reuse of metal components will not be displayed separately if the MCA is applied but reported together with the metals recycled. In result, it is not possible to compare the reuse between Member States applying the MCA and MS that do not. As the target is also a combined target for recycling and reuse, the Member States are not encouraged to support (or even monitor) reuse separately (as it should be when following the waste hierarchy). As the Member States do not report on the treatment capacities (in particular the information of post shredder treatment (PST) plants would be needed), it is also not possible for the EC to assess if the reported data on recycling rates is valid or not. In some cases, Member States report high recycling rates without having PST plants. However, without PST plants it is difficult (or even not possible) to achieve such high recycling rates. Lack of sufficiently clear reporting obligations undermined the effectiveness of the ELV Directive by hindering the proper monitoring the implementation of re-use, recycling and recovery targets by the relevant economic actors across the Member States.

- *Regulatory/behavioural failures - insufficient information requirements for the vehicle manufacturers on presence, localisation, composition of materials and re-use potential of parts/ components*

The ELV and 3R type-approval Directives do not either sufficiently incentivise car manufacturers to provide dismantling information on car components and materials that would facilitate ATFs, garages and repair shops to identify, locate and dismantle valuable spare parts and components. The provisions on this point in Article 8 of the ELV Directive, and their implementation by the car manufacturers, are often seen by the dismantling sector as too limited, notably as the information might not be free of charge and do not contain user-friendly

²¹⁷ Commission Decision 2005/293/EC of 1 April 2005 laying down detailed rules on the monitoring of the reuse/recovery and reuse/recycling targets set out in Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles.

²¹⁸ See especially Article 11a of the Waste Framework Directive for municipal waste, as well as Article 6a of Directive 94/26 of the Packaging and Packaging Waste Directive.

instructions. The fact that some parts installed in cars cannot be re-used as they are locked with digital keys is another factor mentioned by dismantlers impeding their re-use or re-manufacturing. While the EU rules have attempted to contribute to improve transparency of the information needed for dismantling, it did not affect design and production of a vehicle, with the aim to ease the reuse, recycling and recovery of the parts and materials. Moreover, localisation of materials and access to the information still remains restricted. These aspects influenced the current situation where only metal and metallic components (such as catalytic converters and batteries) are almost 100% reused and/or recycled. Meanwhile, a higher share of non-metallic components, (e.g. glass, tyres and most plastics) are directed to energy recovery or disposal. The share of re-use is only 12,5%²¹⁹.

To bridge the aspects on design and dismantling of a vehicle, the car industry established the International Dismantling Information System (IDIS). Under this platform, 26 manufacturers with 79 brands and 3477 models and variants use IDIS to provide dismantling information free of charge to around 7000 registered users (e.g. ATFs) in 31 languages in 40 countries on components that need to be dismantled according to Annex I, section 3 and 4 of the ELV Directive²²⁰. In addition to it, producers are also required to provide the information on repair and maintenance information (RMI) to promote the reuse of parts and components. Under the EU “RMI Regulations”²²¹ it obliged independent operators to grant an easy, restriction-free and standardised access to vehicle RMI.

However, it is important to note that the ELV Directive does not oblige the producers to provide such information free of charge. Stakeholders from the repair and dismantling sectors, as well as those involved in the sale of spare parts, have been complaining of a lack of transparency from the car manufacturing side with regard to the characteristics of components in cars, as the car manufacturers often invoke commercial or confidentiality reasons to limit in practice the sharing of this information. Investigation by the European Commission concluded *“The key issues involve challenges for repairers when accessing RMI directly from OEM websites. The wide variation in user interfaces and software incompatibilities cause great inconvenience to users, particularly occasional users or repairers that service many different brands”*²²². Divergent interpretation by stakeholders of certain aspects has also been identified as an additional shortcoming. Because of this investigation, the requirements that were previously in the RMI Regulations have been consolidated and are now detailed under Article 61 of Regulation 2018/858/EU²²³. This change is aimed to ensure easier access and use of RMI information by independent operators, which had struggled in the past as information was provided “piece by piece” affecting its comprehension

²¹⁹ ADEME (2020): Rapport Annuel de l’Observatoire des Véhicules Hors d’Usage – Données 2018.

²²⁰ See further detail under IDIS Webpage: <https://www.idis2.com/index.php>, last viewed 28.10.2021.

²²¹ Regulation (EC) No 715/2007 and Commission Regulation (EC) No 692/2008 of 18 July 2008 implementing and amending Regulation (EC) No 715/2007 of the European Parliament and of the Council on type-approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information, OJ L 199, 28.7.2008, p. 1.

²²² Report from the Commission to the European Parliament and the Council on the operation of the system of access to vehicle repair and maintenance information established by Regulation (EC) No 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information (COM/2016/0782 final).

²²³ Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, amending Regulations (EC) No 715/2007 and (EC) No 595/2009 and repealing Directive 2007/46/EC.

and usability. In this respect, Article 61 specifies that “*Independent operators shall have access to the remote diagnosis services used by manufacturers and authorised dealers and repairers*”. This obligation is not understood to require the provision of such information for-free. In consequence, as in the past, the producers provide ATFs with access to RMI with the same approach as for any independent operator (e.g. of a repair garage), i.e. at a cost. Such conditional access to the relevant information is often factor for some ATFs to promote removal and reuse of parts, due to the incurred additional costs. It weakens the possibility to open the full potential of the vehicle circularity.

Increased amount of the electric and electronic equipment in a vehicle, insufficient access to data is also a relevant problem for economic operators, such as repair shops, ATFs, as these parts are coded and locked by the manufacturers. This limits reuse potential of these components. In a study performed by EGARA²²⁴, 20-35 of dismantled pieces were identified as impossible to be used despite being suitable for multiple models and makes.

- *Market and regulatory failures – high-quality end-of-life treatment of ELVs is not profitable*

It is currently not profitable in most Member States to recycle from ELVs materials like plastics and glass, as well as precious metals from electronic components. Economies of scale and incentives to promote better quality of scrap are lacking. Similarly, spare parts like bumpers, dashboards and windshields are not re-used or remanufactured. The cost for their dismantling is high and not covered by the revenues from their sales. As a result, authorised treatment facilities, which receive ELVs from their last owners and carry out their depollution, do not remove these materials or parts before forwarding depolluted ELVs to shredders. ATFs are almost all SMEs which make most of their business in the commercialisation of the most valuable spare parts removed from ELVs and the sale of depolluted ELVs to shredders. Their economic viability is fragile and they would not be able to absorb new costs linked to additional dismantling operations. Most of them are not equipped (for example through access to digital marketplaces) to reach out a wide range of customers, which limits the market for these sparts.

For shredder companies, usually also SMEs, the shredding process will generate low or negatively valued residue fractions that are either landfilled, incinerated with energy recovery, or used for backfilling without recovery of remaining metal content. This is except for those countries where sophisticated “post shredding technologies” (PST) is in place which allows for the segregation, separation and recovery of these materials. Here again, the investment costs and competing recycling routes providing lower quality but also lower gate fees, represent a barrier to further development of PST technologies. Without investment security and cost compensation, PST technologies are not fully deployed throughout the EU.

The same impediments prevent ferrous and non-ferrous metal materials from ELVs from being recycled into high quality steel or aluminium scrap. Many shredders are operated flexibly to treat mixed scrap and to realise economies of scale. These unsorted operations and a widespread practice not to remove components like engines and gear-boxes despite the requirement in Annex I of the ELV Directive lead to subsequent contaminations of copper in

²²⁴ See EGARA’s contribution to the inception impact assessment (road map).

steels and difficult to sort aluminium alloys, which advanced PST treatment or subsequent treatment of these ELV scraps cannot overcome.

There is no regulatory intervention which would allow to overcome the market failure described in the points above. Especially, **the ELV Directive does not specify that car manufacturers should contribute financially to the costs linked to the dismantling, re-use, remanufacturing and recycling of materials and components from ELVs.** This is in contrast also to what applies in the EU for other sectors, like batteries, electric and electronic equipment and packaging, where “extended producer responsibility” (EPR) schemes explicitly include the financing by producers of the waste management phase of their products. The Waste Framework Directive also makes it clear that, when EPR schemes are established, they should cover inter alia the costs necessary to meet waste management targets. The absence of legal obligations under the ELV Directive on this issue is all the more problematic as the automotive industry has traditionally been reluctant to provide, on a voluntary basis, financial support to the waste management phase of vehicles. In March 2022, the Commission carried out inspections at the premises of automotive companies and associations of such companies, based on concerns that several of them may have violated antitrust rules and colluded to agree not to provide any financial support to the dismantling and recycling sector. The investigations on this case are ongoing²²⁵.

There is no offset mechanism for the mandatory ELV treatment costs. The provisions in the ELV Directive on the producers’ responsibility for the management of ELVs are limited when compared to the obligations for producers in other sectors to contribute financially to the waste management phase of their products, pursuant to the Waste Framework Directive and other EU waste legislation (for example electric and electronic equipment or packaging).

Currently, “shared responsibility” is applied across the Member States, where producers demonstrate (either individually or jointly in a PRO) the compliance with the requirement that ELVs are taken free of charge back from the consumer by contracts with ATFs confirming the free take back. Details of contracts with ATFs, e.g. whether there is compensation for ATFs, are usually not disclosed. Different stakeholders emphasized that the free take back declarations are issued by ATFs without or with minimal compensation for the ATFs. This system is based on the assumption that it is economically feasible to comply with the requirements of the ELV Directive without cost compensation by producers. Moreover, different levels of costs associated with the ELV collection and treatment at the national level encourage trade of the used vehicles approaching the end-of-life stage both intra-EU and extra-EU.

The current system is not future-proof and currently only economically viable recycling is conducted²²⁶. In addition, the system is exposed to strong competition of the illegal sector. Furthermore, even for materials which are accounted as fully or nearly fully recycled under the ELV Directive (steel and non-ferrous metals), there is no incentive to perform high-quality recycling, such as ensuring that steel or aluminium scrap from shredding contain minimum levels of contamination by other metals (i.e. copper). This reduces the value of such steel or aluminium scrap and the possibility to use them in a number of applications.

²²⁵ See: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1765

²²⁶ Reuse of parts (and sells for remanufacturing) contribute to the profits of ATFs.

The market conditions therefore do not allow to internalise the costs linked to high quality recycling and re-use of materials from ELVs and the current EU regulatory framework does not address this problem either.

Currently there is no harmonised approach at the EU level ensuring the financial profitability of a full scale and high-quality recycling and re-use of materials, parts and components from ELVs. It is closely linked to the fact that the EPR schemes are generally set up at national level addressing mainly products purchased and consumed in a given country. However, end-of-life treatment of vehicles is labour intensive and a further complication results that EPR fees taking into account different cost structures. In the meantime, national EPR schemes for ELVs are not suit to cover collection, depollution and dismantling costs of those ELVs which final treatment occurs in another Member State than the one where a vehicle was originally placed on the market and the EPR fees paid. National EPR schemes would require uniform rules and a transfer system to cover the expenses for the processing of ELVs that are collected in a MS where they have not been placed on the market as new car.

Different cost coverage requirements have been adopted by the Member States linked to the implementation of the ELV Directive, either through the establishment of fees paid to the administration or the establishment of producer responsibility scheme in almost a half of all the Member States. These measures are mostly focusing on the basic obligations under the ELV Directive, e.g. collection of ELVs and their delivery to ATF. They do not address the costs linked to the compliance of obligations linked to the dismantling and recycling/re-use of materials, parts and components of ELVs.

In some situations, dismantling information is provided by manufacturers for a fee, in others it is provided freely to certain actors or not at all. The main difficulty in the current situation is related to certain data not always being accessible to ATFs which could facilitate an increase in reuse or recycling were the data available. In some cases, this is a result of a lack of harmonisation or of certain actors not making use of platforms already available.

Moreover, end-of-life treatment of new generation type of vehicles, i.e. electric vehicles, includes the removal and storage of end-of-life batteries, requires special training, knowledge and specialized infrastructure for the ATFs leading to additional financial burden. These aspects, related to the change of the vehicles produced, e.g., weight, material composition.

Therefore, today the problem the lack of profitability of the dismantling/recycling sector is the most prevailing. It jeopardises the attainment of the objectives of the ELV Directive and would be an obstacle to the attainment of more ambitious targets designed to ensure a higher recovery of all materials in ELVs and a better quality of the recyclates stemming from their recycling.

6.3.3 *How would the problem evolve?*

The current design of the ELV Directive leaves the treatment of end-of-life vehicles behind its possibilities, as explained in F4F opinion²²⁷. Under the business-as-usual scenario, insufficient reuse and material recycling of end-of-life vehicles in the EU would evolve over the next decades, continuing to bring environmental, economic and social concerns.

²²⁷ For more information, see Suggestion 7 of F4F opinion.

The sub-optimal treatment of end-of-life vehicles would in particular contribute to the loss of valuable secondary resources in the context of the circular economy, such as plastics, metals and CRMs. The current design of the ELV Directive leaves the treatment of end-of-life vehicles behind its possibilities.

EU and its Member States would continue to implement and enforce the requirements set out in the ELV Directive, which will remain of the generic manner and will not be aligned with the sectoral legislation. In this sense, the ELV Directive will maintain only minimum targets of reuse, recycling and recovery based on weight criterion and recycling definition covering ‘backfilling’. The expected changes in the design of vehicles, increasing the amounts of plastics and materials with unclear recyclability with a view of reducing weight can be expected to change the balance between the share that is reused and recycled and that recovered or even worse landfilled. Achieving the reuse and recycling target of 85% is expected to become harder in the following years. While some Member States may attempt introducing individual regulation to ensure higher levels of reuse and recycling, it is expected that others will have an increasingly harder time complying with the current targets.

The low quality and quantity of end-of-life treatment of vehicles can also have negative economic costs, as it can lead to the loss of valuable resources that could instead be recycled or reused. If the current situation continues, currently disproportionate regulatory burden faced by ATFs will remain, as discussed in the F4F platform opinion²²⁸. It will become challenging in particular, as the ELV Directive does not set out clear requirements of the extended producer responsibility (EPR), how the costs deriving from mandatory treatment operations, e.g. depollution, removal of parts and components, including batteries, would need to be compensated. Therefore, the absence of specific provisions in the ELV Directive on the responsibility of producers will further hamper the transition of the automotive sector to a circular economy. The economic viability of the ELV dismantling/recycling sector will remain fragile and hardly allow them to meet the current targets on recycling and re-use set out in the ELV Directive without providing any additional economic incentive for ELV treatment higher up in waste hierarchy, which also addresses the quality aspect of secondary materials. There will remain a limited interest for car manufacturers to consider the recyclability/re-usability of the materials that they are using for the production of vehicles, nor on the quantity and quality of recycling fractions like steel, aluminium and copper, electric and electronic equipment (EEC).

6.4. Problem area 3: ‘Missing vehicles’ cause environmental impacts

6.4.1 What is the problem?

While around 6.1 million ELVs (58%) are reported to be treated according to the ELV Directive every year, **it is estimated that around 32% of de-registered vehicles, i.e., approximately 3.4 million units per year, are of unknown whereabouts (so-called “missing vehicles”) and 1 million units exported for reuse (10%).** Despite numerous studies on this problem, it is challenging to estimate the proportion of these vehicles gone missing due to “administrative problems” (insufficient traceability) or because they have been illegally treated in the EU or illegally exported outside the EU. It can however be assumed that a considerable amount of ELVs are illegally treated in the EU or illegally exported from the EU to third countries. In such cases,

²²⁸ Ibid.

the treatment of ELVs and the recovery of materials from these ELVs would not happen according to the requirements set out and are likely to generate environmental damages like oil spillage, unsound treatment of refrigerants, removal of hazardous substances and of components for higher quality of recycling. This represents unfair competition and economic losses for authorised treatment facilities, which have to abide by the EU rules. This also means that a share of these vehicles would be treated outside the EU and that the materials they contain would not be re-used or recycled back into the EU economy, thereby representing a loss of resources which are important for the supply of the EU industry and for reducing its environmental footprint through the use of recyclates instead of primary resources. Illegal dismantling and export of ELVs are also feeding criminal networks involved in environmental crime and a potential carrier for smaller hazardous waste and other illicit items.

The export of used vehicles also raises important environmental and public health challenges.

As reported by UN Environmental Programme²²⁹, between 2015 and 2018, 14 million used vehicles were exported worldwide. 70 % were destined to low- and middle-income countries, especially to Africa, receiving the largest share (40%) of all those used vehicles and having the highest road traffic fatalities, at an alarming 246,000 deaths each year. The African vehicle fleet is set to grow five times by 2050, and the road safety impacts are likely to rise exponentially²³⁰. Globally, LDVs fleet is expected to double by 2050 and 90% of this growth will mainly take place in non-OECD countries, which import mainly used vehicles. Without harmonised regional, global regulations on the quality to control these vehicles, the trade leads to increased pollution and climate emissions, high energy consumption and operating costs, and most importantly, weakening road-safety in the receiving countries. Despite these negative trends, most developing countries today have limited or no regulations on governing the quality and safety of imported used vehicles and rules which do exist are often poorly enforced. Equally, few developed countries have enforced restrictions on the export of used vehicles²³¹.

The question is well addressed in the communication on “Pathway to a Healthy Planet for All EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil’”²³²: “end-of-life vehicles (ELVs), which are hazardous waste and cannot be exported to non-OECD countries, are often labelled as used cars and illegally exported. This leads to serious pollution threats caused by their unsound management. **The EU is the biggest exporter of used vehicles worldwide. In 2020, the number of used vehicles exported from the EU to 3rd countries amounted to 870,000, at a value of € 3.85 billion.** The most important destinations are Africa, Eastern Europe, Central Asia and the Middle East. To address the situation, the EU is committed to further partner with key countries to fight waste trafficking and facilitate intra- and inter-regional cooperation, with a view to reduce the EU external pollution footprint. A recent study²³³ on the quality of used vehicles carried out by the Dutch Ministry of Infrastructure and Water Management shows that a significant part of the used vehicles exported to African countries is of similar age as end-of-life vehicles recycled in the Netherlands. Most of them do not meet Euro 4/IV emissions standard, i.e. they are older than 15

²²⁹ <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

²³⁰ According to the UNEP report, more than 90% of road crashes take place in developing countries.

²³¹ [Global Trade in Used Vehicles Report | UNEP - UN Environment Programme](#)

²³² COM(2021) 400 final,

²³³ <https://www.ilent.nl/documenten/rapporten/2020/10/26/rapport--used-vehicles-exported-to-africa>

years. The findings from this study, based on their sample, show that most used vehicles exported today outside the EU do not have a valid roadworthiness certificate.

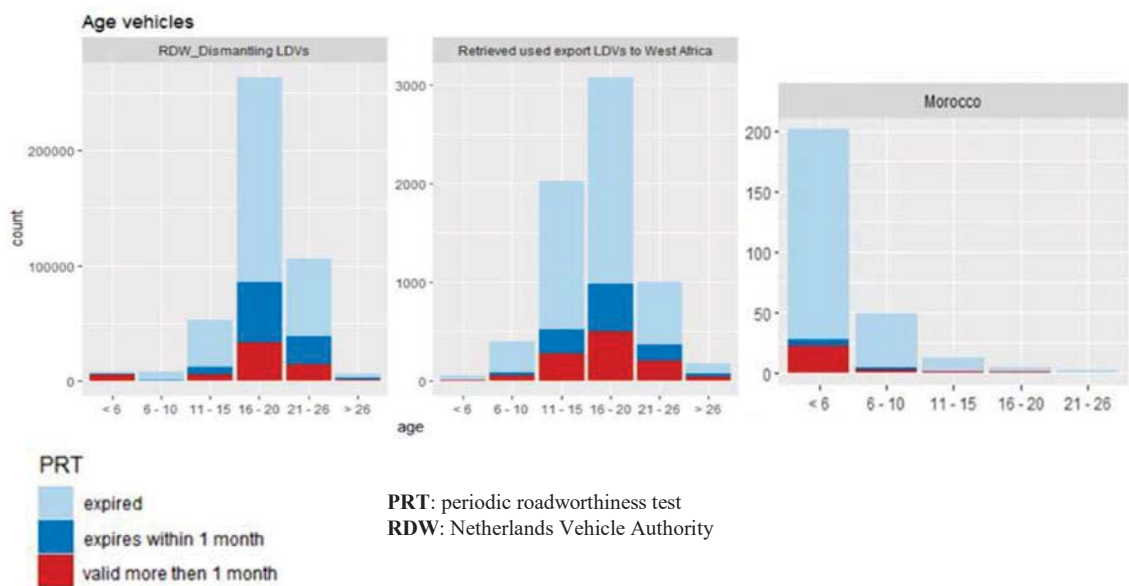
The Dutch study²³⁴ assessed the characteristics of end-of-life vehicles (ELVs) in the Netherlands as well as used vehicles exported to 12 West African countries for the period 2017-2018. The study found that for both groups, ELVs and exported vehicles, the maximum age range was between 16 and 20 years old. This contrasts with Morocco, where the youngest vehicles are imported due to a five-year age limit and the requirement of Euro 4 vehicle emission standards for used vehicle imports, which was introduced in 2011.

The study also revealed that only a minority of used vehicles exported, including the youngest ones, had a valid technical inspection certificate for more than a month.

In 2017-2018, about 14% of ELVs treated in the Netherlands had a roadworthiness certificate valid for more than one month, while this share was slightly higher at 15.5% for vehicles exported to countries in West Africa.

The findings of the study suggest that used vehicles share similar characteristics, meaning that around 85% of these vehicles leaving the EU market may not, due to different reasons, have valid roadworthiness certificates, thereby posing serious environmental and safety concerns in the destination countries, despite of the fact that they are not technically fit to be on the EU roads²³⁵.

Figure 6.3 Age of dismantled (LDVs) versus retrieved vehicles exported to West Africa²³⁶



²³⁴ Netherlands Human Environment and Transport Inspectorate, Ministry of Infrastructure and Water Management (2020): Used vehicles exported to Africa: A study on the quality of used export vehicles

²³⁵ For more information see Chapter 6.5.1.3, Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

²³⁶ Source: Netherlands Human Environment and Transport Inspectorate, Ministry of Infrastructure and Water Management (2020): Used vehicles exported to Africa: A study on the quality of used export vehicles
Data: combined Customs and RDW. © ILT-IDlab

It is clear from this study and other sources that most used vehicles exported from the EU to African countries are polluting the environment and present a high risk for road safety. While there is no direct evidence that second-hand EU vehicles cause road accidents, there is data suggesting that an increase in the age of vehicles is linked to an increased risk of accidents. According to a UNEP study²³⁷, the risk of a crash increases by 7.8% with each additional year of vehicle age. It is also observed, that used vehicles often have compromised roadworthiness and crashworthiness due to age, wear and technical design. Informal character of the used vehicle trade further perpetuates the import of vehicles with mechanical and safety defects²³⁸. It is in particular relevant to some import markets, such as Somalia, not requiring vehicles to meet certain safety standards, such as the presence of airbags or compliance with crashworthiness criteria. It proves the availability of increasing evidence on the links between road safety and used vehicles. As documented by the UN Environmental Programme²³⁹, to address these problems, a growing number of countries and regional organisations²⁴⁰ have adopted in recent years legislation to restrict the import of used vehicles, based on their age or compliance with air emission limits (Euro emissions). This is the case for the majority of the countries to which used vehicles are exported from the EU.

6.4.2 What are the problem drivers?

The **drivers** for this problem are a mix of regulatory and market failures resulting in (i) a lack of traceability (ii) insufficient enforcement and (iii) the absence of considerations linked to roadworthiness and environmental protection when used vehicles are exported from the EU.

- *Market failures – higher revenues from informal and illegal treatment activities and export of vehicles to non-EU countries*

There are **economic incentives for insurance companies, dealers and private owners of ELVs to sell them on online market places or directly to non-authorised treatment facilities or export them in contravention of EU rules: they will obtain higher prices than if they have to deliver them to authorised treatment facilities, which have to abide by the requirements of the ELV Directive** for the treatment of these vehicles and are subject to social security, employment and other fiscal charges (unlike the informal sector). In certain cases, such vehicles are sold as their documents are used to provide stolen vehicles a new ID or for tax fraud purposes. The informal sector will typically dismantle and not fully depollute the vehicle and sell the most profitable spare parts, after which the remainder of the vehicles will be sold to a shredder or exported.

When it comes to used vehicles, an important driver for their export outside the EU is the steady demand in developing countries, associated with the high prices that exporters of such vehicles can obtain compared to what they could gain with selling them in the EU. This does not necessarily mean that exported used vehicles are in poor condition or are low value. There is a large demand for four-wheel drive (4WD) or high-cubic capacity used vehicles in good condition

²³⁷ For more information see: <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

²³⁸ Alloweg, Hayshi and Hirokazu (2011)

²³⁹ <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

²⁴⁰ For example, the Economic Community of West African States (ECOWAS⁸) adopted on 5 September 2020 a Directive limiting the import of used vehicles to those with a minimum Euro 4/IV emission standard. The age limit for importing vehicles into the ECOWAS region is 5 years for light duty vehicles, two-wheel motor vehicles, tricycles and quadricycles and 10 years for heavy-duty vehicles.

that do not meet EU emission standards and are exported, for example, because of emission taxes in Europe or because they are banned from access to Europe's urban centres. At the same time, cheap used vehicles fulfil a critical function by providing affordable mobility to low-income populations around the world and any gap in this market will be rapidly filled by imports of used vehicles from third developed economies, in particular from Asia and the United States of America. By making the necessary repairs and retrofitting, used vehicles are not necessarily ELVs and, by exporting them, they can be given a longer life so contributing to the global circular economy, while meeting minimum EU safety, emission and pollution requirements. However, today practices show these requirements are often disrespected, and instead of contributing to the global circular economy, large share of the imported used vehicles from the EU actually contributes to the domestic environmental and human health problems, thus enlarging the EU external pollution footprint.

– *Regulatory failures – insufficient traceability of ELVs*

The obligation to record and report ELVs is not clearly attributed to stakeholders and public authorities. The ELV Directive states that the last owner of a vehicle shall be issued a “certificate of destruction” (CoD) when he delivers it to an authorised treatment facility (ATF). There is however no clear obligation for the last owner or the authorised treatment facility to transmit this CoD to the registration authorities where the vehicle was registered. As a result, the vehicle registration authorities are not promptly informed about the fact that a car is not any more operating and shall not be accounted into the national fleet. Moreover, the actual vehicle status becomes officially undefined and can be exposed for the following informal treatment (e.g. selling, illegal export). There is no requirement either for the shredding facility which receives ELVs after their depollution at an ATF to verify that a CoD has been issued as a result. To address this problem, some Member States have adopted specific incentives or rules to ensure that ELVs delivered to ATFs are confirmed to be shredded by the shredding companies as a verification reported to the relevant administrations. They have been focusing on encouraging the last owners to deliver their vehicles to ATFs and report the corresponding CoD to the administration, in the forms of “pay out scheme” where a premium is granted upon presentation of the CoD to the competent authorities or linking the end of the payment of registration taxes or insurances to the final verification of the CoD for the corresponding vehicle.

– *Regulatory failure – no systemic exchange of vehicle registration information*

In addition, the fact that a vehicle is “de-registered” from a national vehicle register does not always mean that it has become an ELV, as the issuance of a CoD is not the only ground here where vehicles get deregistered subject to the national legislation. Such fragmentation creates a regulatory failure creating consequences at the EU level. Some Member States allow vehicles to be “temporarily de-registered”, for example when they are off the road, so as not to be subject to registration taxes. Other conditions include export to another country, migration of the vehicle together with the owner to another EU country or theft. Therefore, the total number of ELVs reported by the Member States cannot be assumed to correspond to the number of deregistered vehicles. There is no obligation for the Member States to indicate in their register the motives for which a vehicle has been de-registered, which leads to a situation where the fate of a large number of de-registered vehicles remains unknown.

The fact that a large number of used vehicles are shipped throughout the EU renders the traceability of ELVs even more challenging. The ELV Directive and the EU legislation on registration documents and roadworthiness are not designed to track properly what happens to these vehicles when they reach the end of their life. There is in particular no

systematic exchange of information between vehicle registration authorities which would ensure that the Member State of previous registration of a vehicle is systematically informed when such vehicle is recycled and a CoD has been issued in another Member State. Although the authorities of the Member States of last registration should have the information available about it being an ELV based on the Article 3a of Directive 1999/37/EC²⁴¹, today this information is not always updated and correspond to the actual situation of the vehicle concerned.

- *Regulatory failure – non-legally binding nature of guidelines distinguishing used vehicle vs. waste vehicle*

The absence of clear and legally binding criteria on the distinction between used vehicles and ELVs makes enforcement of the requirements of the ELV Directive very challenging.

Specific guidelines²⁴² were developed by the Waste Shipment Correspondents to assist enforcement and customs authorities in implementing the rules on the export of ELVs, and especially to distinguish between ELVs and used cars. These guidelines are however non-binding and often considered too complicated to apply in practice by enforcement agencies. The illegal sector widely exploits this grey area around the distinction between used vehicles and ELVs. Only vehicles which are considered as waste are subject to the requirements of the ELV Directive, while used vehicles can be commercialised without any restrictions. Even economic actors in the formal sector (for example insurance companies which own a large share of accidented vehicles which might, or not, qualify as ELVs and usually sell them in bulk through auction sales) do not always make the effort to properly check if the vehicles that they sell are ELVs, as it remains more profitable for them to sell them as used vehicles. This is a problem both for ELVs sold in the EU and ELVs exported outside the EU (as “used vehicles” can be exported without restrictions, while shipments of ELV are regulated under the waste shipment regulation, which prohibits especially their export outside the OECD). The effect is that many ELVs are illegally exported to third countries.

The absence of legal provisions preventing the **export from the EU of used vehicles** which are not roadworthy makes it possible to ship used vehicles to third countries, despite the fact that such vehicles are not authorised to be driven on EU roads. In addition, while, as indicated above, a large number of third countries have established or announced rules governing the import of used vehicles, there is no provision in the EU legislation which would require EU inspection and customs authorities to take these import requirements into consideration when authorising the export of used vehicles. There is no mechanism either which would direct these authorities to cooperate with the authorities in the import countries to make sure that used vehicles are only exported from the EU in line with the conditions laid out by these third countries.

- *Regulatory failures – insufficient enforcement*

There are no specific provisions in the ELV Directive requiring the Member States to carry out **inspections or take enforcement actions** to ensure that its provisions are properly implemented, or to establish penalties against breaches of the requirements set out in the Directive. There is little monitoring on how the Directive is enforced and the illegal treatment and the illegal export of ELVs do not feature as priorities in the strategies laid out by enforcement and customs authorities against environmental crime. Some initiatives are taken on a voluntary basis by the Member

²⁴¹ Council Directive 1999/37/EC of 29 April 1999 on the registration documents for vehicles (OJ L 138, 1.6.1999, p. 57).

²⁴² Correspondents' Guidelines No 9 on shipment of waste vehicles:

https://ec.europa.eu/environment/pdf/waste/shipments/correspondents_guidelines9_en.pdf

States, but there is no coordinated approach at the EU level designed to improve enforcement of the rules under the ELV Directive.

6.4.3 *How would the problem evolve?*

Not addressed, a range of regulatory and market drivers would continue to contribute to the phenomenon of “missing vehicles”. For the baseline scenario it is estimated that the situation of 30% to 40% missing vehicles, i.e. 3 to 4 million vehicles, will persist without any major improvement. It means that there will be no mechanism in place needed to ensure if all ELVs are directed to authorised treatment facilities (ATFs), nor to improve cross-border traceability of vehicles. Such scenario is also supported by the reasoning provided in F4F opinion, highlighting that today not all Member States require the vehicle's last owner to provide a COD upon deregistration, which is serving as a proof that the vehicle has been properly dismantled in accordance with the ELV Directive. This is due to the circumstance that some Member States do not distinguish the reasons between short-term deregistration and final deregistration of a vehicle or deregistration for final disposal or other purposes. Therefore, lack of coordination and exchange of information between Member State vehicle registration authorities will persist. Moreover, there will be no EU wide incentives or obligations for a last owner of a vehicle to deregister a destructed vehicle²⁴³.

No improvement is either expected in the area of the export of used vehicles to non-EU countries deepening the EU external pollution footprint. If no actions are taken at the EU level, a significant share of vehicles exported to extra-EU countries will remain under characteristics similar or equivalent to ELVs. Accordingly, the countries receiving the used vehicles from the EU will become more and more affected as the concerns of environment, road safety, air pollution risks will continue to grow, including the material losses of potential recyclables, negative economic and social impacts for the formal sector, when vehicles are not directed to legal treatment facilities. While environmental and social risks exist for the countries of destination, cases of illegal export from the EU will also affect Member States of origin, causing financial violations.

6.5. Problem area 4: Lack of EU level playing field to improve circularity in the design, production and end-of-life treatment of lorries, buses and motorcycles

6.5.1 *What is the problem?*

The ELV and 3R type-approval Directives apply to passenger and some three-wheel vehicles (M1), as well as to light commercial vehicles (N1). Around 85 % of 323 million vehicles registered in the EU fall within the scope of ELV Directive²⁴⁴. 15% of these vehicles are therefore not covered, representing around 52 million vehicles (powered two- and three wheelers (PTW), lorries and buses)²⁴⁵. By mass, this represents 35% of registered vehicles, or 191 million tonnes. The average sum of materials from powered two- and three wheelers (PTW), busses and lorries that became waste in 2019 can be estimated to amount to more than 4.13 million tons. The

²⁴³ For more information see Suggestion 4 of Fit4Future platform: <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

²⁴⁴ 76 % Passenger cars (M1 type) and 9 % lorries (N1 type).

²⁴⁵ It should be noted that this impact assessment does not address the situation of e-bikes, ships, planes, trains, agricultural and non-road mobile machinery (NRMM, T-approved), and military purposes & space. These vehicles are non-road vehicles, with the exemption of non-type approved (electric) bicycles. They are subject to specific regulations, e.g., for e-bikes or ships, or the series in which they are produced are very small, e.g., trains or NRMM. Also, their type-approval is separate to that of road vehicles and in particular does not address objectives of the 3R type-approval.

vehicles excluded from the ELV and 3R type-approval Directives are currently not subject to any specific requirement when it comes to eco-design and their waste phase (waste prevention, collection, treatment and recycling). Although the general provisions from the Waste Framework Directive apply to end-of-life vehicles which are not covered by the ELV Directive, their effect is limited, as they do not contain requirements which are specifically tailored to these vehicles.

The consequences of this exclusion are the following:

- no guarantee on the environmentally sound management of the waste stemming from end-of-life vehicles outside the scope of the legislation,
- no legal incentive for the re-use or recycling of large volume of materials (steel, iron, aluminium, copper, plastics, glass...) stemming from such waste,
- no legal incentive to increase the design for circularity of the vehicles in question,
- risk of a fragmentation of the EU market as individual Member States take individual measures to address the end-of-life stage of the vehicles concerned.

The data and information available on the end-of-life treatment of powered two- and three wheelers (PTW), busses and lorries in the EU is more limited than the information for M1-N1 vehicles. They show that an important number of used lorries and (to a lesser extent) used buses are exported from the EU to third countries, in particular in the developing countries, where the price is an important factor, creating demand for the trade in used HDVs with some remaining useful economic life. It is also noted that despite efforts to promote circular economies through formal HDV scrapping programs in the top exporting countries, including EU, there are reported cases of illegal shipments of end-of-life vehicles to low-income markets, resulting in a material loss for the circular economy objectives of these countries. Since 2015, the EU has exported around 75,000 buses and about 898,000 lorries outside Europe. For every single used bus shipped, 12 used trucks are exported from the EU. The top destinations for EU exports are West Africa and the Eastern Europe, Caucasus, and Central Asia, matching the trade supply chain of used light-duty vehicles²⁴⁶.

There is a market for the re-use and remanufacturing of spare parts from lorries and that there are authorized treatment facilities in some Member States which are able to dismantle lorries, in addition to passenger cars.

When it comes to two- and three wheelers, data available show that there is a specialized market for spare parts, but that there is only a limited number end-of-life motorcycle which are dealt with by authorized treatment facilities, although they would be able to dismantle them without particular extra investments or training.

The data collected for this impact assessment also shows that **at least 7 Member States have adopted various types of legal provisions governing the end-of-life stage of lorries, buses or motorcycles**. Many of them have especially established a requirement that these vehicles should be delivered to an ATF at the end of their life. These provisions remain far less far-reaching than the provisions applying to M1-N1 vehicles pursuant to the ELV Directive. It also presents the risk of fragmenting the EU market and does not anyway represent an efficient approach as economic actors willing to escape national rules could decide to get their vehicles dismantled in another EU Member State with less or no requirements on this phase.

²⁴⁶ <https://www.unep.org/resources/report/global-trade-used-vehicles-rep>

Overall, the integration of circularity in the business model of producers of vehicles outside the scope of the ELV and 3R type-approval Directives largely relies on the market situation, as well as on voluntary actions by some economic actors wishing to be more ambitious than their competitors on this aspect and different regulatory interventions in some Member States. As a result, the potential of a very large share of the automotive sector to contribute to the ambitions of the Green Deal for a climate-neutral, clean and circular economy remains unexploited.

6.5.2 Problem drivers

– Regulatory failures – different national legal regimes

The main driver for the problem exposed below is the exclusion of powered two- and three wheelers (PTW), lorries and buses from the scope of the ELV and 3R type-approval Directives. This choice was made by the co-legislators when the ELV Directive was adopted in 2000. More than twenty years after this adoption, this has led to a situation where there is no transparency on the degree of circularity of the sectors concerned and that they are not incentivised to go beyond a “business as usual” scenario.

The fact that some Member States have taken an initiative and set out national rules covering the end-of-life stage of vehicles that are currently not in the scope of the EU legislation, is a sign that the current limited scope is considered as sub-optimal. Many Member States require that the sound treatment of PTWs and/or lorries is ensured and/or environmental permits for facilities are requested through specific legislation²⁴⁷.

For example, the information provided by France and Spain regarding their experience in dealing with different categories of vehicles shows some similarities and differences.

In France, there is no specific economic analysis on treatment costs, however, there is evidence that the reuse of parts can be particularly important for L-category vehicles. In addition, these vehicles have a content of metal similar to that of passenger cars, making their treatment potentially profitable, because the intrinsic value linked to the material content is significant. However, it is unclear to what extent this applies to quadricycles, and the market for reusing quadricycle parts is less documented.

In Spain, the requirements for ATFs to handle both LCVs and LCVs/L-category vehicles are the same, including de-registration of vehicles in connection with the CoD condition. As for the differences, there are specific certification requirements for personnel who work with electric and hybrid vehicles. In terms of reporting requirements, the same procedures apply to ATFs that deal with L/HDV vehicles and LCVs, as both are required to submit annual reports on managed waste. The documents proving the treatment of an ELV vary depending on the type of vehicle. LDVs require a certificate of destruction, while for other types of vehicles, ATFs must issue an environmental treatment certificate. This separation of certificates allows more effective control and monitoring of the treatment process according to vehicle category.

Belgium (Flanders) and the Czech Republic have similar regulations for ATFs that handle both LCVs and VLDs. Both countries require the same environmental permits and processing

²⁴⁷ This is the situation at least in Spain, France, Flanders/Belgium, Lithuania, Italy, Hungary, Netherlands and Germany.

conditions for all types of vehicles, but there are additional permit requirements for passenger cars and vans, in terms of meeting recycling targets. There are no specific training or certification requirements for personnel who work with HDVs or end-of-life HDVs. The legal requirements regarding depollution, disposal and storage are consistent for all the types of vehicles mentioned. Belgium issues CoD destruction only for the treatment of end-of-life passenger cars and light vans up to 3.5 tonnes, however, there is no de-registration requirement for the owner of any type of vehicle, the ATF system automatically includes the vehicle's VIN in the national registration system which registers these VINs separately. In the Czech Republic, a separate approach is taken where a CoD is issued for both HDVs and motorcycles, and the responsibility for de-registration of the vehicle lies with the owner regardless of its type. There is no data collected on the costs and benefits of mandatory ATF treatment for different stakeholders. The costs may outweigh the benefits in some cases. However, Member States pointed out that the costs and benefits associated with the treatment of each vehicle vary considerably due to several factors such as the feasibility of reusable parts, the costs of secondary raw materials, energy expenditure, among others, which makes it difficult to achieve final product conclusions in this area. A diverse array of national regulations on end-of-life treatment across the EU Member States creates certain risks related to fragmentation of the EU internal market.

Market drivers – difficulty in identifying and controlling treatment operators

A common feature for PTW and Heavy-Duty Vehicles is the importance of the market for used spare parts and the associated potential to retrieve such parts from end-of-life vehicles. This potential is however not fully exploited. In addition, the fact that the informal sector plays an important role in the treatment of end-of-life PTW and HDVs presents environmental challenges, as this treatment is not operated under conditions ensuring a proper depollution of the vehicles and represents unfair competition for other operators which comply with higher standards. More information is provided below on the respective situation for PTW and HDVs.

Problems and drivers per vehicle category



PTW (powered two- and three wheelers): the end-of-life and repair business is dominated by small companies or individual operators, with a minimum regulatory control over their activities. Estimates are available on the number of PTW becoming waste every year, as well as their material composition. For most categories of PTW, the mass fraction of re-usable spare parts is higher than for passenger vehicles and, when it comes to the material composition of PTW, most of them contain a share of metal comparable to the share of metals in passenger cars. There is therefore an important potential for re-using spare parts from end-of-life PTW. In view of the presence of many different actors in the manufacturing, repair and end-of-life treatment of such vehicles, and of the absence of information requirements in national or EU legislation, it is not possible to quantify with a sufficient degree of granularity the current market for the re-use and recycling of parts and components from PTW. It can be assumed though that the share of the informal sector in the dismantling of PWT and the commercialisation of spare parts is non-negligible. Export of used PWT on the other hand is relatively limited, when compared to used passenger cars or lorries.



Lorries: The design and structure of lorries, as well as the types of parts that they contain, differ from those in M1-N1 vehicles. They also usually have a longer lifetime than M1-N1 vehicles. This has an impact on the treatment of end-of-life lorries. Treatment facilities require specific infrastructure, storage, tools, technologies and knowledge to treat them properly. This is done either in specialised facilities, or in facilities that also perform

the treatment of end-of-life M1-N1 vehicles. One key difference is that, while the de-polluted body of the M1-N1 vehicles are shredded as a whole, this is not always possible for HDVs, which are dismantled further.

An important characteristic of the sector is the considerable share of used lorries that are shipped between EU Member States, as well as exported from the EU to third countries (up to 75%). This represents an important market, with used lorries shipped out of the EU especially after they have reached a certain age or mileage to be used further in third countries, where they finally reach their waste stage.



Buses: Compared with trailers and lorries, the fleet of buses registered in the EU is smaller. The material composition of buses is different, as they contain more glass (from windows) and textiles (from seats) than in any other vehicle category. This is creating specific challenges at the dismantling and treatment stages of these vehicles. Compared to lorries, the relative share of used buses exported is also lower but it remains overall quite significant (~34%).



(Semi-)Trailers: In terms of the entire fleet, trailers account for less than 6% by unit, but ~18% by weight. The variability of these vehicles is high, the material composition also varies greatly depending on the trailer type. Little is known about the end-of-life treatment of trailers. Export trade statistics show that ~ 75,000 trailers are exported per year (~8% of expected ELVs). This is a rather small share, compared to other vehicles presented above. Therefore, it is concluded that there is a large mass of materials from trailers for which there is currently no information available about their design and end-of-life stage. It is therefore unclear to what extent the circular economy potential is exploited.

6.5.3 How would the problem evolve?

Non-inclusion of vehicle types other than M1 and N1 from the scope of the ELV Directive will hinder establishing a fully-fledged EU legal framework of vehicles. Without a proper regulatory framework, it would not be feasible to build coherence between national approaches and streamline obligations of national authorities and economic operators in setting up systems for the collection, treatment and recovery of all end-of life vehicles. Such regulatory gap would lead to twofold problems: 1) creating favourable conditions for the risk of damage to the environment and human health associated with the mismanagement of the vehicles that are not covered by the EU harmonized rules on the end-of-life vehicles; 2) continuous loss of material resources from the share of vehicles not covered under the ELV and 3R type-approval directives, accounting for around 52 million vehicles with 159 million tonnes by weight, thus putting aside certain streams of the automotive sector from the circular economy transformation.

It would also have negative impact on the pace of technological progress linked to a more circular design and efficiency in end-of-life treatment of 15% of remaining vehicles without a regulatory support at the EU level. It remains unclear whether the market would be addressing design-for-recycling in a sufficient manner. Otherwise, the EU will not be able to take into account/rely contributions from the whole vehicle sector to the achievement of the targets set out in the EU Green Deal and the Circular Economy Action Plan.



EUROPEAN
COMMISSION

Brussels, 13.7.2023
SWD(2023) 256 final

PART 3/4

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT REPORT

ANNEXES 7 TO 9 to the IMPACT ASSESSMENT REPORT

Accompanying the document

Proposal for a Regulation

of the European Parliament and of the Council on circularity requirements for vehicle design and on management of end-of-life vehicles, amending Regulations (EU) 2018/858 and 2019/1020 and repealing Directives 2000/53/EC and 2005/64/EC

{COM(2023) 451 final} - {SEC(2023) 292 final} - {SWD(2023) 255 final} -
{SWD(2023) 257 final}

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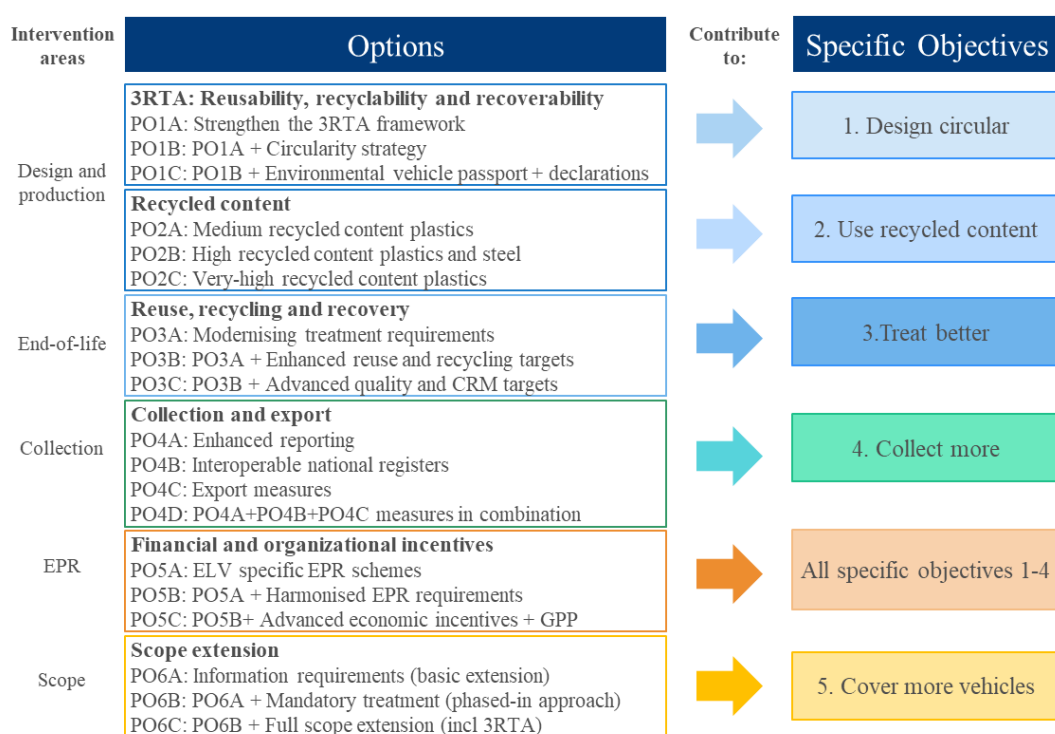
ANNEX 7: OVERVIEW OF MEASURES

7.1 Description of the policy options

As indicated in section 5.2 of this report, six policy options are analysed in this impact assessment. These options contain themselves three sub-options, which consist in different individual measures. The purpose of this Annex is to present these individual measures in a more detailed manner as what has been done in the report itself.

An overview of the options and their relation the objectives, problems and drivers of the intervention logic is described is displayed below:

Figure 7.1 Overview of options contributing to the specific objectives



A full overview of all measures per policy option, their application dates as well as the discarded measures are presented in Table 7.1.

Table 7.1 Overview of all measures considered

Policy Options	#	Measures (all implementing dates are specified as +x yrs from entry-into-force)	EIF *	Pref. *
PO1 – Design Circular	1A	M1 - Ensure that new 3RTA rules provide for a proper implementation of circularity requirements for new vehicle types	+1	Y
		M2 - Empowerment for the Commission to develop a refined methodology to determine compliance with 3R-requirements	+3	Y
		M3 - Provision of basic dismantling information to ELV treatment operators	+3	Y
		M4a - Declaration on substances of concern verified by 3R type-approval authorities	+3	N
		M5a - Restrictions of substances under the revised ELV Directive (<i>analysed separately in Annex 9</i>)	+1	N

	1B	Includes measures M1,M2,M3 of PO1A. M4b - Mandatory declaration on recycled content of plastics, steel, aluminum M5b - Restrictions of substances under REACH and other existing legislation (analysed separately in Annex 9) M6 - Obligation for vehicle manufacturers to develop circularity strategies M7 - Design requirements for new vehicles to facilitate the removal of components	+5 +8 +3 +6	Y N Y Y
	1C	Includes measures M1-M3, M6,M7 of PO1A and PO1B. M4c - Mandatory declaration on recycled content for materials, other than plastics, including CRMs, steel, aluminium M5c - Hybrid approach: maintenance of current restrictions under ELV with new restrictions under REACH (analysed separately in Annex 9) M8 - Establishment of a digital Circularity Vehicle Passport	+5 +8 +7	Y Y Y
Discarded PO1		M34 - Voluntary pledges campaign to increase circularity M35 - Preparation of non-binding guidelines to improve circularity M36 - Obligatory due diligence requirements for materials used in vehicles		X X X
PO2- Use Recycled Content	2A	M9a - Mandatory recycled content targets for plastic used in vehicles - 6% recycled plastics content by 2031, 10% by 2035 at fleet-level, of which 25% of recycled material from closed loop production, calculation and verification rules at +2 yrs M10a – Empower the Commission to set a mandatory recycled content target for steel, including calculation and verification rules at +3 yrs, based on a dedicated feasibility study, application to newly type approved vehicles at +7 yrs	+6 +7	N Y
	2B	M9b - Plastics recycled content: 25% in 2031 for newly type-approved vehicles only, of which 25% closed loop M10b - Steel recycled content: 20% in newly type-approved vehicles	+6 +7	Y N
	2C	M9c - Plastics recycled content: 30% in 2031 for newly type-approved vehicle only, of which 25% closed loop, calculation rules and verification rules at +2 yrs M10c - Steel recycled content: 30% in newly type-approved vehicles, of which 15% from closed loop M11 - Empowerment for the Commission to set a mandatory recycled content targets for other materials (aluminium alloys, CRM), feasibility study +3 yrs, target levels, calculation rules +5 yrs, application to newly type approved vehicles >7 yrs	+6 +7 >7	N N Y
		M37 - Higher than 30% of recycled content target for plastic of in 2031 M38 - Recycled content targets for copper M39 - Recycled content targets for glass M40 - Recycled content targets for rubber/ tyres		X X X X
PO3- Treat Better	3A	M12- Aligning the definition of recycling (at EIF) and aligning the calculation methodology for recycling rates (+3 yrs) with other waste legislation M13a - Mandatory removal of certain parts/components prior to shredding to encourage their recycling or re-use, 'list A' M14a - New definition of 'remanufacturing' (at EIF) and new monitoring requirements (+3 yrs) for re-use/ remanufacturing M16a - Ban on the landfilling of automotive waste residues from shredding operations	+3 +3 +3 +3	Y Y Y Y
	3B	Includes all measures of PO3A (cumulative) M13b - Mandatory removal of longer list of components, including those that contain a high concentration of valuable metals or CRMs, 'list B' M14b - Market support for the use of spare parts M15b - Recycling targets for plastics – 30% at 5 yrs EIF. calc rules +2 yrs EIF M16b - Ban on mixed shredding of ELVs with WEEE and packaging waste	+3 +3 +5 +3	Y Y Y Y
	3C	Includes all measures of PO3A and PO3B (cumulative) M13c - Mandatory removal of additional components, 'list C' M15c - Glass – 70% recycling as container glass quality or equivalent. M16c - Setting requirements on Post Shredder Technologies (PST) to improve the quantity and quality of metal scrap recovered from ELVs	+5 +5 +5	N N N
Discarded PO3		M41 – setting specific recycling targets for metals M42 – setting specific recycling targets for non-metal materials		X X
PO4 –	4A	M17a - Reporting by Member States on “missing vehicles”, vehicle registrations,	+3	N

Collect More		the import and export of used vehicles, incentives to encourage delivery to an ATF and penalties M18 - Obligations for dismantlers /recyclers to check and report on ELVs/ CoDs M19a - Setting minimum requirements for sector inspections and enforcement action (including non-binding Correspondents Guidelines No9)	+3 +1	Y Y
	4B	M17b - Setting fines for the ELV sector if an ELV is sold to illegal dismantlers and for dealers (and electronic platforms) dealing with dismantled (used) spare parts from non-authorised facilities. M19b - Clearer definition of ELVs to ensure that there is a better distinction between used vehicles and ELVs (binding CG9) M20 - Improving the information contained in national vehicle registries and making them interoperable	+3 EIF +5	Y Y Y
	4C	M19c - Provide or making available information on vehicle identification and roadworthiness available to customs authorities (VIN) M21 - Export requirements for used vehicles linked to roadworthiness	+4 +7	Y Y
	4D	Includes measures M17b,M18,M19a-c,M20,M21 of PO4A, PO4B and PO4C (cumulative)		Y
	Discarded PO4	M43 - Establish a mandatory collection target of ELVs based on the reporting obligations on the national vehicle market M44 - Voluntary campaigns on export of ELVs incl. waste shipment correspondents' guidelines No9 on distinction ELVs and second-hand vehicles M45 - Establishing a central EU vehicle registration database M46 - Exchange of Member States on the implementation of incentives supporting effectiveness of the Certificate of Destruction (CoD) M47 - Support / software interfaces to international notification system M47a - Setting threshold for age and emission for the export of all used vehicles from the EU to third countries		X X X X X X
PO5 – EPR	5A	M22 - Requirement for the Member States to establish collective or individual EPR schemes, incl. monitoring compliance costs and minimum financial obligations M23 - Reporting obligations for producers	+3 +3	Y Y
	5B	Includes measures M22, M23 of PO5A (cumulative) M24 - Harmonised modulation of EPR fees M25 - Transfer of the EPR fees/ guarantees (cross-border EPR)	+5 +3	Y Y
	5C	Includes measures M22-M25 of PO5A and PO5B (cumulative) M26 - Setting up national deposit refund schemes M27 - Harmonised GPP criteria (voluntary)	+5 +5	N N
	Discarded PO5	M48 - Establishment of an EU wide EPR scheme M49 - European-wide deposit refund scheme supervised by a single European body M50 - Collection of vehicles at holder's premises and abandoned vehicles free of charge for the last holder		X X X
PO6 – Cover more vehicles	6A	M28 - Provision of information to dismantlers and recyclers	+5	Y
	6B	Includes measure M28 of PO6A (cumulative) M30a - Mandatory treatment of end-of-life L3e-L7e-category vehicles, lorries (N2,N3) and buses (M2,M3) and trailers (O) at ATFs + CoD M30b - Export requirements for used vehicles linked to roadworthiness status for lorries (N2,N3) and buses (M2,M3) and trailers (O) M31b - Minimum EPR requirements for end-of-life L3e-L7e category, lorries (N2,N3) and buses (M2,M3) and trailers (O) M32 - Review clause on the regulatory extension of 3RTA scope to new vehicles	+5 +5 +5 +8	Y Y Y Y
	6C	Includes measures M28,M30a-b,M31b of PO6A and PO6B (cumulative) M31c - Full application of EPR and advanced economic incentives M33 - Full scope application of the new 3RTA and end-of-life treatment requirements to additional vehicle categories	>7 >7	N N
	Discarded PO6	M51 - Extension of new requirements to special purpose, multistage vehicles and vehicles produced in small series M52 - A full regulatory 3RTA scope extension to all vehicle categories		X X

* Entry-into-force of the Regulation; Pref. is preferred option, see Section 8.1

7.2 Description of individual measures contained in the different policy options

7.2.1 Policy Options 1A, 1B and 1C (related to specific objective 1 ‘design circular’): Improve reusability, recyclability and recoverability, 3R Type-approval

PO1A, PO1B and PO1C target the specific objective 1 ‘**Design Circular**’, with an increasing level of ambition. These options are cumulative (i.e. PO1B = PO1A + additional measures; PO1C = PO1B + additional measures).

- **PO1A – “Better compliance verification** includes first the adaptation of 3R type-approval process to the new Regulation (EU) 2018/858 on type approval and market surveillance¹, including the possibility to perform conformity of production and market surveillance tests. It includes the possibility to recall vehicles, withdraw type-approval certificates and sanction manufacturers in case of non-compliance (M1). It includes an empowerment for the Commission, within 3 years, to revise the calculation methodology on how vehicles manufacturers should demonstrate compliance with their obligations on recyclability, re-usability and recoverability of new vehicles, and, if needed, to propose a modernised methodology that supports more circularity in new vehicle designs. This could be done either through supporting a change to the current ISO standard on this point, or through the development of new rules at EU level, and would be preceded by an impact assessment. (M2). **PO1A also requires manufacturers to provide treatment operators and consumers, through existing platforms, with detailed and user-friendly repair, reuse and safe dismantling instructions (M3) and information on the location of the parts/components in their vehicles containing CRMs with a specific focus on declaration of indicative weights, locations, fastening and coating techniques as well of labelling of CRMs such as neodymium and dysprosium in e-drive motors.**

PO1A contains the following Measures 1-4 (M1-M5a):

- **M1 – Ensure that the new rules provide for a proper implementation of circularity requirements for new vehicle types**

The measure consists in aligning the provisions on type-approval relating to re-usability, recyclability and recoverability with the overall type-approval framework set out in Regulation (EU) 2018/858. Regulation (EU) 2018/858 contains technical requirements that vehicles shall fulfil at the stages of type approval and placing on the market, as well as obligations for manufacturers, Member States and the Commission to ensure that these requirements are complied with. This includes the obligation for Member States market surveillance authorities to carry out regular checks (see Article 8), as well as the possibility to impose fines on vehicle manufacturers and to withdraw vehicles from the market or recall them if manufacturers fail to take adequate corrective measures in case of non-compliance. The Commission also has a duty to carry out tests and inspections to verify that vehicles comply with the requirements laid down in the Regulation (see Article 9).

¹ Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (OJ L 151, 14.6.2018, p. 1–218).

This measure will clarify how these provisions of Regulation (EU) 2018/858 will apply in relation to the requirements linked to re-usability, recyclability and recoverability.

To support the improvement of circularity in vehicle designs, and in particular the technical know-how of vehicle manufacturers and type-approval authorities about vehicle recyclability, the Commission will monitor appropriately the compliance of the issued type approvals with the 3R type-approval requirements. This may include the performance of dismantling and shredding tests at the premises of an ATF or a shredding facility.

- The dismantling and shredding tests will document the dismantling of each vehicle and analyse the information to estimate the achievability of the 3R type-approval targets at end-of-life stage. For this purpose, the ATF shall apply methods specified in the type-approval submission for the dismantling of components. Tools specified in such information shall only be applied if they are tools commonly used by ATFs. The ATF performing the test will document the parts dismantled (time of dismantling, tools used to support the task, composition of part). On this basis, the party will then estimate the probable route of treatment of each component dismantled.
- On the basis of all collected data, and comparison with the type-approval data, the Commission will provide feedback to the manufacturer and the type-approval authority.
- A report documenting the annual results of dismantling tests will be published. It shall include references to each of the vehicle cases and, where possible, recommendations as to how to improve the recycling of the concerned vehicle types at the end-of-life stage. This report can inform market surveillance actions, [which can include fines in case market surveillance authorities conclude on non-compliance by the vehicle manufacturers, as well as the requirement that the design of the type concerned is changed to meet the TA targets (and that the vehicle manufacturers would need to obtain a new type-approval before being able to put new vehicles of this type on the EU market)].

These requirements shall apply 1 year after entry into force of the new legislation.

According to Article 8 of Regulation EU 2018/858, EU Member States are already under the obligation to regularly check and verify that vehicles comply with type approval requirements, including those related to 3R type-approval.

- **M2 – Empowerment for the Commission to develop a refined methodology to calculate compliance with requirements on recyclability, reusability and recoverability of a vehicle**

This measure aims to refine the methodology to be used by vehicle manufacturers to calculate and show to which degree the materials in new vehicles are re-usable, recyclable and recoverable. In the current legal regime, the data to be presented to demonstrate compliance with the requirements on re-usability, recyclability and recoverability are contained in Annexes I and II of the 3R type-approval Directive. Annex I states that the calculation method that car manufacturers should use is set out in ISO standard 22628:2002².

The proposed measure introduces an empowerment to the Commission to propose, within 3 years after adoption of the Regulation, based on a comprehensive support study, a detailed calculation methodology on how vehicle manufacturers should demonstrate compliance with

² Standard ISO 22628: 2002.

3R type-approval rates. The proposal shall also consider the possibilities to review the current ISO 22628: 2002 standard. The aim of the review is to refine this calculation approach in order to reflect the actual potential of a new vehicle to be recycled, reused and recovered at the end-of-life while taking into account the ongoing technological progress of the ‘proven technologies’ that exist at the moment of vehicle placement into the market.

As a minimum, all components to be removed prior to shredding at the end-of-life stage of the vehicle (as defined in Measure M13a, 13b, 13c, see below) would be considered as re-usable if they have a potential for re-use or remanufacturing, or as recyclable when they are recycled separately to achieve higher recycling qualities or quantities.

Until the adoption of specific calculation methodology, the ISO standard for the current calculation of re-usability, recyclability and recoverability rates continues to apply.

- **M3 – Provision of dismantling information to ELV treatment operators**

The objective of this measure is to improve the communication and documentation along the automotive value chain (from design to end-of-life treatment) on all information and data which is relevant for the treatment of ELVs. Under this measure, the Regulation would establish an obligation for vehicle manufacturers to provide a set of information to the actors involved in the dismantling and recycling of ELVs. This measure builds on the existing Article 8(3) and 8(4) of the ELV Directive but will be more specific. In addition, vehicle manufacturers would have to provide evidence to the type-approval authorities concerned that they have provided this information, as part of their application to the type-approval process. The type-approval authorities would have to check and be satisfied that the vehicle manufacturers have properly submitted this information, before granting the relevant type approval. They would not have to verify the accuracy of this information. This is different from measure M4a, which contains a specific regime and obligations for type-approval authorities to verify the compliance of the declared information with the EU legislation on substances of concern.

The new provisions will list the elements and harmonise the format in which data is to be provided. The manufacturers, including their authorised representatives and importers, will be required to provide the following information free of cost through information platforms³:

1. Location, dismantling time and method for components for which there are depollution obligations⁴.
2. Location, dismantling time and method for components with potential for re-use and/or remanufacturing⁵.
3. Digital keys, also referred to as “Smart Access Control solution” and information as to the dismantling method for components using digital keys.
4. Location, dismantling time and method of components which are obligatory to dismantle for promoting re-use and/or recycling.

³ For instance, Repair and Maintenance Information (RMI), IMDS (International Material Data System³) and the international dismantling information system (IDIS). More information available at: <https://public.mdssystem.com/en/web/imds-public-pages>

⁴ Annex I (3) of the ELV Directive.

⁵ See a section on the preliminary list of components in 13a and 13b.

5. Components containing materials that cannot be recycled at the time when the vehicle is placed on the market (e.g., carbon enforced plastics, composites) – i.e. those for which the recycling methodology is classified as below TRL9.
6. Information on the presence and location of selected relevant materials as defined in the EU list of critical raw materials at the time of the type-approval of the vehicle, as well as on instructions on how to dismantle them for recycling. For the e-drive motors, the core of the measure is defining design constraints on the OEM to provide clear and succinct instructions on the disassembly operations. Such instructions should include a list of interfering components and parts to be taken out to reach the e-drive motor, the different tools required as well as the number of fastening techniques to unlock and extract the e-drive motor⁶. Information required for Nd and Dy in the e-drive motors are:
 - indicative weight, location and chemical composition of all individual permanent magnets included in the product;
 - number of permanent magnets at e-drive motor level;
 - presence and use of glue in the assembly of the permanent magnet and any additives used within the e-drive motor;
 - coating used on permanent magnet;
 - labelling of e-drive motors where one or more rare earth permanent magnets are present. More information on this is presented in Annex 15.2.4⁷.
7. Information on the presence and location of hazardous substances in components in the vehicle, as well as on their safe and environmentally sound dismantling and treatment. The future legislation or a delegated act shall include a provision specifying the information or any additional obligations in terms of the systems used to provide data and minimum requirements as to the format in which data is to be submitted.

The Commission would also be tasked to update this list (relating to dismantling information to ELV treatment operators) regularly taking into account environmental benefits, the evolution of the automotive sector and cost-effectiveness.

These requirements shall apply 3 years after entry into force of the new legislation.

M4a – Declaration on substances of concern verified by 3R type-approval authorities

This measure sets out a requirement for vehicle manufacturers to provide a declaration, as part of their type-approval application process, on relevant substances of concern⁸ contained in the vehicle type concerned. The type-approval authorities would have a procedural obligation to verify that the information provided in this declaration complies with the EU legislation on restriction of chemicals relevant to vehicles (i.e. generic minimisation requirements for hazardous substances / substances of concern in vehicles under ELV, applicable specific

⁶ Art 27 CRM Regulation refers to recyclability of permanent magnets of the following 4 types: (i) Neodymium-Iron-Boron; (ii) Samarium-Cobalt; (iii) Aluminium-Nickel-Cobalt; (iv) Ferrite

⁷ N. Tazi, M. Orefice, C. Marmy, Y. Baron, M. Ljunggren, P. Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821.

⁸ The definition of substances of concern contained in the proposal for ESPR should be used in that respect

restrictions in ELV, in REACH, POPs Regulation, Batteries Regulation⁹) before granting the required type-approval. This measure does not require type-approval authorities to analytically determine the presence and concentration of the concerned substances in vehicles or vehicle components.

These requirements apply 3 years after entry into force of the new legislation.

- **M5a - Restrictions of substances under the revised ELV Directive**

Under this measure, restrictions on all relevant chemicals that are used in a vehicle would be regulated in the new Regulation¹⁰. This includes restrictions on the four substances currently regulated in the ELV Directive (lead, cadmium, mercury and hexavalent chromium), as well as possible new restrictions.

It will provide a mechanism for restricting substances used in vehicles and components of vehicles, relying on an assessment by the relevant committees¹¹ of the European Chemicals Agency (ECHA) of restriction dossiers prepared by ECHA at the request of the Commission, or by Member States on their own initiative. The process would be run under the new regulation replacing the ELV Directive and any restrictions on new substances would be enacted via delegated acts under the new regulation, based on opinions submitted by ECHA to the Commission. Therefore, under this measure, a regulatory mechanism for introducing new ELV-relevant restrictions for substances is established under the new Regulation. They will be laid down via delegated acts, prepared with the support of ECHA¹².

Existing restrictions on the four currently restricted substances under the ELV Directive and exemptions to them will be maintained under ELV legislation and reviewed as appropriate, via delegated acts, with the support of ECHA (rather than using contractors to the Commission, as currently). In addition, relevant active exemptions having a review date [Annex II points 2(c)(ii), 3, 8(e) and 8(g)(ii)] will be maintained and reviewed under the new Regulation, also with the support of ECHA. Other exemptions that do not require a review will be also maintained in ELV legislation. The scope of the assessment of exemptions will be widened including an analysis of alternatives, a socio-economic analysis and a comparative analysis of the health and environmental impacts of alternatives.

For any expansion in scope of ELV to heavy-duty vehicles, trailers and L-category vehicles (as described under PO6) a new dedicated restriction process would be run under the ELV specific Regulation, via delegated acts, with the support of ECHA and/or consultants. The new legislation will assign the new tasks to ECHA with regard of the assessment of substances relevant to these vehicles.

Exemptions for the use of lead and cadmium under the ELV Directive which are specific to batteries [Annex II points 5(a) and 5(b) (lead) and 16 (cadmium)] will be, following a transition process, taken up by the Batteries Regulation (*lex specialis*) and removed from the new Regulation replacing ELV Directive via delegated acts.

⁹ Regulation of the European Parliament and the Council of [date] 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (OJ L [...]).

¹⁰ It should be noted that the requirements under the Authorisation title of REACH for those substances of very high concern (SVHCs) listed in Annex XIV to REACH (such as certain chromium VI salts) applies, regardless of whether restriction provisions for substances in vehicles remain in ELV or are transferred to REACH or sector / product-specific legislation.

¹¹ Committee for Risk Assessment (RAC) and Committee for Socio-economic Analysis (SEAC) defined under article 76 of the REACH Regulation.

¹² This is similar approach to the one used in the Batteries Regulation.

Consequently, under this measure, the restriction procedure for substances in vehicles would be contained, as a self-standing process, under the new Regulation and would have to be defined in the legal proposal. This approach would follow the Commission proposal for a Batteries Regulation¹³ and, more specifically that contained in its Articles 6 and 71¹⁴. The measure would also grant Member States the right of initiative to propose restrictions.

These requirements shall apply 1 year after entry into force of the new legislation.

PO1B: Circularity strategy builds on PO1A with additional **requirements for vehicle manufacturers to develop (i) a specific circularity strategy for each new vehicle type which is type-approved (“type-specific strategy”)**. This strategy would foster cooperation between vehicle manufacturers and actors in the dismantling and recycling sectors. The objective of this “type-specific strategy” would be for vehicle manufacturers to explain how they will ensure that re-usability, recyclability and recoverability rates at type approval for the vehicle type are realised at the end of life, with a particular focus on materials (such as CRMs) for which no recycling technology is available at commercial scale or that need to be removed prior to shredding. The findings from the strategy should be used to inform the recycling/dismantling sector, as well as by the vehicle manufacturer to improve the circular design of future vehicles. This strategy should contain a non-technical summary which should be publicly available. To provide transparency and allow for monitoring of the progress made by the sector toward circularity, the Commission will establish regular reports on circularity in the automotive sector, drawing notably from these strategies and from other data allowing to track progress. In addition to these measures, **PO1B** includes provisions on **design for dismantling and recycling**, especially a requirement that vehicles are designed in such a way that professional dismantlers can remove batteries and electric drive motors from EVs and potentially other parts/components¹⁵ safely without excessive costs (M7). This also includes an empowerment for the Commission to develop standards or specific requirements on the design for dismantling and recycling of selected parts or components from vehicles, especially those made of plastics or containing CRMs, to be adopted within 6 years after the adoption of the new legislation. Additionally, **vehicle manufacturers are requested to provide evidence of the share of recycled content (plastics and steel, but also aluminium, and copper) used in each vehicle type**¹⁶ (M4b). Finally, **PO1B** clarifies that all new restrictions of substances in vehicles, for reasons related to chemical safety, will be carried out primarily under REACH¹⁷ or, for the specific case of substances in batteries used in vehicles, under the new

¹³ COM(2020) 798 final and 2020/0353 (COD). <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52020PC0798>

¹⁴ The description of the measure takes into account the provisional political agreement achieved between the European Parliament and the Council in the trilogue held on 9 December 2022.

¹⁵ More information on this is presented in Annex 15, based on N. Tazi, M. Orefice, C. Marmy, Y. Baron, M Ljunggren, P Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821

¹⁶ Including the shares of post-consumer, pre-consumer and closed loop percentages derived from ELV treatment on a mass-balance basis.

¹⁷ Or as applicable under the Regulation on Persistent Organic Pollutants.

Batteries Regulation¹⁸. It addresses the call to ensure a legal coherence, as highlighted in F4F opinion¹⁹. Under this policy option the existing restrictions on lead, mercury, hexavalent chromium and cadmium in vehicles, as well as their specific exceptions in Annex II of the ELV Directive, remain with enhanced provisions²⁰ under the new ELV Regulation with a planned reassessment of their full take-up by REACH (M5b) at 8 years after entry into force.

PO1B contains the following Measures 4-7 (M4b-M7):

- **M4b – Mandatory declaration on recycled content of plastics and steel**

As a part of the 3R type-approval procedures, the vehicle manufacturers will be required to provide technical documentation proving that a required share [%] of recycled plastic and steel is present in a new vehicle type, for which the target levels are specified under PO2 (M9 and M10). The declared information should include a specification of the origin meaning the share of pre-consumer and post-consumer content and closed loop percentage resulting from ELV recycling. Type-approval authorities will have obligation to verify the documentation submitted by the manufacturers based on the calculation/verification methodology mentioned under PO2. To ensure a consistent approach and avoid unsubstantiated claims, clear definitions of closed and open-loop and post-consumer versus pre-consumer shares are required at entry into force of the legislation. This applies to all recycled content related measures, including measures M9, M10 and M11.

The requirements shall apply 5 years after entry into force of the new legislation.

- **M5b - Restrictions of substances under REACH and other existing legislation**

Under this measure, restrictions concerning all relevant chemicals, for reasons associated primarily to their chemical risks, that are used in a vehicle are to be removed from the ELV²¹ legislation and are to be addressed primarily under REACH²².

It means that existing restrictions on the four substances currently restricted under the ELV Directive and exemptions therefrom (currently in Annex II) are no longer maintained under ELV specific legislation and would require an “ad hoc” transfer to REACH Annex XVII²³ during co-decision. Relevant active exemptions having a review date [Annex II points 2(c)(ii), 3, 8(e) and 8(g)(ii)] would be maintained and reviewed under REACH via dedicated reviews of the corresponding restrictions introduced during co-decision. Other “inactive” exemptions that do not require a review would also be listed in Annex XVII of REACH or in a separate dedicated Appendix, that would have to be introduced in REACH.

¹⁸ Based on the results of provisional 1st reading agreement 9 December 2022:

<https://www.europarl.europa.eu/news/en/press-room/20221205IPR60614/batteries-deal-on-new-eu-rules-for-design-production-and-waste-treatment>

¹⁹ For more information see Suggestion 6 at <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>;

²⁰ Allowing an in depth assessment of alternatives and of their socio-economic impacts, similar to that carried out under REACH.

²¹ It should be noted that the requirements under the Authorisation title of REACH for those substances of very high concern (SVHCs) listed in Annex XIV to REACH (such as certain chromium VI salts) applies, regardless of whether restriction provisions for substances in vehicles remain in ELV or are transferred to REACH or sector / product-specific legislation.

²² or as appropriate the POPs Regulation or the Batteries Regulation

²³ Annex on restrictions

For any expansion in scope of ELV legislation to L-category vehicles, lorries, buses and trailers (as explained in PO6), restrictions on the four currently restricted substances, their possible exemptions, and any restrictions on new substances, would require the initiation of new restrictions process under REACH.

These requirements shall apply 8 years after entry into force of the new legislation.

- Coherence with the Batteries Regulation

To ensure a regulatory coherence between the EU sectoral legislation, all the current entries in the ELV Directive related to the use of lead in batteries in 12V applications will be covered under the Batteries Regulation. This is implemented as a complementary measure to the transfer to REACH. As a result, exemptions for the use of lead and cadmium under the ELV Directive and which are specific to batteries [Annex II points 5(a) and 5(b) (lead) and 16 (cadmium)], are, following a transition process, taken up by the Batteries Regulation (*lex specialis*) and removed from the ELV specific legislation via delegated acts.

Consequently, the new Regulation would clarify that all chemical risk related restrictions would be addressed under REACH (and as appropriate covered under the POPs Regulation) and, for batteries, under the Batteries Regulation.

- **M6 - Obligation for vehicle manufacturers to develop and implement circularity strategies**

The current 3R type-approval Directive states that “manufacturers shall recommend a strategy to ensure dismantling, reuse of component parts, recycling and recovery of materials. The strategy shall take into account the proven technologies available or in development at the time of the application for a vehicle type-approval” (Article 6(3)). Certificate of compliance, granted during the type-approval process, shall describe this strategy recommended by the manufacturer (Article 6(5)).

While the current EU legislation remains vague in terms of specifying the manufacturers responsibilities, the content of the strategy and its enforcement, the measure aims to clarify these aspects. To increase the circularity in the design, production and end-of-life treatment of vehicles, vehicle manufacturers would be obliged to establish a specific circularity strategy for each new vehicle which is type-approved (“type-specific strategy”). This obligation would build on the requirements set out in Article 6(3) of the 3R type-approval Directive.

The “type-specific strategy” should be provided to the TA authorities as part of the application for the type-approval of the vehicle type concerned. The vehicle manufacturers would have to provide an update of this strategy every 2 years, especially to provide information on the progress made in achieving its aims.

The objective of this strategy would be for vehicle manufacturers to demonstrate how, after the TA approval, they will follow-up on their obligations to ensure that the requirements on re-usability, recyclability and recoverability for this vehicle are met. It would cater for vehicle manufacturers to work in close cooperation with actors in the dismantling and recycling sectors and provide clear indications on how this cooperation will be developed.

This strategy will include the following elements:

- a) actions planned to verify that the vehicles conforming to the type in question continue to meet the legal requirements on re-usability, recyclability and recoverability, as indicated in the type-approval certificate, and to support (i) the dismantling of all parts

and components that need to be removed prior to shredding and (ii) the recycling of materials for which recycling technologies are not widely available at commercial scale at the time of the TA decision.

- b) a feedback mechanism to draw lessons from the actions undertaken under subparagraph (a) above, aiming to inform the recycling/dismantling sector and to be used by the vehicle manufacturer to improve the circular design of future vehicles. This feedback mechanism should in particular cover elements relating to (i) the amount and possible increase in recycled materials (such as CRMs) in vehicles, (ii) the use and possible increase of materials which are easy to dismantle for re-use or for high quality recycling, (iii) the use and possible increase of materials which are easy to recycle, and (iv) the adoption of measures to address the challenges posed by the use of materials and techniques which hamper easy dismantling or make recycling very challenging (for example composite plastics or fibre-reinforced materials).

A non-technical summary describing the content of this strategy should be made publicly available. The elements that should be included in the “type-specific strategy”, as well as those that should feature in the publicly available non-technical summary, would be provided in an annex to the new legislation. The Commission shall have a delegated power to update this information. The requirements for the vehicle manufacturers to develop a circularity strategy for each new vehicle type shall apply 3 years after entry into force of the new legislation.

The Commission will have an obligation to establish regular reports on circularity in the automotive sector, which would draw from these strategies and from publicly available manufacturer roadmaps and similar information. This would provide transparency and allow for monitoring of the progress made by the sector toward circularity.

To large extent this measure builds on current practices by manufacturers, which already integrate different elements of circularity into their long-term manufacturing policies. A number of companies publish this information in a form of strategies, annual sustainability reports²⁴ or general overviews on their websites. Among other information, these documents include the overview on the innovations, investment into R&D, long term climate neutrality objectives, social and corporate responsibility in sourcing materials, measures taken to increase resource efficiency and decrease cost of production. New requirement for the manufacturers to prepare and implement a circularity strategy for the vehicles they produce would complement current practices, placing a clear focus on circularity and allowing for transparency, comparison and emulation.

M7 – Design requirements for new vehicles to facilitate removal of specific components

This measure would include first a requirement that vehicle manufacturers shall design and place in new vehicles batteries from EVs (and potentially other parts/components containing CRMs²⁵) in a way which makes them easy and cost-effective to remove by

²⁴ E.g. Nissan: <https://www.nissan-global.com/EN/SUSTAINABILITY/LIBRARY/SR/2022/>, Hyundai: <https://www.hyundai.com/eu/about-hyundai/sustainability/sustainability.html>; Stellantis: https://www.stellantis.com/content/dam/stellantis-corporate/sustainability/csr-disclosure/fca/fca_2020_sustainability_report.pdf; Ford: <https://www.ford.co.uk/experience-ford/sustainability>

²⁵ More information on this is presented in Annex 15, based on N. Tazi, M. Orefice, C. Marmy, Y. Baron, M Ljunggren, P Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other

repairers/dismantlers so that they can be removed prior to shredding and then recycled in line with the Batteries Regulation. A preliminary formulation of these removability requirements for batteries originates from the Battery Regulation Recital 26c²⁶, which recommends that these requirements are taken up in the ELV revision.

A similar requirement would apply for electric drive motors. The design of the vehicle and joining, fastening or sealing techniques should in particular not prevent disassembly operations for repair and reuse purposes of the e-drive motor. Compliance with these requirements shall be verified by type-approval authorities.

This measure also includes the possibility to develop standards or specific requirements on the design for removability, dismantling and recycling of selected parts or components from vehicles, especially those made of plastics or containing CRMs, to be adopted within 3 years after the adoption of the new legislation (*see examples for such precedents in the draft batteries*²⁷ and *packaging regulation*²⁸). For more information See Annex 15.2.2.

These requirements shall apply 6 years after entry into force of the new legislation.

PO1C: Circularity Vehicle Passport: PO1C builds on PO1B and includes in addition the requirement that each vehicle needs to be accompanied by a digital **Circularity Vehicle Passport** (M8), containing information provided by the manufacturer on the composition of vehicles and its components, relevant for repair, maintenance, dismantling, re-use, remanufacturing and recycling as a single entry for consumers and treatment operators. In an increasingly digital society, this development is based on the suggestion of the F4F opinion and is fully consistent and coherent with the corresponding provisions that are included in the proposal for Battery Regulation (battery passport)²⁹, the ESPR proposal (product passport³⁰) and the proposal for the Euro 7 standard (Environmental Vehicle Passport³¹). As part of the digital information, recycled content levels for all materials should be declared allowing for verification of manufacturer's claims (M4c). The Commission would be tasked to develop the technical features of this passport within 7 years from entry into force of the new legislation,

materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821

²⁶ "SLI batteries and electric vehicle batteries incorporated in motor vehicles should be removable and replaceable by independent professionals. It is appropriate to consider provisions, including as regards joining, fastening and sealing elements, to ensure that those batteries can be removed, replaced and disassembled through relevant legislative proposal to revise Directive 2000/53/EC. For the purposes of the design, manufacturing and the repair of SLI batteries and electric vehicle batteries, manufacturers should provide the relevant vehicle on-board diagnostic information and vehicle repair and maintenance information on a non-discriminatory basis to any interested manufacturer, installer or repairer of equipment for vehicles of categories M, N and O as provided for in Regulation (EU) 2018/858. Further, the Commission should encourage the development of standards for design and assembly techniques that facilitate the maintenance, repair and repurpose of batteries and battery packs".

²⁷ Article 15(2) of the Regulation on Batteries and Waste Batteries lists the provisions of this Regulation, for which the Commission will request development of standards, without indicating any deadlines for issuance of such requests. [EUR-Lex - 52020PC0798 - EN - EUR-Lex \(europa.eu\)](#)

²⁸ In the proposal for a Regulation on Packaging and Packaging Waste, the Commission's commitment to request development of standards was mentioned only in the recitals, without any time-specific indications. [Proposal Packaging and Packaging Waste \(europa.eu\)](#)

²⁹ Regulation of the European Parliament and the Council of [date] 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (OJ L [...]).

³⁰ COM(2022) 142 final

³¹ COM(2022) 586 final

ensuring further consistency with other similar initiatives under development in the ESPR framework and the Euro7 regulation.

PO1C contains the following Measures 4-8 (M4c-M8):

- **M4c – Mandatory declaration on recycled content for materials including CRMs, others than plastic and steel**

As a part of the 3R type-approval procedures, the vehicle manufacturers will be required to provide technical documentation proving which percentage of recycled materials, including aluminium, copper and specific CRMs like magnesium, is present in a new vehicle type. The declared information should include a specification of the origin meaning the share of pre-consumer and post-consumer content and closed loop percentage resulting from ELV recycling, on a mass balance basis. The mandatory declaration should be submitted with other documents of the application for the type-approval and will be aligned in format with additional material declarations related to presences of hazardous substances (M4a). With the declaration, the manufacturer is made responsible for the data gathering and reliability of the information from its suppliers. Type-approval authorities will have obligation to verify that the required documentation has been submitted by the manufacturers.

The aimed implementation date is 2031, aligned with the mandatory recycled content targets under PO2. Compared to M4b (which describes the declaration on recycled content plastics and steel, for which targets would be set as per PO2), under this measure type-approval authorities will only have a procedural obligation to verify the documentation. The verifiable information provided at type approval about declared recycled content levels may be used as a basis for i) (harmonised) EPR fee modulation under PO5B, or ii) in support to the establishment of future mandatory quantitative targets for additional selected materials under PO2C (M11).

These requirements shall apply 5 years after entry into force of the new legislation.

To ensure a consistent approach and avoid unsubstantiated claims, clear definitions of closed and open-loop and post-consumer versus pre-consumer shares is required. This applies to all recycled content measures including those under M9, M10 and M11.

- **M5c – Hybrid restriction approach: maintenance of current restrictions under the ELV Directive with new restrictions being taken-up under REACH**

It is a hybrid of measures 5a and 5b, maintaining the current restrictions under the revised ELV Directive with new substance restrictions being taken-up under primarily under REACH and introducing a streamlined assessment procedure with ECHA. Consequently, restrictions on the four substances already existing in the ELV Directive and their exemptions are maintained in the proposed new Regulation. It means that limitations of all vehicle-relevant new substances would be addressed under REACH³². This would be done under the existing REACH procedures and workstreams for restriction (via the regulatory procedure with

³²Or as appropriate the POPs Regulation or the Batteries Regulation. It should also be noted that the requirements under the Authorisation title of REACH for those substances of very high concern (SVHCs) listed in Annex XIV to REACH (such as certain chromium VI salts) applies, regardless of whether restriction provisions for substances in vehicles remain in ELV or are transferred to REACH or sector / product-specific legislation.

scrutiny) or, as appropriate, as defined under the POPs Regulation or the Batteries Regulation (via delegated acts).

Existing restrictions on the four substances and their exemptions are maintained under the revised legislation and reviewed via delegated acts with the support of ECHA. Relevant active exemptions having a review date [Annex II of ELV Directive, points: 2(c)(ii), 3, 8(e) and 8(g)(ii)] are maintained and reviewed under new regulation replacing ELV Directive, with the support of ECHA. Other exemptions that do not require a review will be also maintained in the new Regulation. The possibility of a transfer of these restrictions, and any remaining exemptions, to REACH would be reassessed in the future once the ongoing REACH review is concluded and sufficient implementation time has elapsed to assess its functioning (potentially in 8 years).

As an exception to the point above, exemptions for the use of lead and cadmium under ELV Directive which are specific to batteries [Annex II of ELV Directive, points: 5(a) and 5(b) (lead) and 16 (cadmium)] are, following a transition process, taken up by the Batteries Regulation (*lex specialis*) and removed from the Regulation replacing ELV Directive.

The scope of the assessment of exemptions is widened beyond the current description in Article 4(2) of the ELV Directive, which only takes into account whether the “*the use of the substances is unavoidable*”. A broader approach, similar to that used in assessing applications for authorisation under REACH, including an analysis of alternatives, a socio-economic impact analysis and a comparative analysis of the health and environmental impacts of alternatives (at least at the level of comparing the hazards of the different alternative substances) would be included.

For any regulatory extension to L-category vehicles, lorries, buses and trailers (as described in PO6), a new dedicated restriction process, implemented via delegated acts, would be run under the new Regulation with the support of ECHA and/or consultants within a given timeframe or addressed as new restrictions under REACH. The feasibility and appropriateness of addressing these under REACH would be decided once the ongoing REACH review is concluded and sufficient implementation time has elapsed to assess its functioning (potentially 8 years). The new Regulation will include the necessary empowerments to, in due time, act according to either of the options.

The objectives and scope in Articles 1 and 4 of the ELV Directive will be changed in the new regulation to cover impacts on human health and the environment across the full life cycle of vehicles (and not only focus on waste management). In addition, the definition of “hazardous substance” in regulation on ELV will be aligned with CLP Regulation. Similar to the approach in proposal for a Regulation on Packaging and Packaging Waste, reference to the definition of “substance of concern” will be included³³.

³³ According to Article 2(28) of proposal for a Regulation on Eco-design for Sustainable Products, substances of concern means a substance that:

- (a) meets the criteria laid down in Article 57 and is identified in accordance with Article 59(1) of Regulation (EC) No 1907/2006; or
- (b) is classified in Part 3 of Annex VI to Regulation (EC) No 1272/2008 in one of the following hazard classes or hazard categories:
 - carcinogenicity categories 1 and 2,
 - germ cell mutagenicity categories 1 and 2,
 - reproductive toxicity categories 1 and 2, [to be added in the course of the legislative procedure once Regulation (EC) No 1272/2008 contains these hazard classes: Persistent, Bioaccumulative, Toxic (PBTs), very Persistent very

The new requirements shall apply 8 years after entry into force of the new legislation.

- **M8 - Establishment of a digital Circularity Vehicle Passport**

To ensure a coherent implementation of information requirements, this measure would foresee that vehicle manufacturers would have a duty to develop and put in place a digital Vehicle passport containing or providing an external link to all information relevant for the proper implementation of the future legislation.

This Vehicle Passport would be built on the digital information tool contained in the Euro7 legislative proposal, i.e. 'Circularity Vehicle Passport' or 'CVP' which is defined as a record on paper and digital form containing information on the environmental performance of a vehicle at the moment of registration, including the level of pollutant emission limits, CO₂ emissions, fuel consumption, energy consumption, electric range and engine power, and battery durability and other related values. Consistency with the digital passport concept developed under the ESPR Regulation would also have to be ensured.

Complementary to these Euro 7 requirements, the vehicle manufacturers would be obliged to provide additional information elements about the vehicle to be placed on the market. The information sources would be based on the existing platforms in the automotive sector (e.g. IDIS³⁴ for dismantling, IMDS³⁵/GADSL³⁶/SCIP³⁷ for material declarations/ SVHC³⁸ declarations), individual platforms for tracking spare part availabilities (Catena-X, B-parts from individual groups of manufacturers). The simplification and reduction potential lies in a targeted extraction of key information from existing platforms to respective end-users (consumers, garages, dismantlers, shredders, recyclers etc.) with different data needs.

Comparable to the provisions foreseen under the Euro 7 legislative proposal, to ensure uniform conditions for the implementation of the provisions related to development of the vehicle passport, implementing powers would be conferred to the Commission to set up a format and specify information that shall be provided in this passport as a part of the type-approval process within 7 years of the entry into force of a new Regulation. These requirements shall then start to apply 7 years after entry into force of the new legislation.

Bioaccumulative (vPvBs); Persistent, Mobile and Toxic (PMT), very Persistent very Mobile (vPvM); Endocrine disruption],

- respiratory sensitisation category 1,
- skin sensitisation category 1,
- chronic hazard to the aquatic environment categories 1 to 4,
- hazardous to the ozone layer,
- specific target organ toxicity
- repeated exposure categories 1 and 2,
- specific target organ toxicity
- single exposure categories 1 and 2; or

(c) negatively affects the re-use and recycling of materials in the product in which it is present;

³⁴ IDIS (International Dismantling Information System) <https://www.idis2.com/>

³⁵ IMDS (International Material Data System) <https://www.mdssystem.com/imdsnt/startpage/index.jsp>

³⁶ GADSL (Global Automotive Declarable Substance List) <https://www.gadsl.org/>

³⁷ SCIP (database for information on Substances of Concern In articles as such or in complex objects (Products)) <https://echa.europa.eu/scip>

³⁸ Substances of Very High Concern

7.2.2 7.2.2 Policy Options 2A, 2B and 2C (related to specific objective 2 ‘use recycled content’) : Increase the use of recycled content in new vehicles

The material specific approach of this impact assessment aims to use the right type of measure and target level in such a way that regulatory or market failure elements are adequately addressed. In simple words: in case a material is adequately removed and due to its value sufficiently attractive to be recycled into new (automotive) products, then a recycled content target is not the right instrument. This is the case for instance for copper and glass as explained in Annex 7.3.2 under discarded measures.

PO2A, PO2B and PO2C are targeting this specific objective 2 ‘use recycled content’, with increasing levels of ambition.

In the case of plastics, the analysis of problems and drivers indicate the need to develop a recycled content target.

For other materials like steel, aluminium alloys and critical raw materials such as rare earth elements or magnesium, the analysis of problems and drivers and available literature and impact assessment data is not yet conclusive whether a recycled content target is both necessary and the right type of measure. In this case, feasibility studies are planned which should further clarify key demand and material application trends, expected supply of secondary raw materials and their quality, economies of scale and recycling technology development and economic viability.

Only recyclates from post-consumer waste would be eligible to be accounted for the targets presented below. The proposed targets would only apply to new M1 and N1 vehicle types entering the EU market and excluding L-category vehicles, lorries, buses and trailers not covered by the current ELV Directive.

PO2A includes a requirement for recycled content targets for plastics in new vehicles of at least **6% of the overall plastics contained in the vehicle fleet by 2031, and 10% by 2035** (M9a), of which **25% of recyclates originates from closed loop** recycling from ELVs. **PO2A** includes an empowerment allowing the Commission **to lay down a target for recycled content for steel for newly type approved vehicles 3 years after entry into force** of the Regulation, based on a specific feasibility study. The necessary calculation and verification rules should be laid down at the same time. The study should assess the uncertainty and technical limitations to improve scrap utilisation. **Actual targets would start to apply 7 years** after entry into force of the Regulation (M10a). Under **PO2A**, no other mandatory recycled content targets for other materials would be set, but a voluntary declaration regarding the share of recycled materials embedded in new vehicle types at type-approval stage (see M4b for the declaration to this point).

PO2B includes **recycled content targets for plastics in newly type-approved vehicles of 25% in 2031, of which 25% from closed loop** (M9b). This would represent an annual growth of 30% until 2031 compared to the average baseline in 2022. **PO2B** would advance the setting of a cautious **mandatory recycled content target for steel at 20% for newly type approved vehicles** in the Regulation with the target to be achieved 7 years after entry into force (M10b). A review clause is foreseen in case supply and demand of steel is rapidly increasing or decreasing as material choices may be subject to change.

PO2C includes recycled content targets for plastics in newly type-approved vehicles of 30% of recycled content by 2031 of which 25% from closed loop (M9c). PO2C sets a more ambitious mandatory recycled content targets for steel of 30% for newly type approved vehicles, including a 15% closed loop percentage at 7 years after entry into force (M10c). In addition, the Commission would be (i) tasked to assess the desirability, feasibility and impacts of setting out recycled content targets in new vehicles for other materials, especially aluminium alloys, copper and critical raw materials such as rare earth elements or magnesium (M11), and (ii), based on this assessment, entitled to set out recycled content targets for the materials in question.

PO2A, PO2B and PO2C contain the following Measures 9-11 (M9-M11).

- **M9 - Establishment of mandatory recycled content targets for plastics**

In view of the low recycling and recycled rates of plastics from ELVs, options PO2A, PO2B and PO2C focus first on recycled content for plastics. The description of the measures is presented in detail in the JRC report on recycled plastics in vehicles.

New provisions would be introduced into the future legislation requiring a minimum share of recycled plastic to be used in new vehicles.

The scope of plastics covered by the targets incorporates all plastics³⁹. Only recyclates from post-consumer waste⁴⁰ would be eligible to be accounted for the target. In addition, a minimum share of closed-loop origin is required to ensure the intended ‘pull-effect’ relates to the supply of secondary plastics from ELV treatment. Important consideration here is that the ratio reflects properly the potential supply in types and quality of plastics on one hand in relation to the growth in plastics content per vehicle and the number of units collected and treated versus placed on the market as new vehicles. A specific methodology for the calculation of recycled content for plastics would therefore be established, similar to what is implemented or in development, e.g. in the packaging waste regulation and in the Batteries Regulation for cobalt, lead, lithium and nickel. Depending on the options presented in the impact assessment, this measure would include different levels for the targets on recycled plastic content.

The basis for the proposed targets could either be on the total amount of vehicles placed on the market from a certain date (‘fleet level’ approach) or would apply from a certain date for newly type approved vehicles only. Applying a single target to newly type approved vehicles provide more certainty in production planning.

During the **open public consultation**, 70% or 146 of all the respondents agreed or strongly agreed that more recycled plastics should be used in the manufacturing of new vehicles, while only 4% or 8 individuals objected to this statement in the questionnaire. 27 individuals or 13% of the responses were neutral, while 24 individuals or 12% of all the participants had no opinion on this question. 50 stakeholders from manufacturers/importers or suppliers provided their responses to the question on setting a recycled content target. 18 of them represented large companies. From all the respondents, only 7 (TESLA, VALEO, Ford Motor Company,

³⁹ Thermoplastics (e.g. polyolefins, styrenics, polyamides) as well as polyurethane foams

⁴⁰ CPA. (2021). *Guidance on Waste Definitions* (Issue September).

<https://ec.europa.eu/docsroom/documents/46954/attachments/8/translations/en/renditions/native>

European Association of Automotive Suppliers (CLEPA), Estonian association of car sales and service companies, etc.) disagreed with setting the mandatory target for plastics. Other manufacturers or suppliers (VOLVO, Jaguar Land Rover, Borealis, Evonik Industries AG, The Society of Motor Manufacturers and Traders, Continental, Spanish Association of Automobile and Lorry Manufacturers (ANFAC)), agreed or were neutral, including the German Association of the Automotive Industry (VDA) and ACEA – the key representative of the vehicles producers in Europe. To the question what would be the other materials for which recycled content targets should be considered, steel, aluminium alloys were mostly supported by the producers. When inquired what types of costs are expected to be affected by setting a recycled content target for plastic, R&D, production and verification costs were mentioned the most.

- **M9a – a target level of 6% recycled plastics content by 2031, 10% by 2035 at the fleet-level, of which 25% of recyclates originates from closed loop**

Under this measure, based on the total amount of plastics in all new vehicles ('fleet level' approach), **a first target of 6% would be set for 2031 (i.e. at least 6 years after expected entry into force of the new legislation) and a second of 10% in 2035.** The first threshold has been chosen to reflect the frontrunner's current practices which are already in line with a 6% recycled content value. It would correspond to an annual growth rate of ca. 15% when considering a starting point of 2% recycled content as an average considering all vehicles put on the EU market recently. This corresponds with scenario 3a in the JRC study⁴¹.

- **M9b –25% in 2031 for newly type-approved vehicles only, of which 25% closed loop**

Under this option, a target of 25% would be set for 2031 (i.e 6 years after expected entry into force of the new legislation⁴²) for newly type approved vehicles. Considering a starting point of 2% recycled content, these targets would correspond to an annual growth rate of 29% until 2031. The targets cover 25% closed loop criteria⁴³.

- **M9c –30% in 2031 for newly type-approved vehicle only, of which 25% closed loop**

Compared to the previous measure, it sets higher requirements with a recycled content target of **30% in 2031⁴⁴**. This scenario will ensure a higher uptake of recyclates from the automotive sector. The targets again include the 25% closed loop criteria as in M9a and M9b.

- **M10 – Establishment of a mandatory recycled content targets for steel in vehicles**

Although the recycling rate for steel from ELVs is high, the quality of steel fractions from ELV treatment is low, resulting in significant export of low-quality steel scrap outside the EU (estimated at 20 million tonnes, with a significant share from ELV shredders). At the same time, the uptake of recycled steel by the automotive sector, especially in new vehicles, is very limited. On average, 13% of steel used in vehicles comes from recycling (including post-consumer waste and pre-consumer waste).

Environmental rationale

⁴¹ This corresponds with the scenario JRC3a in the respective study (JRC129008).

⁴² If the new legislation enters into force after 2025, the date would be later than 2030. The legislative proposal will clarify that the date applies 5 years after entry into force of the new legislation

⁴³ This corresponds with the scenario JRC4b in the Annex of the study (JRC129008).

⁴⁴ This corresponds with the scenario JRC4c in the Annex of the study (JRC129008).

From a global perspective, according to the IEA⁴⁵, the global decarbonisation of steel production falls short in meeting Net-Zero goals “as the current pipeline of projects clearly falls short of what is required”.

The measure aims to address the decarbonisation objective of the EU industry, by promoting the uptake of recycled steel, which results in significant environmental savings, particularly reduced consumption of coal, oil and natural gas in steel production⁴⁶. It is estimated that improved scrap use reduces global steel production emissions from 4,300 to 3,500 million tons of CO₂eq by 2050⁴⁷, with improved circularity as a key element in the ongoing decarbonisation investments in electric arc furnaces (EAF) replacing Blast Furnaces (BF). Between now and 2040, with greening of production in the meantime, the CO₂ emission generation per ton of steel is reduced between 1.8 and 1.0 ton of CO₂ per ton of scrap utilised better⁴⁸. The use of steel scrap also reduces biodiversity impacts linked to the extraction of primary raw materials (iron ore and coal).

Due to electrification, the automotive sector is characterised by a specific trend in its expected consumption of a relatively high share of flat steel products versus long steel products. The global demand for flat steel (e.g. for car manufacturing and so-called white products) is projected to increase by 87% towards 2050, while the demand for long steel products (e.g. for infrastructure and construction) will only increase by 30%. The availability of steel scrap re-entering the production cycle will increase by 167% and play an important role in decarbonising the long steel sectors globally⁴⁹. Using recycled steel in the manufacturing of new cars can help to curb CO₂ emissions. First, using recycled steel can help reduce the demand for primary steel, which is typically produced through the process of smelting iron ore. This process requires a significant amount of energy and is a major source of greenhouse gas emissions. By using recycled steel instead of primary steel, vehicle manufacturers can help to reduce the amount of energy that is needed to produce steel, which can in turn help to reduce CO₂ emissions.

For EU domestic steel production in 2030, every ton of scrap replaces around 270 m³ of natural gas compared to natural gas fuelled DRI-EAF production per ton of hot metal produced⁵⁰; and improved steel recycling contributes to the reduction of transportation emissions⁵¹ and ultimately to less export of lower quality steel scraps outside the EU. A comparison of the carbon intensity for various production routes is derived from IEA with the scrap EAF routes on the right hand of Figure 7.2:

Figure 7.2 Global average CO₂ emissions of crude steel production IEA scenario⁵²

⁴⁵ IEA (2022), Iron and Steel, IEA, Paris <https://www.iea.org/reports/iron-and-steel>, License: CC BY 4.0

⁴⁶ The Mission Possible Partnership – Making Net-Zero Steel Possible - An industry-backed, 1.5°C-aligned transition strategy, page 10

⁴⁷ The Mission Possible Partnership – Making Net-Zero Steel Possible - An industry-backed, 1.5°C-aligned transition strategy, page 10

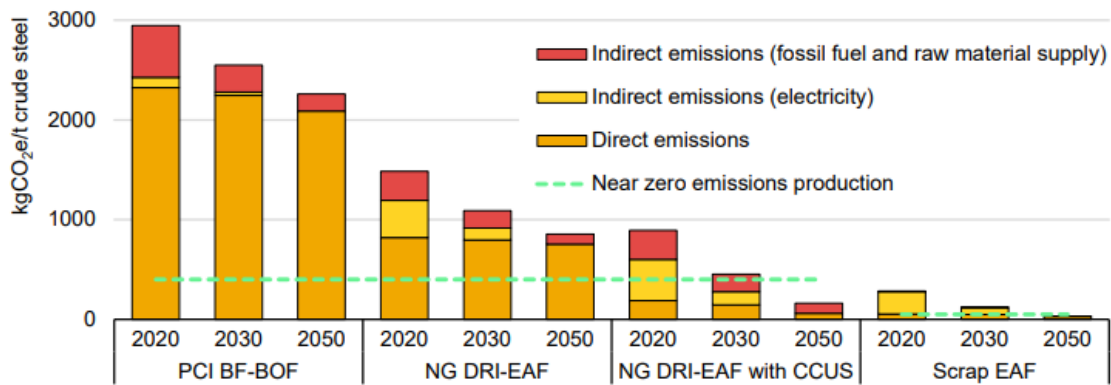
⁴⁸ idem, page 36

⁴⁹ EPRS, Carbon-free steel production - Cost reduction options and usage of existing gas infrastructure, European Parliamentary Research Service, April 2021

⁵⁰ Z. Fan, S.J. Friedmann, Low-carbon production of iron and steel: Technology options, economic assessment and policy, Joule 5, 829-862, April 21, 2021, Elsevier Inc.

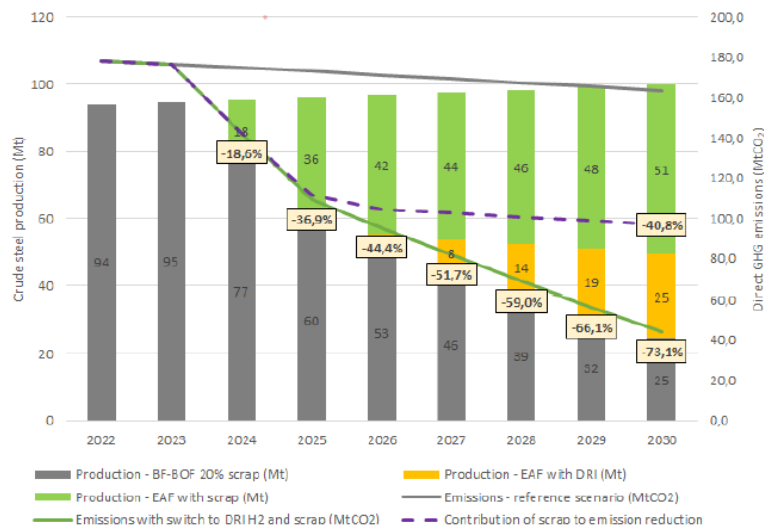
⁵¹ R. Su, A.Assous, Starting from scrap - The key role of circular steel in meeting climate goals, Sandbag, June 2022

⁵² IEA - Achieving Net Zero Heavy Industry Sectors in G7 Members, 2021



Note: All process routes use zero scrap, apart from the Scrap EAF route, which uses 100% scrap.

Figure 7.3: Contribution of scrap to GHG saving in EU steel productions⁵²

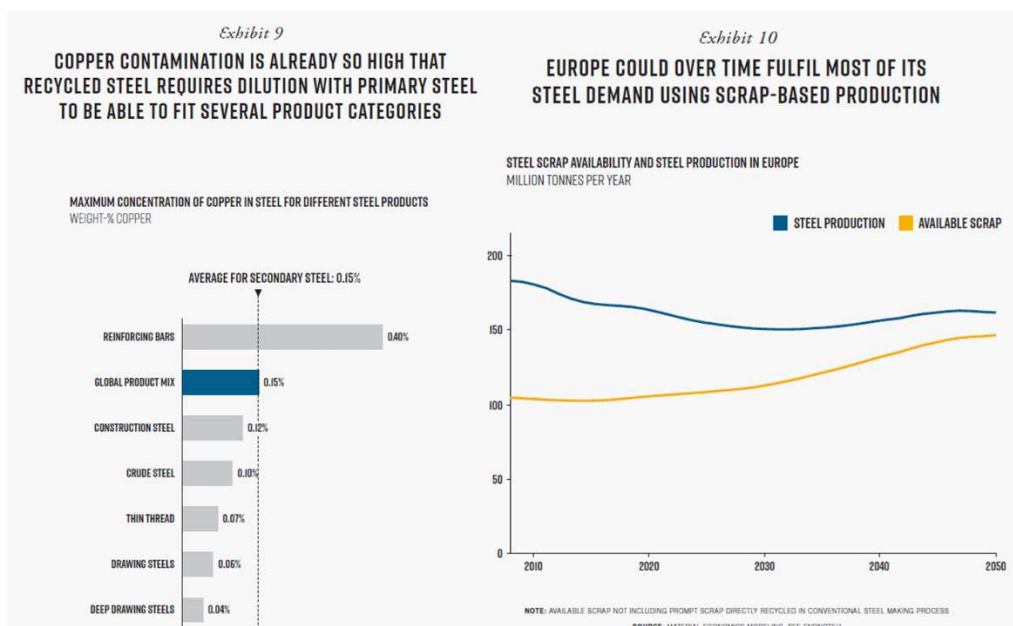


The copper roadblock in ELV steels

In theory all available EU steel scraps could over time fulfil most of the steel demand as highlighted in below Figure (right hand)⁵³. This figures also illustrates that it becomes increasingly difficult to remove copper to required levels to sustain production of flat products, which demand very low tolerances for copper, typically below 0.10% (displayed left). In this regard, ELV steel scraps are a particular concern. ELV steel scraps typically contain too much copper, typically around 0.40%, hindering higher scrap utilisation rates in the future.

Figure 7.4: The copper roadblock to future scrap-based production

⁵³ Material Economics (2020). Preserving value in EU industrial materials - A value perspective on the use of steel, plastics, and aluminium, EIT – Climate KIC).



Combined with increasing demand of flat products, in particular for automotive applications like hoods, roofs, doors etc that are demanding even lower copper tolerances, specification trends will be essential to form a future threshold to increase recycled content rates. This ‘circularity’ gap in matching secondary supply in new demand will lead to increased use of primary units to dilute scrap⁵⁴ and ultimately the export of steel fractions from the EU to countries with higher demands for reinforcement bars. Automated recognition and sorting of high quality flat-product parts from ELVs is currently not available, therefore recycled content targets for these steel products are technically not feasible today. It is however possible to already include a limited amount of flat products scrap in BOF/BF furnaces up to 30% for current Best-Available Technologies and on average already around 20% of mixed scrap is used in BOF/BF and in the future also in EAF production routes⁵⁵.

Economic rationale

Improved scrap utilisation will not only reduce carbon emissions but also strengthen industrial competitiveness by shielding industrial production from volatile fossil fuel markets and support international technology leadership according to RePowerEU⁵⁶: Improved scrap utilisation can complement decarbonised primary steel production that will be required in the future namely for flat steel production. Under RePowerEU, the Commission expects that around 30% of EU primary steel production will be decarbonized with renewable hydrogen by 2030, “requiring 1.4 million tonnes of renewable hydrogen and investments of EUR 18-20 billion to replace blast furnaces with direct reduced iron (DRI) processes fuelled by renewable hydrogen”.

⁵⁴ According to EUROFER: “For steel grades demanding lower Cu content (<0.1%) the EAF producer can either utilize clean iron units from primary sources or use cleaner sources of scrap. ... dilution with primary iron units avoids potential issues with copper, and that there will be future constraints if copper concentrations are allowed to further increase. These constraints are not so evident today”.

⁵⁵ Somers, J., Technologies to decarbonise the EU steel industry, EUR 30982 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-47147-9, doi:10.2760/069150, JRC127468

⁵⁶ Communication from the Commission to the European Parliament, the European Council, The European Economic and Social Committee and the Committee of the Regions, RePowerEU Plan, SWD(2022) 230 final.

This policy option takes into account the efforts to reduce copper contamination by removal of components under the policy options 3 **as the primary measure**. In order to achieve the necessary quality, ELV scrap needs to improve as specified under M13, M16b and M16c under PO3. According to JRC, when the potential to increase scrap quality is maximised and overall steel demand is reduced, the share of scrap steel inputs used in EU steelmaking could increase from the current 50% to 60% or even 70% in high recycling scenarios⁵⁷. For all steels, the Sandbag study⁵⁸ reviews that the improved scrap utilisation routes are the most cost-efficient possibility for decarbonisation of steel production in Europe. While improved scrap utilisation is one of the most cost-efficient possibilities to decarbonise steel production, it is important to acknowledge the role that primary low-carbon steel production will play in the future mix. This is particularly true due to increasing demand for high-quality steel, and, on the other hand, the long-lasting nature of steel in many long-product construction applications.

Recycled content friendly material specifications

According to individual vehicle manufacturers attempting to increase recycled content levels⁵⁹, there is room for allowing higher tramp element tolerances in certain vehicle steels, whereas other applications are more stringent. Volvo set the ambition by 2025 to use 25% of recycled steel⁶⁰. Fiat Chrysler Automobiles (FCA) has a closed-loop process to return aluminium and steel scraps to selected suppliers in Europe and recycle them back into manufacturing processes⁶¹. From 2026 onwards, the BMW Group plans to use the lower-CO₂ steel in series production of cars at the European plants. It has also set up closed-loop material cycles for sheet steel waste with several steel suppliers⁶². Many manufacturers are researching and innovating on their steel specifications to lower the footprint of production like for example Renault using structural parts from recycled steel⁶³. An improved mapping of supply and demand for automotive applications can lead on average to less demand for primary iron ores. It is estimated that the average impurity of all collected scrap is around 0.29% and for ELV scrap likely higher. With around 65 million tonnes of “virgin ore” added to the EU production system in 2017, the impurity content was in fact 0.20%, which is below the average tolerable demand of around 0.25%-0.27%⁶⁴. This indicates actual room for improvement between supply and demand. More consistent use of steel types and improved mapping where more relaxed tolerable impurity levels are possible versus where not to avoid production and quality issues may bring significant circularity potential.

Matching secondary supply and demand

In new EVs, it is possible to use (higher quality) recycled steel for ‘long products’ with copper levels in secondary production up to 0.25%. These steel types are used in the chassis,

⁵⁷ Somers, J., Technologies to decarbonise the EU steel industry, EUR 30982 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-47147-9, doi:10.2760/069150, JRC127468

⁵⁸ R. Su, A. Assous, Starting from scrap - The key role of circular steel in meeting climate goals, Sandbag, June 2022

⁵⁹ Examples include Volvo, which has set the ambition to use 25% of recycled steel by 2025 <https://www.volvocars.com/intl/v/sustainability/circular-economy> and L. Petersson, Recycled content steel, Global Sustainability Team Volvo, 30/01/2023

⁶⁰ <https://www.volvocars.com/intl/v/sustainability/circular-economy>

⁶¹ https://www.stellantis.com/content/dam/stellantis-corporate/sustainability/csr-disclosure/fca/fca_2020_sustainability_report.pdf

⁶² <https://www.press.bmwgroup.com/global/article/detail/T0405678EN/bmw-group-secures-co2-reduced-steel-for-global-production-network?language=en>

⁶³ <http://www.circularity.eu/project/renault-closed-loop/>

⁶⁴ R. Su and A. Assous, Starting from scrap - The key role of circular steel in meeting climate goals, Sandbag, June 2022

main body and ‘thick’ reinforcement parts (around 21% of all steel in the vehicle). It is uncertain for future vehicles how the share of long products will evolve with the electrification of the drivetrains, as it is likely that this share will go down⁶⁵. At the moment, recycled content levels for these long products from EAFs for all applications combined lies around 60% with significant upwards potential as there are no technical limits to reach 100% scrap-based production in case copper contamination levels are reduced. A recent study exploring better scrap utilisation illustrates that for all steels in between 60 to 114 million tonnes would be feasible compared to a production in Europe between 130 and 164 million tonnes⁶⁶. However, there is uncertainty regarding to what extent flat products can contribute to the recycled content levels for all steel in future vehicles, as it is unclear what will be the share of flat products versus long products in new electric vehicles. At the moment, two important players in the US and one in Italy are blending scrap and DRI to produce high-grade flat steel like deep drawing steel, characterized by strict purity requirements⁶⁷. A major player in the steel recycling sector reports on its new processing line⁶⁸ produces a high quality recycled raw material, the quality of which is significantly higher than that of a classic E40, e.g. with a Cu content of < 0.1%. Other accompanying elements such as Cr, Mn, Mo, Ni, Ti are also adjusted according to the required specifications and guaranteed accordingly. In addition, the material is virtually free of organic and mineral impurities. The recycled raw material can be used both in the BF (10-15%) and in the converter (25-30%). In total 32-40% for flat steel and deep drawing steel. With the future EAF route for flat steel, a recycling rate of up to 60% could be possible. As a best-case scenario it is assumed that roughly around 30% increase in recycled content is feasible.

Some vehicle manufacturers have set their own targets in terms CO2 emissions reduction as well as for the use of recycled materials in their vehicles⁶⁹ but indicated that achieving higher levels is difficult. The feasibility of using recycled steel in new cars depends on a variety of factors, including the quality, cost and availability of recycled steel, the technical requirements of the car's design, and the demand for recycled materials from manufacturers and consumers. This measure may require some changes in certification and testing of steel products to ensure further processing is not negatively affected.

Definitions and classifications

Many studies and individual responses highlighted the need for improved definitions of recycled content. Based on an industry-led automotive working group, the following elaboration is made to illustrate the desired clarity of definitions better⁷⁰.

⁶⁵ <https://rmis.jrc.ec.europa.eu/veh#/v/components>

⁶⁶ R. Su and A.Assous, Starting from scrap - The key role of circular steel in meeting climate goals, Sandbag, June 2022; Somers, J., Technologies to decarbonise the EU steel industry, EUR 30982 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-47147-9, doi:10.2760/069150, JRC127468; Material Economics (2020). Preserving value in EU industrial materials - A value perspective on the use of steel, plastics, and aluminium, EIT – Climate KIC).

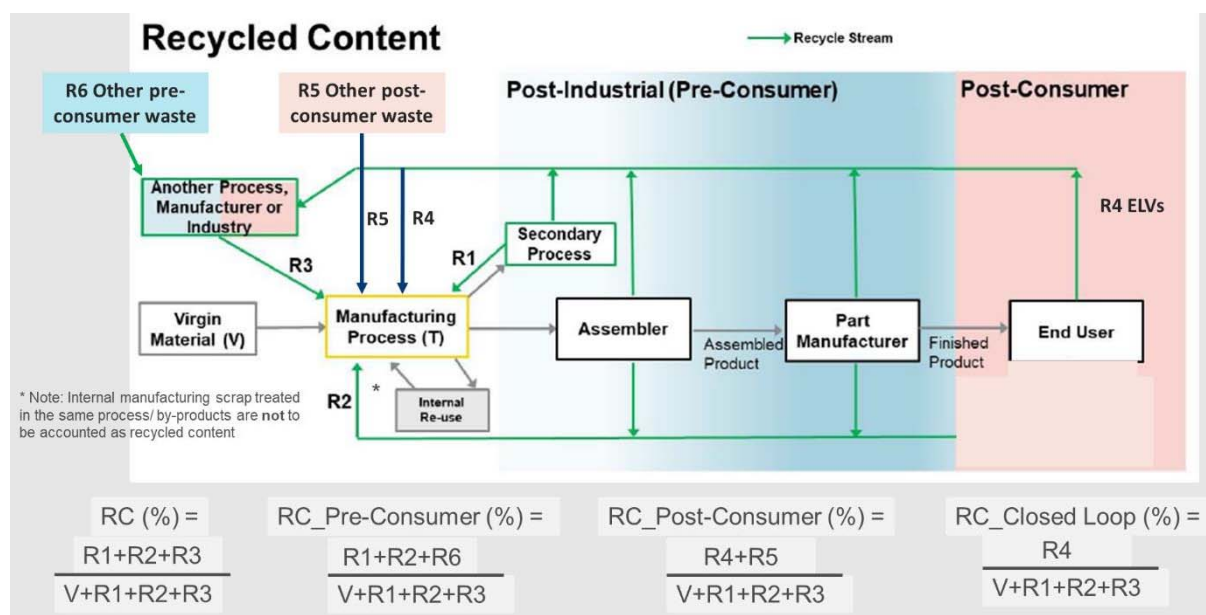
⁶⁷ R. Su and A.Assous, Starting from scrap - The key role of circular steel in meeting climate goals, Sandbag, June 2022;

⁶⁸ Planned full capacity of the first plant: > 300,000 t/a. In 2026, when several other plants will or have become operative, a capacity of 1.5 million t will be available with the same design concept and quality guarantees within the group of the major player in the steel recycling sector.

⁶⁹ According to Eurofer: “Nearly all OEM’s have set clear targets in terms of CO2 reduction and LCA carbon footprint reduction of their fleet. Some OEMs have clear targets on “recycled content” as well. Often without detailing exactly a definition for “recycled content” per material type”

⁷⁰ Automotive Industry Action Group and suppliers Partnership for the Environment, Guidance on Measuring Recycled Content of Automotive Products, September 2021

Figure 7.5: Possible improvement to recycled content definitions



In addition, there is a need for a clearer and commonly shared definition of ‘green-steel’, as indicated by IEA⁷¹ and the German steel industry⁷², and improved scrap classifications for higher quality fractions from (ELV) treatment⁷³. In the context of the proposed Regulation on Ecodesign for Sustainable Products (ESPR), requirements on recycled content may be considered for end products and intermediate products in the scope of ESPR, including steel. If steel is confirmed among priority products to be regulated⁷⁴, the dedicated preparatory work would address these issues and define criteria for sustainable products.

Rationale behind a recycled content target

Various studies highlight the need to improve demand related incentives in policies, for instance summarised in the IEA study⁷⁵. It is important to include improved scrap utilisation as a more immediate solution **in relation to the longer-term green steel conversion plans both from a technical as well as demand incentive point of view**. The rationale for a recycled content type of target is that the steel industry as the recycler ‘in the middle’ can play a pivotal role to the solution by negotiating both the ‘product’ with its customers as well as the scrap specifications with its suppliers for improved matching of decarbonised demand from its automotive clients with higher quality scrap from shredders. The improved quality requirements under the policy options 3 would tackle the identified interventions on the recycling side, but will not tackle the identified market failures and lack of incentives to

⁷¹ See the Technical Annex on page 133 of IEA - Achieving Net Zero Heavy Industry Sectors in G7 Members, 2021

⁷² Green Steel Definition - A Labelling System for Green Lead Markets - Proposal of the Steel Industry in Germany, November 2022

⁷³ EFR - EU-27 Steel Scrap Specification, 2007.

⁷⁴ Somers, J., Technologies to decarbonise the EU steel industry, EUR 30982 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-47147-9, doi:10.2760/069150, JRC127468;

⁷⁵ See Table 2.4 in Chapter 2 of IEA - Achieving Net Zero Heavy Industry Sectors in G7 Members, 2021

include higher recycled content levels as a complementary ‘pull mechanism’ on the production side to improve **the matching of secondary supply and demand**.

Policy options for setting a steel recycled content target.

The baseline for recycled content use in automotive production is estimated at 13% for which the share of post-consumer content as opposed to pre-consumer (or process scrap) content is currently not entirely clear due to varying recycled content definitions used internationally.

Table 7.2: Proposed targets for steel recycled content in newly type approved vehicles 7 years after entry-into-force of the Regulation

Proposed targets	Baseline	M10a	M10b	M10c
Post-consumer recycled content target all steel in vehicles	13% (including pre-and post-consumer scrap)_	Commission empowerment to lay down a r target	20%	30%
of which % from closed loop (ELV steel to new vehicles)	3-7%		none	15%

All requirements would apply to the vehicle categories (M1 and N1) which are covered by the scope of the current ELV Directive.

- **M10a - Empowerment for the Commission to set a mandatory recycled content target for steel, incl. calculation rules and verification rules at +3 yrs, based on a dedicated feasibility study, application to newly type approved vehicles at +7 yrs**

PO2A includes an empowerment for the Commission for setting a recycled content target levels for steel (M10a), based on a dedicated feasibility study. The study particularly focuses on determining an appropriate target level and take into account:

- The current and forecasted availability of steel recycled from post-consumer sources of steel waste;
- The current share of post-consumer waste in various steel semi-products and intermediates used in vehicles;
- The potential uptake of post-consumer recycled steel by manufacturers in vehicles⁷⁶ to be type-approved in the future; and
- The relative demand of the automotive sector in comparison to the demand for post-consumer steel waste of other sectors.

The adoption of the target level should be accompanied with the necessary calculation and verification rules at the same time at 2 years after entry into force. Similar to the case of plastics, improved definitions of ‘recycled content’ and ‘post-consumer’ will be included in such exercise, as well as more clarity on ‘green steel’ definitions and the positioning of scrap in them. Actual targets would then start to apply on newly type-approved vehicles at 7 years after into force of the Regulation.

- **M10b – 20% in newly type-approved vehicles**

⁷⁶ Notably linked to the future share of steel long products in electric vehicles, which are the candidates for high scrap utilisation rates and in flat-products expected to be used more in future vehicle designs

PO2B would set a **mandatory recycled content target for steel at 20% for newly type approved vehicles** in the Regulation, with the target to be achieved 7 years after entry into force. The advantage of **PO2B** is that it sets a more upfront incentive for increasing scrap utilisation in steel production to accelerate the reduction in natural gas, coal and iron-ore dependencies faster than under **PO2A** but it contains high uncertainties related to future supply and demand balances due to changing vehicle designs. The target would not include a closed-loop percentage to retain maximum flexibility in the sourcing of post-consumer scrap. It takes into account that the number of new vehicles on the market are 15.2 million in 2035, whereas the number of vehicles collected and treated are 11.7 million units as a maximum. A review clause at years after entry into force will be needed in case supply and demand of steel is rapidly increasing or decreasing as material choices may be subject to change.

These requirements shall apply 7 years after entry into force of the new legislation.

- **M10c – 30% in newly type-approved vehicles, of which 15% from closed loop**

PO2C would be a more ambitious option, setting mandatory recycled content targets for steel of 30% for newly type approved vehicles, including a 15% closed loop percentage. The closed loop percentage accounts for the fact that typically one third of ELV steel is shredded with two-thirds of other mixed metal scraps. The closed loop percentage ensures that so-called ‘E40+’ ELV derived steel scrap will contribute directly to the decarbonisation of vehicle manufacturing and to avoid ‘cheating’ with other sources of recycled steel like demolition steel often having higher copper contamination levels. This would represent the case that automotive production would take a more equal share in the uptake of post-consumer scrap compared to other sectors and be more directly made involved in ELV treatment. This is assuming a maximum technical scrap utilisation rate of 90%-100% for long products in EAF production and an additional improvement on the use of recycled content in flat production.

These requirements shall apply 7 years after entry into force of the new legislation.

- **M11 – Provisions the establishment of mandatory recycled content targets for other materials than plastics and steel**

The use of recycled steel and plastics in new cars is just one aspect of a broader strategy to increase the use of recycled materials in the automotive industry. It may be important to target other materials commonly used by the automotive industry for which markets for secondary raw materials are underdeveloped and recycling measures are regarded insufficient. Such approach was supported by the stakeholders during the open public consultation: aluminium, rare earth elements (REEs), platinum group metals (PGMs), magnesium, gallium were indicated as additional candidate materials to set a mandatory recycled content target in addition to recycled content for plastics.

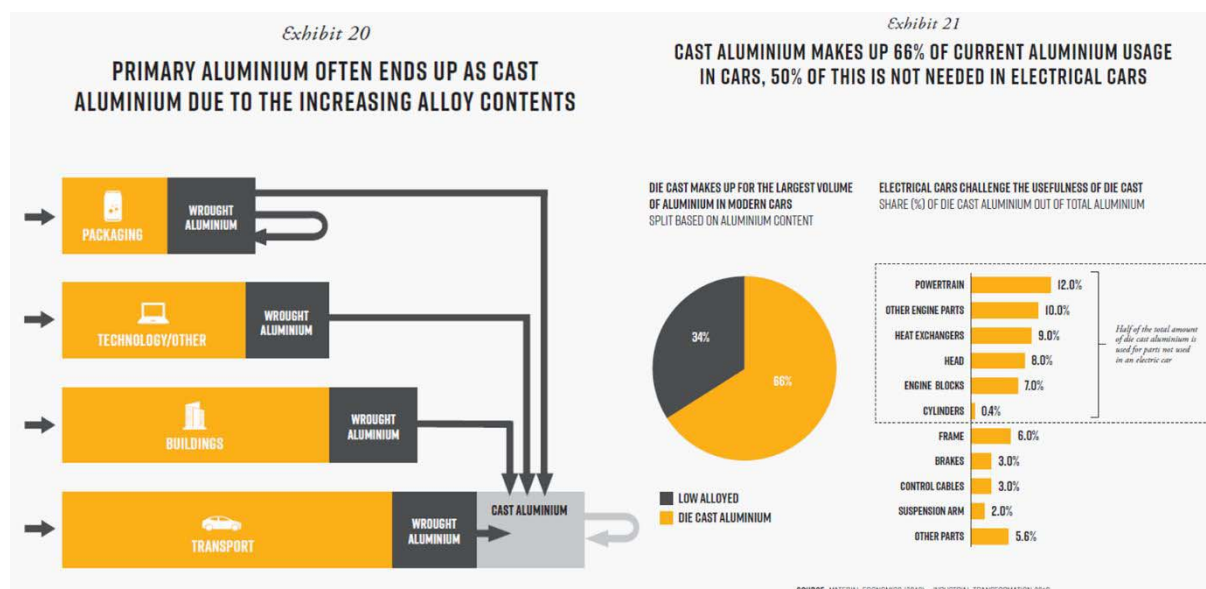
Under this measure, in addition to the recycled content targets on plastic and steel, the Commission would be (i) tasked to **assess the desirability, feasibility and impacts of setting out recycled content targets in new cars for other materials, especially aluminium alloys and critical raw materials such as rare earth elements and magnesium**, and (ii), based on this assessment, entitled to set out recycled content targets for the materials in question. The feasibility study should include an assessment of both past and expected materials trends for the future, consistent use of materials in design and production, expected supply of secondary

raw materials and their quality, the effect and necessity to realise economies of scale to re-feed recycled materials in existing production infrastructure and finally the development of recycling technologies and its future economic viability.

This feasibility study should be carried out within 3 years after the entry into force of the new legislation, accompanied with the revision proposal depending on the outcomes of the study. As an example, the key elements of the feasibility study are applied to aluminium as a first assessment:

Aluminium: Increasing secondary raw materials is hindered by the switch from cast to wrought alloys. In the case of aluminium, the transition to EVs requires lower alloying levels for wrought aluminium alloys than currently available in (ELV) aluminium scraps, posing a real and significant risk of mixed aluminium scrap surpluses, especially for high EV deployment scenarios, whereby high energy intensity materials cannot be recycled to their full potential. Similar to the case of steel, the accumulation of ‘tramp elements’ in aluminium alloys historically has not been an issue for the utilisation of aluminium scraps. The main destination of high alloyed and mixed aluminium has been cast alloys used in engine and gearbox production. With increasing electrification, this outlet disappears. The effect of electrification of drivetrains is explained in the next Figure 7.6.

Figure 7.6: The electrification effect forming a risk to future scrap surplus for aluminium



Due to these trends, there is a real risk of creating a so-called ‘scrap surplus’ situation in about 10 years from now. Meaning, secondary aluminium from ELV treatment with a high original material production footprint may not be recycled anymore (against much lower impacts) but will have to be discarded.

The feasibility study for a recycled content target will need to address the following elements:

- **Demand:** With the (automotive) market being very dynamic, it is yet unclear to what extent new large castings of battery encasing and e-drive motors may effectively replace some of the demand for cast alloys or not.

- **Consistent use of alloy (families):** There are many alloys type with strict manufacturing requirements. Often, manufacturing specifications are very diverse in nature and even more specific than existing material aluminium classification standards. Without more consistent use of a limited number of recipes, supply and demand may be difficult to match.
- **Secondary supply:** Current ELVs do not yet contain not as much aluminium as new vehicles. After removing engines, heat exchangers, etc, at the moment not much wrought aluminium (about 20kg) is left, but this may ultimately go up to about 180kg/vehicle.
- **Economies of scale:** Economies of scale in sorting. In order to make a target function, aluminium alloys will need to be sorted in at least 8 main family types to retain alloy value as compatible fractions for new applications.
- **Recycling technology development:** Advanced sorting technologies (LIBs) may become commercially attractive soon. With significant value for wrought alloys specifically, the market may take care of the desired value retention.

Due to the complexity and uncertainty in above initial assessment results, a recycled content target for aluminium is not immediately feasible. The foreseen feasibility study should provide more clarity with more information becoming available in the coming years.

Similar feasibility considerations apply to other candidates for recycled content targets. Investigating current and expected future recycling rates targeted material is an important element in the feasibility study as well. Based on this, an initial assessment for other materials is provided below:

Rare earth elements (REEs) in e-drive motors: In case EU primary production, magnet recycling and strategic projects supporting domestic production capabilities would be realised, then a recycled content target, including production scraps, can be a strategically relevant and environmentally attractive possibility. Such a development may mirror the approach for recycled content for battery raw materials.

Platinum Group Metals (PGMs): Palladium in car electronics is relatively dispersed. When removed and car electronics treated in similar processes as WEEE, there is sufficient intrinsic value present which does not require a recycled content type of target to overcome specific failures related to the market for secondary raw materials.

Magnesium: The material is sometimes used as die-cast ‘mono-material’ in automotive parts, with significant value. It is also frequently used in aluminium alloys covered above. Removal of die-cast parts may in the future lead to relevant quantities to enable a recycled content target. However, with very low quantities, economies of scale are difficult to be realised. Therefore, information requirements for its identification to treatment operators (PO1) and the removal requirements under (PO3) are currently better alternatives compared to a recycled content target.

Other CRMs:

Candidates may be:

- Silicon steel used in e-drive motors. Here, the value, economies of scale and limited supply risk are questionable in term of warranting a recycled content type of measure.
- Other materials like gallium are too dispersed to warrant a recycled content target, the same counts for titanium parts, which although concentrated, are used very rarely so far.

The feasibility study for other materials for M11 has a wider scope than the one for steel mentioned under M10 and includes additional economic viability and cost related elements:

- The current and forecasted availability of the materials listed in the second subparagraph recycled from post-consumer waste;
- The current shares of recycled content from post-consumer waste in the materials listed in the second subparagraph in vehicles placed on the market;
- Economic viability, technical and scientific progress, including changes in the availability of recycling technologies concerning the type of materials recycled; their material specific recycling rates;
- The effective and potential contribution of a minimum share of recycled content of the materials listed in the second subparagraph, recycled from post-consumer waste in vehicles to the Union's strategic autonomy, climate and environmental objectives;
- Possible impacts on the functioning of vehicles from incorporating recycled content of the materials listed in the second subparagraph into vehicle parts and components; and
- The need to prevent disproportionate negative impacts on the affordability of vehicles containing these materials derived from post-consumer recycled content listed in the second subparagraph.

The envisaged timing for this measure is a feasibility study at 3 years after entry-into-force, adoption of calculation and verification rules at 5 years and the recycled content target to be applicable after 7 years.

7.2.3 7.2.3 Policy Options 3A, 3B and 3C (related to specific objective 3 'treat better')

With regard to objective n°2 ("5.2.2. Increase the quantity and quality of materials re-used, remanufactured and recycled from ELVs"), Policy Option 3 consists in improving the management of waste from ELVs and supporting the market for re-used and remanufactured parts, through the following three different sub-options.

PO3A modernises the current provisions of the ELV Directive to improve clarity and enhance the quality of the treatment of waste. The first element is aligning the ELV Directive with the more recent and **stricter definition of recycling** used in other sectoral waste legislation (M12) which explicitly excludes backfilling. A clearer methodology for the calculation of recycling rates would also be established, similar to what is implemented or in development in EU law and ensuring that what is accounted as "recycled" only includes materials which are effectively recycled and not just collected for recycling. As a supporting element, **a ban on the landfilling of the residues** from shredding operations ("automotive shredder residue" or ASR) would be included (M16a). The option would also clarify the obligation (currently unclear in the ELV Directive and not implemented) **that some parts and components are to be removed prior to the shredding phase**, so as to facilitate high quality recycling or re-use (M13). Finally, to support reuse and remanufacturing of spare parts, **a definition of remanufacturing** (including conditions for warranty) would be introduced in the new legislation, as well as clearer instructions for reporting on the level of

re-use and remanufacturing from ELVs (M14a). All these measures follow the suggestions provided in the F4F opinion focussing on retrieving higher volume and quality of secondary materials from the automotive sector.

PO3A contains the following Measures 12-16 (M12-M16a).

- **M12 – alignment of the definition of recycling and of the calculation methodology for recycling rates with the horizontal waste legislation**

This measure consists first in aligning the definition on ‘recycling’ in the ELV Directive with the Waste Framework Directive⁷⁷. In line with Article 3 point 17 of the Directive 2008/98/EC (Waste Framework Directive), the definition of recycling will be laid down as follows in the future legislation on ELV:

- *‘recycling’ means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.*

In addition to aligning the definition of recycling with the definition in the WFD, this measure also consists in providing additional clarity and guidance on the methodology that should be used by economic operators and Member States to calculate and report on recycling rates. This methodology would be aligned with the provisions of the WFD⁷⁸ which clarify that recycling targets should be based on the weight of waste which enters recycling. As a general rule, the actual measurement of the weight of waste counted as recycled should therefore be at the point where waste enters the recycling operation. As part of this methodology, the new legislation will include definitions of “calculation point” and “measurement point”, similarly to what has been done for example for packaging waste through the 2019 amendment of Commission Decision of 22 March 2005 (Article 2)⁷⁹:

- *(d) ‘calculation point’ means the point where waste materials enter the recycling operation whereby waste is reprocessed into products, materials or substances that are not waste, or the point where waste materials cease to be waste as a result of a preparatory operation before being reprocessed;*
- *(e) ‘measurement point’ means the point where the mass of waste materials is measured with a view to determining the amount of waste at the calculation point.*

This new methodology will have an impact on the reporting on the attainment of recycling targets, which is currently regulated through Commission Decision 2005/293/EC. The Commission will be empowered to introduce the corresponding changes to this Decision within 3 years after entry into force of the Regulation. In that exercise, the possibility to apply the concept of ‘average loss rates’⁸⁰ will also be introduced, depending notably if rules on this issue are adopted under the umbrella of the WFD in the future.

⁷⁷ Directive 2008/98/EC of the Council and the European Parliament.

⁷⁸ Article 11a of the Waste Framework Directive.

⁷⁹ Commission Decision of 22 March 2005 establishing the formats relating to the database system pursuant to Directive 94/62/EC of the European Parliament and of the Council on packaging and packaging waste (2005/270/EC).

⁸⁰ The Commission proposed requirements on the calculation of average loss rate for municipal waste, in line with Article 11a(10) of the WFD, but these requirements have not yet been adopted: the Council objected in December 2021 to the adoption of delegated decision of 31.8.2021 supplementing Directive 2008/98/EC of the European Parliament and of the Council with regard to rules for the calculation and verification of the weight of materials or substances which are removed

- **M13a - Mandatory removal of certain parts/components prior to shredding to encourage their recycling or re-use (based on list contained in existing legislation)**

The ELV Directive sets out minimum technical requirements for treatment of ELVs to promote reuse and recycling, which include the “removal” of certain parts and components contained in Annex I(4). The provisions of the ELV Directive are however not sufficiently precise on what “removal” means and at which stage of the treatment process such “removal” should take place. Overall, these provisions have limited effect on the facilitation of the removal or disassembly of parts and components for their reuse or recycling into high quality recyclates.

This measure therefore aims to make operational and clearer the requirements contained in the ELV Directive by clarifying the conditions when removal prior to shredding would be performed with a view to increasing the potential for reuse, remanufacturing and/or high-quality recycling.

With this intention, this measure would set up an obligation that ATFs perform “**selective treatment for materials and component to be removed prior to further shredding**”, so as to facilitate high quality recycling or re-use for a selected list of parts and components (identical to the ones currently listed in the ELV Directive).

This selective treatment would include, in relation to depollution requirements (as in Annex I of current ELV Directive):

- removal or neutralisation of potential explosive components, (e.g. air bags),
- removal and separate collection and storage of fuel, motor oil, transmission oil, gearbox oil, hydraulic oil, cooling liquids, antifreeze, brake fluids, air-conditioning system fluids and any other fluid contained in the end-of-life vehicle, unless they are necessary for the re-use of the parts concerned,
- removal, as far as feasible, of all components identified as containing mercury.

It would also include removal obligation to improve reuse and recycling for the following parts/components:

- batteries,
- e-drive motors⁸¹
- liquified gas tanks,
- tyres,
- catalysts,
- glass, specifically windshields, rear and side windows,
- large metal components, specifically engines and gear boxes,
- large plastic components, specifically bumpers, dashboards and fluid containers.

The definition of selective treatment requires a more precise definition than currently used in the ELV Directive and should be harmonised with similar provision in the Battery Regulation and WEEE Directive Article 8 (and Annex VII). In this context ‘removal’ refers to manual dismantling or (semi-) automated disassembly in a non-destructive way for components with

after a sorting operation and which are not subsequently recycled, based on average loss rates for sorted waste (C(2021) 6295 final).

⁸¹ Tazi, N., Maury, T., Orefice, M., Mathieux, F., Initial analysis of selected measures to improve circularity of Critical Raw Materials and other materials in vehicles, JRC Science for Policy Report, 2023 (XXX)

a potential reuse or remanufacturing potential and in destructive manners for components destined to further recycling. The measure would foresee that the list should be updated by the Commission through secondary legislation, taking into account novel components in vehicles in the future, technological developments and the protection of the environment.

Specific requirements apply to the mandatory removal of e-drive motors by ATFs to prevent their shredding with the car hulk and the loss of permanent magnet materials subsequently. More detailed information on this is provided in Annex 15.2 by the JRC.

The requirements shall apply 3 years after the entry into force of the new legislation. For the removal of e-drive motor, this shall apply as well to maximise their reuse potential and to support innovation projects aiming to establish novel recycling capacities for the embedded REEs in the permanent magnets.

- **M14a – Introduction of a definition of “remanufacturing” and new monitoring requirements for re-use, refurbishing and remanufacturing**

This measure first consists in the introduction of a definition of remanufacturing and refurbishment, and of remanufactured part/component, following the provisions established in the proposal on a new Ecodesign for Sustainable Products Regulation.

In 2016, six associations⁸² that are part of the automotive production sector reached a common understanding as to basic definitions associated with their industry. The associations have proposed the following definitions⁸³:

Remanufacturing process: Remanufacturing is a standardized industrial process⁸⁴ by which cores are returned to same-as-new, or better, condition and performance. The process is in line with specific technical specifications, including engineering, quality and testing standards. The process yields fully warranted products.

Core: A core is a previously sold, worn or non-functional product or part, intended for the remanufacturing process. During reverse logistics, a core is protected, handled and identified for remanufacturing to avoid damage and to preserve its value. A core is not waste or scrap and is not intended to be reused before remanufacturing.

In addition, European Association of Automotive Suppliers⁸⁵ had previously agreed to the following definition applicable in Europe:

Remanufactured part: A remanufactured part fulfils a function which is at least equivalent compared to the original part. It is restored from an existing part (CORE), using standardized industrial processes in line with specific technical specifications. A remanufactured part is

⁸² The European Association of Automotive Suppliers (CLEPA), Motor & Equipment Remanufacturers Association (MERA), Automotive Parts Remanufacturers Association (APRA), Automotive Parts Remanufacturers National Association (ANRAP), European Organization for the Engine Remanufacture (FIRM) and Remanufacture Committee of China Association of Automobile Manufacturers (CPRA).

⁸³ [Remanufacturing Associations Agree on International Industry Definition](#), International agreement an important milestone in further development of a growing industry, Frankfurt, September 2016.

⁸⁴ An industrial process is an established process, which is fully documented, and capable to fulfil the requirements established by the remanufacturer.

⁸⁵ [Remanufacturing Associations Agree on International Industry Definition - CLEPA – European Association of Automotive Suppliers](#)

given the same warranty as a new part, and it clearly identifies the part as a remanufactured part and states the remanufacturer.

Currently, an ISO “Technical product documentation — Design for manufacturing, assembling, disassembling and end-of-life processing — Part 2: Vocabulary”⁸⁶ is under development. It is planned that remanufacturing definitions will also be addressed in this document.

The above clarifies that there are different options for the definition of remanufacturing and also processes underway to harmonise the definitions used by various actors.

Relevant in this regard is how the concept of remanufacturing relates to guidance under the ‘Blue Guide’ on the implementation of EU product rules (2022/C 247/01). Remanufacturing typically involves modifications and repairs to products, including cores. In this respect the Blue Guide states:

“After they are placed on the market, products may be subject to life extension processes. While some of these processes intend to maintain or restore the product to its original condition, others imply that substantial modifications are made to the product.

A product, which has been subject to important changes or overhaul after it has been put into service must be considered as a new product if: i) its original performance, purpose or type is modified, without this being foreseen in the initial risk assessment; ii) the nature of the hazard has changed or the level of risk has increased in relation to the relevant Union harmonisation legislation; and iii) the product is made available (or put into service if the applicable legislation also covers putting into service within its scope). This has to be assessed on a case-by-case basis and, in particular, in view of the objective of the legislation and the type of products covered by the legislation in question.

Where a modified product (38) is considered as a new product, it must comply with the provisions of the applicable legislation when it is made available or put into service.”

A limitation in the definition proposed by associations is that it does not clarify whether the modifications in this context are considered ‘substantial’, which leads to the parts to be considered as ‘new’. To differentiate between operations that substantially or non-substantially modify, the proposal on a new Ecodesign for Sustainable Products Regulation provides definitions for remanufacturing as well as refurbishment, where the former typically involves modifications that are considered substantial:

‘remanufacturing’ means an industrial process in which a product is produced from objects that are waste, products or components and in which at least one change is made to the product that affects the safety, performance, purpose or type of the product typically placed on the market with a commercial guarantee;

‘refurbishment’ means preparing or modifying an object that is waste or a product to restore its performance or functionality within the intended use, range of performance and maintenance

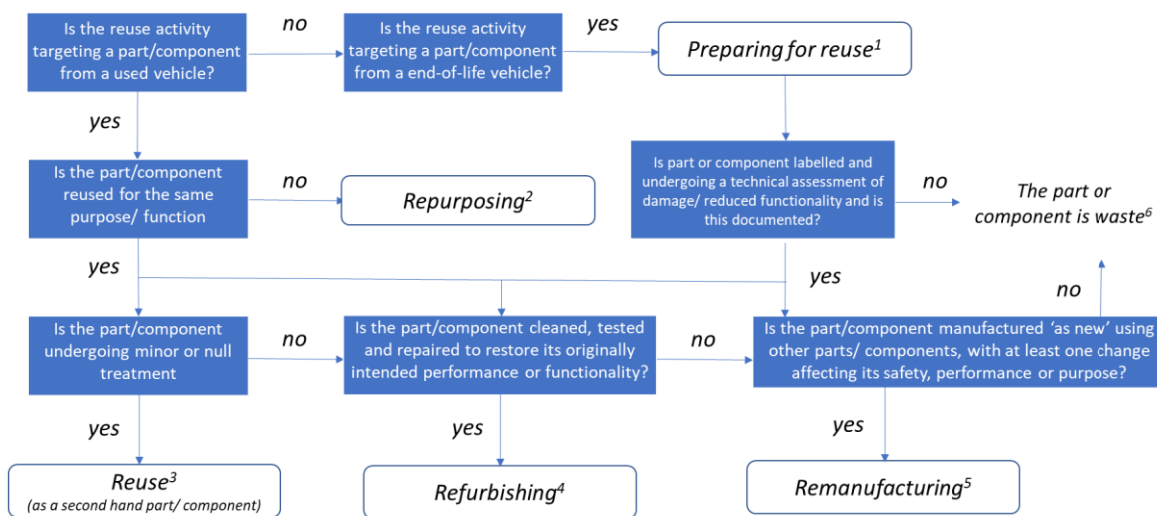
⁸⁶ [ISO/DIS 8887-2](#) Technical product documentation — Design for manufacturing, assembling, disassembling and end-of-life processing — Part 2: Vocabulary.

originally conceived at the design stage, or to meet applicable technical standards or regulatory requirements, with the result of making a fully functional product;

To support the remanufacturing and refurbishment practice, a legal definition on remanufacturing and refurbishment will be introduced in the new legislation on ELV and 3R type-approval, by applying the definitions under the proposal on a new Ecodesign for Sustainable Products Regulation to the ELV context of parts and components removed from vehicles and end-of-life vehicles.

Linked to these definitions, the new legislation would thus contain a provision on parts and components that are fit for direct reuse, refurbishment and remanufacturing, clarifying under which conditions they shall not be considered as waste in line with Article 6(1) of the Waste Framework Directive. This would notably mean that they are not subject to the EU rules on the shipments of waste when they are shipped from or into an EU Member State.

Figure 7.7: Possible reuse definitions in the context of parts and components from ELVs



- (1) 'Preparing for reuse' means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be reused [...] Waste Framework Directive, 2008;
- (2) 'Repurposing' means any operation that results in parts or components being used for a different purpose or application than the one that part or component was originally designed for, Batteries Regulation;
- (3) 'Reuse' or 'second hand' means any operation by which products, parts or components that are not waste are used again for the same purpose for which they were conceived, Waste Framework Directive, 2008;
- (4) 'Refurbishment' means actions carried out to prepare, clean, test and, where necessary repair a part or component that is either removed from vehicles or end-of-life vehicles in order to restore either its performance or functionality within the intended use and range of performance originally conceived at the design stage applicable at the time of its placing on the market, proposal for a Ecodesign for Sustainable Products Regulation;
- (5) 'Remanufacturing' means an operation in which a new part or component is manufactured from parts and components that are either removed from vehicles or end-of-life vehicles and in which at least one change is made to the part or component that affects its safety, performance, purpose or type proposal for a Ecodesign for Sustainable Products Regulation;
- (6) 'Waste' means any substance, product, part or component or object which the holder discards or intends or is required to discard, Waste Framework Directive, 2008;

In addition to these definitions, this measure introduces a new requirement for the Member States to collect and report data on the type and share of automotive parts and components which are re-used or remanufactured. Such reporting obligation will allow to monitor the total level of reuse and remanufacturing at both national and the EU level per year. To ensure harmonized monitoring conditions, the new legislation will set out reporting requirements for ATFs, which will be obliged to provide information on all parts and components that were 1) dismantled and reused or 2) dismantled and remanufactured.

The new legislation will establish a **list of parts and components** that are relevant for reuse, refurbishment and remanufacturing (based on the list provided in Measure 13). The list shall

be regularly revised and updated. Vehicle manufacturers will be required to provide information on the dismantling time and method of these automotive parts and components during the vehicle type-approval procedure, as described in Measure 3. Methodology and reporting format by the Member States will be set out in the revised Commission Decision 2005/293/EC laying down detailed rules on the monitoring of the reuse/recovery and reuse/recycling targets set out in Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles⁸⁷.

These requirements shall apply 3 years after the entry into force of the new legislation.

- **M16a - Ban on the landfilling of automotive waste residues from shredding operations**

Under this measure, the new legislation would set out a prohibition for operators of shredding facilities to dispose waste from ELVs in landfills. While a large share of residues from ELVs are recovered or recycled after shredding operations, this is not the case for some fractions (which are parts of what is often referred to as “fluff”, which typically contains plastics, textile, rubber, glass and other non-metal materials), which are then sent to landfills. In order to improve the treatment of these fractions and reduce the overall amount of waste going to landfilling, this measure would ban the disposal of these fractions in landfills. More details are provided in the supporting study in Sections 2.1.5.4.5 and 3.1.4.7.1. The aimed results are increased direction of shredder light fractions (SLF) and certain (untreated) PST fractions to waste incineration with energy recovery or chemical recycling, all higher in the waste hierarchy. Combined with the removal of window glass, the final volume to landfill would be significantly reduced.

The requirements shall apply 3 years after the entry into force of the new legislation.

PO3B: This Policy Option contains the measures in PO3A and, in addition, **new enhanced measures** to promote the re-use and recycling of relevant metals, plastics and certain CRMs. The list of parts/components to be **removed prior to shredding** (mentioned in P03A) **would be extended with parts and components with high concentrations of valuable materials or CRMs** (M13b)⁸⁸. A derogation to this removal requirement would apply if evidence can be provided that the materials/parts/components will be separated with the same efficiency as manual dismantling/ semi-automated disassembly by post shredding technologies (PST). For monitoring purposes, Member States are to report on established and used capacities of PST plants. The option also foresees that incentives should be put in place to support the market for re-used and remanufactured parts, building on legislation and best practices in some Member States⁸⁹(M14b). To improve warranty conditions of used spare parts, information on their origin should be made mandatory as a condition for their sales (i.e., through the

⁸⁷ 2005/293/EC: Commission Decision of 1 April 2005 laying down detailed rules on the monitoring of the reuse/recovery and reuse/recycling targets set out in Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles (notified under document number C(2004) 2849) (OJ L 94, 13.4.2005, p. 30).

⁸⁸ The additional parts would include e.g., main wiring harness (copper), electric and electronic components (such as printed circuit boards with a surface area > 10 cm², photovoltaic panels with a surface area > 0.2 m², controllers, engine motors), mono-material aluminium components with a weight > 10 kg, requiring the separate collection and treatment of cast and wrought aluminium, e.g., bumpers, wheels, heat exchangers, NdFeB magnets, electric steel and copper from EV drive train in case not destined for (preparation for) reuse/remanufacturing.

⁸⁹ See for example the measure established in France that requires garage and repair shops to provide offers for used spare parts together with new spare parts to their customers (see Article L224-67 of the “Code de la Consommation”, available at https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000032226565/2018-01-19).

provision of the VIN number of the ELV the parts come from). To boost plastic recycling and ensure a sufficient supply of recyclates to meet the demand for recycled plastics in vehicles (see PO2), a **specific plastic recycling target**⁹⁰ of 30% by 2030 would be established (M15b). To ensure improved quality of steel and aluminium scraps from ELVs, a ban to avoid mixing of ELV scraps with WEEE scraps such as whitegoods and refrigerators is included (M16b), which reduces (copper) impurities and improves traceability including the closed loop share of automotive plastics recycling⁹¹.

PO3B contains the following Measures 13-16 (M13b-M16b).

- **M13b - Mandatory removal of larger list of components, including those which contain a high concentration of valuable metals or CRMs**

The measure is based on the description of the measure M13a. In addition to the list provided in M13a, ATFs would have to perform “**selective treatment** for materials and component to be removed either prior to further treatment in the absence of PST technology, **or as part of the treatment process**”. The latter under the condition that the materials/parts/components will be separated with the same efficiency as manual dismantling/ (semi-)automated disassembly by post shredding technologies (PST) and that such selective treatment can be monitored.

Electronics components relevant for this measure can be categorised in four main categories: Controllers, Headlights, Actuators and Cables. Such components typically contain relevant concentrations for precious metals and CRM such as Palladium (Pd) and Gallium (Ga). Pd content is expected to increase due to more electronic components and due to the electrification of the EU fleet. Those metals are mostly lost at the end-of-life if the components are not removed from ELVs prior to their recycling, because car-recycling processes are currently optimized to recover basis metals such as Fe, Al or Cu. In order to improve the performance of the recovery of CRM and precious metals from vehicles, **the measure requires the removal of selected electronic components embedded in vehicles in order to recycle them separately in e-waste recycling facilities**, which are optimized for precious metals recovery. More information on this can be found in Annex 15.2.3 based on the initial findings of the JRC⁹².

The selective treatment of the following additional parts and components either prior or as part of the treatment process are in addition to M13a:

- wheels,
- main wiring harness (copper),
- electric and electronic components (such as printed circuit boards with a surface area > 10 cm², photo-voltaic (PV) panels with a surface area > 0.2 m²)
- controllers (Infotainment control unit containing sound, navigation and multimedia;
- Control module or the valve box for the automatic transmission; Inverter of the EVs),

⁹⁰Applying to ELV thermoplastics and polyurethanes.

⁹¹ The WEEE Directive Art 5 requires separate collection for such products and Art 8/ Annex VII specifies selective treatment requirements.

⁹² N. Tazi, M. Orefice, C. Marmy, Y. Baron, M Ljunggren, P Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821

- mono-material aluminium components with a weight > 10 kg, requiring the separate collection and treatment of cast and wrought aluminium, e.g., bumpers, wheels, heat exchangers,
- neodymium magnets (NdFeB), electric steel⁹³ and copper from electric vehicle (EV) drive train.

ATFs would be exempted from the obligation to remove these parts and components prior to the shredding phase if they can demonstrate that these parts/components will be delivered to a shredder which is able to perform shredding and post-shredding activities in a way that the parts and components will be recycled into materials with the same quality as if they had been removed prior to shredding.

The content of the measure reflects the stakeholders' views. Obligation for ATFs to remove certain parts of ELVs before shredding was supported by 58 participants of the open public consultation (28%), including waste management operators, automotive suppliers and producers, dealers and repair shops. 126 individuals or 61% of all respondents also supported another requirement for car manufacturers to enable the ATFs unlocking parts so that they can be reused and dismantled. With the aim to accelerate reuse of removed parts, stakeholders (70 individuals or 34%) were in favour of complimentary obligation for vehicle manufacturers to provide the dismantling centres (ATFs) information about which parts can be used as identical parts in other models of the manufacturer or even other brands.

The new requirements shall apply 3 years after entry into force of a new legislation.

- **M14b - Market support for used spare parts**

M14b would contain the following measures designed to increase the traceability of used spare parts, as well as to support the demand for such parts:

- To improve traceability on used spare parts and address problems posed by the illegal sales (including online) of used parts or components, an obligation for retailers would be introduced, according to which they would have to provide, at the point of (online) sale, information on the vehicle identification number (VIN) of the ELV the parts come from and on the registration number of the dismantler, together with the components details.
- To support the demand for used components and parts on the EU market, the Member States would be requested to put in place a series of incentives or obligations towards the various actors involved in the supply chain. This could include an obligation, as the one which has been in force in France since 2017, for companies in the maintenance and repair of vehicles to provide customers with an offer to repair a vehicle with used/remanufactured components or parts, alongside offers to repair the vehicle with new components. It is important that such requirement does not apply to repair shops or garages when this creates excessive burden or costs (for example no used spare parts can be found within a reasonable timeframe)⁹⁴. Such incentives could also include a

⁹³ Electrical steel is a unique steel product which utilizes the ferromagnetic properties of iron.

⁹⁴ The measure in force in France in that respect only apply to a selected list of parts. Derogations from the obligation are foreseen where the operator is not able to find a suitable used spare parts within a reasonable amount of time (such as the time of the immobilisation of the vehicle agreed with the customer for the repair operations) or that he finds that the used spare parts available are likely to present important safety or environmental risks. It should be noted that, under the French legislation, this obligation has been extended to motorcycles since 2022.

See: <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000032610837/> and https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000032226565/2018-01-19

streamlining of the distribution channels increasing the transparency of offers on the parts and the logistics for a timely distribution of used or remanufactured spare parts. Other measures accompanying such a process could be a certification procedure on EU level to ensure the quality of parts and foster consumer confidence or financial incentives including a reduced rate of VAT for used or refurbished spare parts.

The Commission would also be tasked to review the effectiveness of the measures above to improve the functioning of the market of used spare parts and, if they prove not to be sufficient, propose to make it mandatory at EU level for garages and repair shops to provide an offer for used or remanufactured spare parts, together with new spare parts.

This measure corresponds to the views expressed by the stakeholders of the Open Public Consultation. When inquired which measures would contribute to increase the reuse of vehicle parts, obligation for repair shops to offer customers used spare parts as an alternative to new ones was supported by 111 individuals or 53% of all participants of the public consultation. 84 of these stakeholders were SMEs, representing dismantling, recycling sectors, ATFs and repair shops.

The measures shall apply 3 years after the entry into force of the new legislation.

- **M15b – Recycling targets for plastics – 30% by 2030**

The measure introduces a mandatory 30% of recycling target for plastic based on the revised definition of “recycling” as aligned with the Waste Framework Directive. This measure would be implemented in a combination with the additional requirements of the mandatory removal prior to shredding/PST (M13a,M13b), regulation of shredder/ post-shredder facilities (M16b, M16c), disposal ban of light-weighted fractions (M16a). Introduction of material-based recycling target would be complementary to the existing combined reuse and recycling targets based on a weight would be maintained, as described in M14.

The proposed recycling level corresponds the opinion of the stakeholders considering that 30% recycling target is ambitious but achievable⁹⁵.

A recycling target would leave a discretion for waste operators to decide what processing stages to apply to ensure it is complied with. In this sense, operators could consider whether to increase dismantling and separate recycling or to adopt advanced PST and promote the development of further PST technologies, to improve their outputs but also to allow the sorting and recycling of additional plastic types. Alternatively, the Commission will consider the possibilities to set minimum performance requirements in a form of secondary legislation for PST treatment of fractions containing plastics (see M16b).

Development of additional PST technologies will be stimulated by the landfill ban of shredder light fractions that are not sent to PST and PST output fractions with a specific weight of > 1.3 g/cm³. Mandatory requirements to remove certain parts and components (e.g. bumper) before shredding will also contribute to higher recycling efficiency.

This material specific target aims to contribute to high-quality recycling by introducing new calculation principles, clarifying that only materials recovered after recycling operations will be considered as recycled. It also includes possible calculation and measurement points for either recyclates or fractions to be recycled as well as a possible reporting point. Special

⁹⁵ Based on the information received from EuRIC (2021); a Plastics Recyclers Association (2021).

calculation methodologies shall be developed within 2 years after the adoption of the legal act and established in a form of secondary legislation.

The new calculation approach would build on the example established in the Packaging and Packaging Waste Directive, where only “the weight of packaging waste recycled shall be calculated as the weight of packaging that has become waste which, having undergone all necessary checking, sorting and other preliminary operations to remove waste materials that are not targeted by the subsequent reprocessing and to ensure high-quality recycling, enters the recycling operation whereby waste materials are actually reprocessed into products, materials or substances”. It has also been applied to the WFD.

The definitions of “calculation point” and “measurement point” relevant for reporting of data on waste have been recently introduced through delegated acts, for instance in the amended Commission Decision of 22 March 2005 (Article 2)⁹⁶:

- (d) *‘calculation point’ means the point where packaging waste materials enter the recycling operation whereby waste is reprocessed into products, materials or substances that are not waste, or the point where waste materials cease to be waste as a result of a preparatory operation before being reprocessed;*
- (e) *‘measurement point’ means the point where the mass of waste materials is measured with a view to determining the amount of waste at the calculation point.*

The possibility to introduce the concept of ‘average loss rates’⁹⁷ will be analysed.

New calculation rules will also require adjustment of the existing reporting scheme within 2 years after entry into force of the new legislation in the Commission Decision 2005/293/EC as recycling operators will be obliged to monitor and report on recycled materials.

Setting material specific targets, including the recycling target for plastic, in relation to the calculation point will contribute to a higher quantity and quality of secondary plastic materials. Introduction of calculation/measurement points for materials would improve comparability of reported data among EU Member States. The intended calculation point for materials for reporting on actual recycling should refer to the recyclates obtained after recycling (losses are excluded). However, it would also retain a possibility to apply ‘average loss rates’ in case where no data on recyclates is available.

Within 5 years after entry into force, the Commission will conduct a feasibility study on the review of the target to be accompanied within the legislative proposal if appropriate.

Setting material specific recycling target was supported by the stakeholders during the open public consultation. 31 participants or 15% of the responses agreed that the establishment of material-specific recycling targets would increase the separate recycling of materials addressed by targets, their quality and revenues from sale of such materials while also increasing the costs of recycling. Other 24 participants equal to 12% of stakeholders answered that such target would increase separate recycling and secondary material quality while also

⁹⁶ Commission Decision of 22 March 2005 establishing the formats relating to the database system pursuant to Directive 94/62/EC of the European Parliament and of the Council on packaging and packaging waste (2005/270/EC)

⁹⁷ Delegated decision of 31.8.2021 supplementing Directive 2008/98/EC of the European Parliament and of the Council with regard to rules for the calculation and verification of the weight of materials or substances which are removed after a sorting operation and which are not subsequently recycled, based on average loss rates for sorted waste (C(2021) 6295 final).

increasing costs. The same share of participants estimate that such targets would only increase the recycling costs. However, the vast majority (64%) of all stakeholders, including SMEs, agreed that material-specific recycling targets have a positive impact on innovation.

- M16b – Ban on mixed shredding of ELVs with certain other waste streams

The measure aims to increase the quality of the shredded materials by introducing a ban to mix the automotive waste (ELV scrap) with other packaging waste (metal cans) and waste electrical and electronic equipment (WEEE).

The requirements shall apply 3 years after the entry into force of the new legislation.

PO3C contains the measures in PO3B and, in addition, specifically targets **higher quality of recycling for specific materials**. Additional components **and novel lightweight materials** would be added to the list of parts/components to be removed prior to shredding (M13c)⁹⁸. For glass, a material specific recycling target of 70% would be set, accompanied with quality criteria to ensure that only recyclates to container glass or equivalent quality are accounted towards the recycling target (M15c). The Commission would be required within 5 years to develop specific and additional requirements to improve the efficiency of post-shredder treatment (PST) operations by setting minimum quality standards (M16c). This may be needed in case novel sorting technologies for aluminium, magnesium or CRMs are insufficient. This may be needed in case novel sorting technologies for aluminium, magnesium or CRMs are insufficient.

PO3C contains the following Measures 13-16 (M13c-M16c).

- M13c - Mandatory removal of additional components

Complementarily to measures M13a and M13b, this measure introduces the most advanced list of parts and components to be removed for selective treatment at end-of-life stage. Their removal would function as a preventive measure to ensure that additional valuable materials and CRMs are diluted or not recovered in the mix of automotive shredder residues, impacting the overall value and quality of the secondary materials.

Under this measure, the preliminary list of parts and components to be removed before shredding would, in addition to the parts and components indicated in M13a and M13b, include:

- Lightweight materials which are particularly difficult to recycle like (carbon)-fibre reinforce plastics;
- Mono-material aluminium components with a weight above 5 kg, requiring the separate collection and treatment of cast and wrought aluminium,
- Smaller copper and EEE parts⁹⁹;
- Small motors, controllers, actuators and inverters¹⁰⁰.

⁹⁸ This would include difficult to recycle lightweight materials such as glass and carbon fibre reinforced plastics, as well as smaller copper and EEE parts, small motors, inverters, etc.

⁹⁹ More detailed lists with number of occurrences, weights of components and material presences can be found in: Groke, M.; Kaerger, W.; Sander, K.; Bergamos, M. (2017): Optimierung der Separation von Bauteilen und Materialien aus Altfahrzeugen zur Rückgewinnung kritischer Metalle (ORKAM). In: Umweltbundesamt, UBA Texte (02/2017) and in Restrepo et al. (2017): Stocks, Flows and Distribution of Critical Metals in Embedded Electronics in Passenger Vehicles. Unter Mitarbeit von Restrepo E., Amund N. Løvik, Patrick Wäger, Rolf Widmer, Radek Lonka, and Daniel B. Müller. Environ. Sci. Technol.

A derogation from this obligation would be granted if ATFs and shredders provide verifiable evidence that separation using automated processes leads (e.g. shredders) to recyclates of at least similar efficiency as manual dismantling and, or (semi-)automated disassembly by post shredding technologies (PST) and that such selective treatment can be monitored.

The requirements shall apply 5 years after the entry into force of the new legislation.

- **M15c - Glass – 70% recycling as container glass quality or equivalent**

Comparable to the M13b, this measure sets a material specific 70% recycling target for glass. The attainment of the quantitative target would be accompanied with quality check criteria for the recycled materials meaning that only recyclates equivalent to the container glass quality shall be accounted towards the calculation of a recycling target.

The level of the target is based on the assessment of case studies demonstrating that 20.8 kg is recovered per ELV when destructive dismantling is applied. Assuming an average weight of 30 kg of glass per vehicle means that this reflects around 70% of the glass in a vehicle¹⁰¹.

Introduction of the provision defining the quality of obtained recycled materials will allow to avoid down-cycling which is of critical importance for glass materials. In this regard, the recycled automotive glass shall be of a quality that can be applied to produce glass products.

This measure leaves open whether the glass is removed and treated separately or recovered from the shredder through application of PST. Available data suggests that current PST technologies would not result in a glass fraction that is of sufficient quality¹⁰², however, such technologies could still be developed and applied in the future if minimum quality requirements are to be achieved. Monitoring and enforcement would require ATFs to provide evidence of the number of vehicles treated and the amount of glass dismantled from all vehicles and sent to recyclers. Shredders and PST operators would be required to report on vehicle inputs and recycled material outputs (glass sent to recyclers and glass containing mineral fractions that can be used in construction or in backfilling operations (limited amounts may be “recovered”)).

As in the case of measure M15b, setting the recycling target would be accompanied with the complementary provisions defining the calculation/measurement points, ‘average loss rates’ which methodological aspects would be further detailed in a form of secondary legislation within the 2 years after adoption of a new legislation.

The requirements shall apply 5 years after the entry into force of the new legislation.

¹⁰⁰ As well as in the Swiss EVA project: Restrepo et al. (2018): Projekt "EVA": Elektronik – Verwertung - Altautos. "Zusammenfassung der Aktivitäten und Resultate". Zusammenfassung EVA und Schlussbericht zum Arbeitspaket C5. Unter Mitarbeit von Restrepo E., Løvik, A., Haarman A. & Widmer, R. Hg. v. Working-group EVA and Bundesamt für Umwelt (BAFU). EMPA. (newer study and reference available but not yet published).

¹⁰¹ Based on Intertek RDC & OVAM (2013) study.

¹⁰² Intertek RDC & OVAM (2013) explain that automotive glass separated after shredding and PST is not accepted (in 2012) by the glass recyclers. This is due to it still containing many impurities (plastics, metals, stones), as it is a mix of glass of different sources (i.e., heterogeneous – sourced from ELVs but also from e.g., washing machines, car lamps) and as it is provided in very small pieces (< 8 mm) which with the current technologies applied hinders the separation at the glass recycling plant into glass of different types (composition). The mineral fraction containing automotive glass is either recycled as building material (Examples: road basement and landfill covering), to replace other mineral materials (sand, rocks...) if the quality is sufficient, or is landfilled.

- **M16c – Setting requirements on Post Shredder Technologies (PST) to improve the quantity and quality of metal scrap recovered from ELVs**

The measure aims to improve the quality of metal scrap (especially steel and aluminium scrap) from ELVs, through the adoption of treatment requirements for shredders.

Currently, the ELV Directive defines minimum technical requirements for treatment operations for depollution of ELVs (Article 6(3) and Annex I (3)) as well as for treatment and for storage, which apply to the dismantling processes performed by ATFs (Annex I (1) and (2)). There are however no such requirements for shredder processes (incl. post-shredder plant) in the current Directive.

Under this measure, the Commission would be empowered to set the following requirements, within 5 years from entry into force of the Regulation:

- minimum requirements for shredder/PST plants designed to improve the quality of scrap as output of the shredding process (for example through a definition of output qualities e.g., limiting the metal content of untreated Shredder Light Fractions envisaged for disposal to 1%, as well as limiting the copper contamination of steel and aluminium scrap to a certain level),
- national reporting obligations on:
- national capacities of PST and
- information on input/output flows, including information on the final use and indication of how much of the input materials comes from Auto Shredder Residues (ASR) in cases where plants treat multiple waste streams.

The measure will contribute to reduction of losses of residual metals while ensuring a minimum level of performance of PST operations.

Supporting information on the measure:

After depollution and dismantling, mechanical treatment of ELVs takes place in shredders of metal waste. The input materials are crushed into smaller material components. Afterwards, the obtained smaller pieces are separated into metallic and non-metallic fractions.

- Limitation of metal content in the Shredder Light Fraction (SLF)

The main output of the process is steel scrap. When this scrap has a high density, high degree of purity and homogenous size, it can be used directly in metal works to produce steel. The other obtained fractions are shredded non-ferrous fractions (containing other metallic products) and Auto Shredder Residues (ASR) containing the subfractions Shredder Light Fraction (SLR) and Shredder Heavy Fraction (SHF). These fractions can be further treated to recover as much material as possible and to minimise the amount of waste sent for disposal.

The possible further treatment of mixed non-ferrous output may be separation, for example by eddy current separations, metal-sensing or by dense media separation.

The ASR fractions can be further treated in post-shredder technology (PST) plants. Such further treatments of the mixed non-ferrous fraction and the ASR fraction can take place in integrated plants or separate (centralised) plants.

As demonstrated in several studies untreated SLF contains several percent of residual metals, representing up to 7.8 %, respectively 6.3 % (Sander et al. 2020) or according to studies performed more than a decade ago even 11 % (Duwe and Goldmann 2012).

Regarding the SLF a joint presentation of Ökopool and Umweltbundesamt (Germany) concluded (Sander et al. 2017): “Typical disposal routes for the shredder light fraction are energy recovery or incineration, backfilling, the use as landfill construction materials, or landfilling. In the case of these disposal routes, functional recycling of the recyclable materials is mostly not carried out. Therefore, a limitation of the contained recyclables, in particular of the metals, seems appropriate.”

A possible maximum metal content for shredder residues, which are destined for backfilling/landfill construction, energy recovery/incineration or final disposal/landfill sites, should be ambitious in order to recover as many metals as possible as secondary raw materials, and should orient themselves to the technical possibilities. The removal of metal from the shredder light fraction at least to below 1 % metal content by means of post-shredder is considered to be feasible¹⁰³.

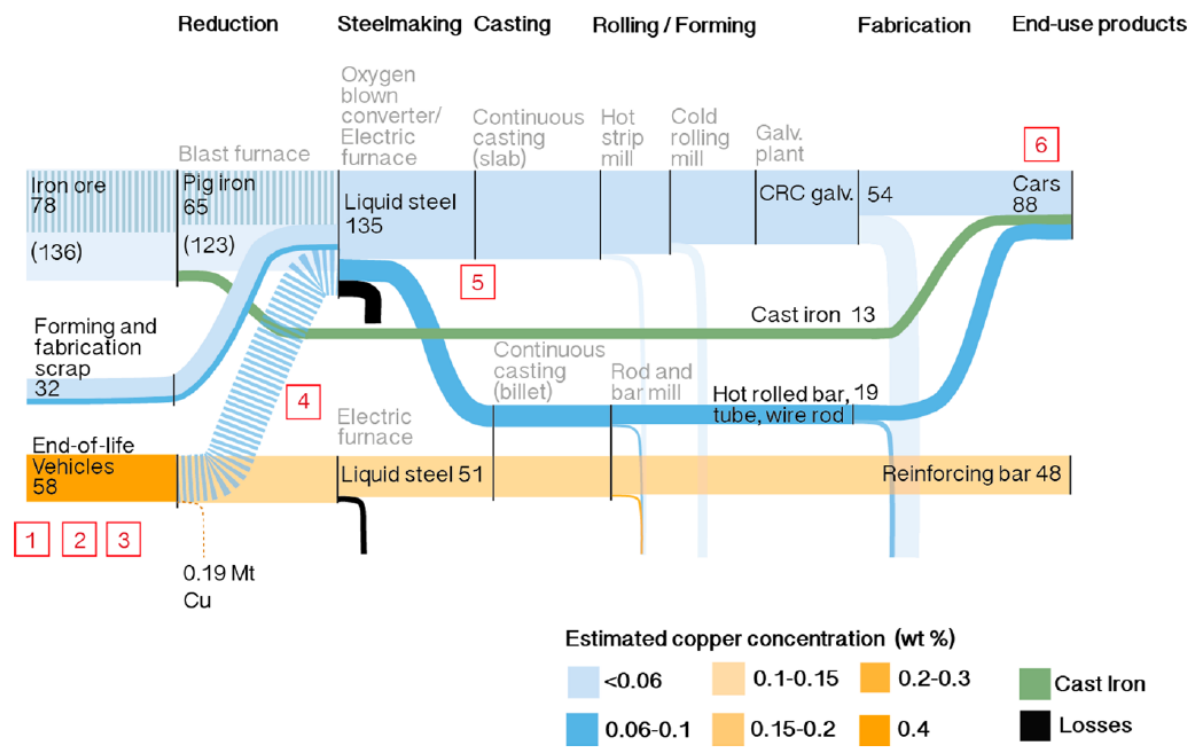
In Switzerland, such an approach is already implemented: According to Article 21 of the Swiss Waste Ordinance¹⁰⁴, metal pieces are to be removed and recycled from the lightest fraction that occurs during the comminution of metal-containing waste (light fraction). Copper content in steel scrap destined for recycling, is considered an impurity of steel and may affect the portfolio of applications in which secondary steel can be applied (EUROFER 27.10.21). As outlined in the consultant study supporting the impact assessment¹⁰⁵, copper (Cu) contamination in steel varies and ranges between 0.2 to 0.7%. Copper content in shredder/PST deliverables is considered an impurity also for fraction rich in aluminium. Similar to steel, Eurometaux state that the dismantling of components with copper prior to shredding would allow secondary aluminium of higher purity.

Figure 7.8 Steel mass flows (in Mt) corresponding to the production of cars and the recycling of end-of-life vehicles traced through the 2008 global steel system, both current practice and a theoretical closed-loop.

¹⁰³Tabel et al. 2011; Sander et al. 2017

¹⁰⁴ VVEA: Verordnung über die Vermeidung und die Entsorgung von Abfällen (Abfallverordnung, VVEA) vom 4. Dezember 2015. Switzerland.

¹⁰⁵ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023



Legend: In the closed-loop, indicated by dashed flows, ELVs are not used for reinforcing bar production. The red numbers represent technical interventions along the supply chain to achieve a closed-loop: (1) more disassembly, (2) better shredding, (3) better sorting, (4) chemical extraction, (5) increase tolerance, and (6) reduce copper content. Source: (Daehn et al. 2017a)

According to (Daehn et al. 2017b) about 80 % of the original copper can be removed in magnetic separation. However, alternative practices exist. For instance, Sicon claims to reduce the output of their improved shredding¹⁰⁶ to 0.1 % of copper concentration. effectiveness copper concentration achievable) to qualitative energy/cost for various technologies to separate copper. The most common separation methods and the methods that are in practice under certain conditions are not necessary the most efficient one and can be actually also quite costly (quite high qualitative energy/cost). Methods that show higher efficiency (copper concentration achievable) and seems to be not too costly need still scale-up development¹⁰⁷. Thus, it would be recommended to introduce the limit on copper contamination in steel scrap (excluding homogenous steel that contains alloyed copper) stepwise and with transition time. According to the European Steel Scrap Specification¹⁰⁸ that defines aimed analytical content of E40 steel scrap (output from the shredder), the aimed Cu-content is 0.25 %¹⁰⁹. Additionally, sorting trials performed by ArcelorMittal with X-ray sorting machine (QXR TITECH) prove that it is possible to obtain Fe fraction with Cu-

¹⁰⁶ High density shredding, which produces 40-50 mm pieces more regular in shape than the about 100 mm pieces from today's low density shredding.

¹⁰⁷ Detail description of existing Cu-removal methods are in Daehn (2019).

¹⁰⁸ <http://ehrhhardt-recycling.de/wp-content/uploads/2017/05/Stahlschrott-Sortenliste-Englisch.pdf>

¹⁰⁹ The values retained for the analytical contents are those which have been experienced in real terms in the various countries of the European Union and are achieved by scrap yards working normally with standard methods and standard equipment.

contamination lower than 0.25 % (obtained 0.209 %) from the shredded scrap with original Cu-contamination in a level of 0.655 %.

Thus, it seems technically achievable to set up a first threshold for average copper content of 0.25 %, which after several years could decrease, while in the meantime technology could develop. Nevertheless, it is possible to obtain the level of 0.25 % also due to improved dismantling. IRSID-USINOR & CTRA Study and presentation from ArcelorMittal¹¹⁰ show that improved sorting dismantling of parts that contain copper prior to shredding significantly influence Cu-content after shredding of the dismantled ELV.

Additionally, an introduction of such provision will also require development of monitoring methods of the concentration of tramp elements in solid scrap since there are no nominal limits for this concentration (Daehn et al. 2017a). Institute of scrap recycling industries (ISRI) classifications do not classify the max. level of Cu in ferrous scrap¹¹¹. This measure shall apply 5 years after entry-into-force.

7.2.4 7.2.4 Policy Options 4A, 4B,4C and 4D (related to specific objective 4 ‘collect more’)

PO4A, PO4B and PO4C target the specific objective 4 ‘Collect more’, with different policy strategies. **PO4D** is a cumulative combination of all measures under **PO4A, PO4B and PO4C**, including a few synergies between them while excluding overlapping elements.

PO4A focuses on **enhanced reporting and enforcement of existing rules**. Member States are required to keep better track of their national vehicle fleets and ELVs by **mandatory annual reporting on the number vehicles registered, de-registered, treated as ELVs and shipped outside the Member State of registration** (M17a)¹¹². To facilitate better traceability, a new obligation would be established for **dismantlers to issue a certificate of destruction (CoD) for each ELV treated and report it digitally** to the competent authorities of their Member State, and for **shredders to only accept ELVs with a corresponding CoD** and then to notify final destruction to the same competent authorities (M18). This is in line with the suggestions from the F4F platform which stressed that the delivery and registration of CoD need to be improved¹¹³. Member States are encouraged to exchange best practices on the use of incentives to achieve higher ELV collection numbers¹¹⁴. To strengthen enforcement, there is a definition of **minimum requirements for sector inspections** and enforcement actions (M19a). Finally, reporting on sanctions applied by the Member States with respect to violations of the rules set out in the future legislation is added to the national reporting requirements (M17a).

PO4A contains the following Measures 17-19 (M17a-M19a):

- **M17a - Reporting by Member States on elements designed to address the problem of “missing vehicles”**

¹¹⁰ Russo, Philippe, Bollen, Jan, presentation on “Scrap for Decarbonized Steels” from ArcelorMittal, IARC – July 5th 2022

¹¹¹ <http://www.scrap2.org/specs/20/>

¹¹² Complementing Commission Decision 2005/293/EC.

¹¹³ RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022: <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

¹¹⁴ Notably through deposit return schemes whereby financial support is provided to the last owner of a vehicle upon its delivery to an ATF. Such schemes are in place in a number of EU Member States already.

The persistent problem of missing vehicles relates elements design to tackle the problem including vehicle registrations, on import and export of used vehicles, on incentives to encourage delivery to an ATF and on penalties.

The measure builds on the current obligations on Member States under Commission Decision 2005/293/EC and introduces first an additional obligation for the Member States to annually report to the Commission on the national vehicle stock and detailed changes. The reporting elements will include the following data: i) total number of vehicles registered; ii) new registrations; iii) imports and exports of used vehicles; iv) temporary de-registrations, and v) permanent de-registrations.

To strengthen the effectiveness of the CoD, this measure will also provide for provisions on the exchange of information on the best practices by the Member States in applying incentives, including the economic ones¹¹⁵, that encourage the last owner of an end-of-life vehicle to deliver it to an ATF and receive a CoD in return. The Member States will be asked to provide information on such incentives to the Commission as part of their regular reporting on the implementation of the regulation.

Thirdly, the measure foresees that Member States should report to the Commission on the measures taken to address breaches of the requirements contained in the new legislation (for example penalties for operators of illegal dismantling and shredding or for selling an ELV to illegal dismantlers and for dealers (and electronic platform) dealing with dismantled (used) spare parts from non-authorised facilities)).

The collected data will allow to collect evidence and verify whether all vehicles that reach end-of life are transferred to ATFs where the certificate of destruction (CoD) is issued.

The reporting period by the Member States shall be every 3 years, with a first reporting 3 years after application of the new legislation.

Example of a draft reporting form on data on the national vehicle market for M1 and N1 vehicles

➤ Reference year (n)	
➤ Certificates of destruction (CoDs) issued for domestic ELVs	
➤ CoDs issued for vehicles, not registered in the reporting country	
➤ Permanent cancellations of registration	
➤ ELVs imported for treatment (excluding transit)	
➤ Total ELVs treated in the reporting country	

	Number per year, during the reference year
(A) New vehicles placed on the national market:	
(1) Registered for the use on public roads for the first time	
(2) not registered (not for the use on public roads)	
(B) Import of used vehicles:	
(1) from other EU Member States and re-registered for the use on public roads	

¹¹⁵ Examples: linking the end of the payment of insurance, administrative fees to the provision of a COD; offer of premiums in return of ELVs sent to ATFs.

(2) from non-EU countries and re-registered for the use on public roads	
(3) not re-registered (not for the use on public roads)	Estimation possible

(C) Change in vehicle stock			
	Numbers on the 31 December of the reference year (n)	Numbers on the 31 December of the previous year (n-1)	Change in stock = year (n) – year (n-1)
(1) Stock of vehicles registered for the use on public roads			
(2) Temporarily de-registered vehicles			
(3) Suspended vehicle registrations			
Total = $\Sigma(C)$			

	Number per year, during the reference year
(D) Export of used vehicles:	
(1) to other EU Member States and re-registered for the use on public roads	
(2) to non-EU countries and re-registered for the use on public roads	
(3) other exports of used vehicles, not re-registered for the use on public roads or unknown if re-registered in the country of destination	
(E) Domestic ELVs treated, proven by issued CoD:	
(1) domestic ELVs treated domestically	
(2) domestic ELVs exported for treatment	

Accompanying notes to the data reporting form:

- For the terms: “registration”, “cancellation of a registration”, “suspension” pls refer to COUNCIL DIRECTIVE 1999/37/EC of 29 April 1999 on the registration documents for vehicles.
- The terms “temporary deregistration” and “Certificate of destruction” is defined in Article [to be completed one the articles are drafted in detail] of the revised ELV legislation.
- The term “permanent cancellation of the registration” means that one of the following situations apply: a) CoD issued to national vehicle register, b) proven theft of a vehicle, c) proven export of a vehicle, d) Exemptions upon specific request: e.g. a vintage vehicle is stored in a (private) kind of museum: accompanying documents demonstrate the conditions where and how the vehicle is stored. The use on private ground shall not be a reason for permanent cancellation of the registration but it shall fall under temporary deregistration.
- Data from intra-EU foreign trade statistics are, due to the reporting thresholds, not reliable for reporting on this intra EU export of used vehicles. Instead, data shall be available from the national vehicle registration authority using data exchange based on Article 5(2) of Directive 1999/37/EC.
- For the data on export to non-EU countries data from foreign trade statistics shall be used as an additional source to the data provided by the national registration authority.
- The submission of the data shall be accompanied by a quality report on methods used for the collection of the data, the data sources and their quality. As far as the quality report does disclose problems with data sources and quality, the report shall outline how the Member State proposes to overcome the identified problems.

M18 - Obligations for dismantlers /recyclers to check and report on ELVs/ CoDs

The measure introduces a requirement for ATFs to issue a Certificate of Destruction (CoD) for each dismantled vehicle through an electronic notification procedure to the competent Member State authority along with the delivery of the CoD to the last owner (hardcopy or electronic statement). The VIN number of a vehicle shall be clearly identifiable on the ELV parts and components sent for shredding.

The notification requirements will be accompanied with an obligation for shredders to request from the suppliers of bulks of vehicle carcasses or shear ELV scrap that these carcasses/scraps are identified by the VIN number of the ELV concerned and accompanied with a copy of the CoD of the ELV. Shredders receiving carcasses or shear scrap from ELV without this information (VIN + CoD) should report it to the competent authorities and only be authorised to use it in their shredding operations upon authorisation from these authorities.

Shredders will be requested to annually report electronically to the competent Member State authority the number of ELVs that they treat and their corresponding VIN and CoD.

This requirement shall apply 3 years after the adoption of the new legislation.

- **M19a - Definition of minimum requirements for sector inspections and implementation and enforcement action**

Under this measure, all Member States would be required to conduct at least once a year a campaign of physical inspections of the sector, comprising a) ATFs, b) repair garages not registered as ATFs and c) known/suspected illegal operators not registered at all. The campaign shall cover at least 10% of all sites/facilities each year. The campaign shall also cover inspections focusing on the shipments of used/end-of-life vehicle, such as storage places, land transport routes and harbours with the aim to verify compliance with the future legislation on ELV and the Waste Shipment Regulation.

This measure would also foresee a requirement for Member States competent authorities to cooperate with each other to ensure enforcement of the legislation, including providing access to their national registers to respective authorities of other Member States (e.g., registration authorities, customs authorities, police) to verify information on vehicles registered/de-registered from their register, including the motives of vehicle de-registration.

The Member States will have to submit a report every 5 years on the inspection campaign and their results to the Commission. Based on them, the Commission shall prepare a report summarising these findings and containing recommendations where appropriate.

This requirement shall apply 1 year after the entry into force of the new legislation.

PO4B provides new measures designed to improve exchange of information between Member States on missing vehicles and to foster harmonised enforcement. With regard to the exchange of information between Member States, PO4B consists in provisions to ensure that Member States (i) provide additional information in their national vehicles registers on elements which are necessary to track de-registered vehicles and ELVs¹¹⁶ and (ii) provide access through digital means to their national registers to all other Member State competent authorities to improve traceability (M20). This would allow for better control of the vehicle status and strengthen the ability of enforcement authorities to carry out more stringent checks on compliance, as stressed in the F4F opinion¹¹⁷. These provisions could be added either in Directive 1999/37/EC on the registration documents for vehicles or in the new legislation on 3R type-approval - ELV. For the export of vehicles, the definition

¹¹⁶ This should include information on the motives for which vehicles are permanently removed from the register (treatment as an ELV in an ATF, export, theft, etc.), as well as a requirement for the owner of a vehicle which is “temporarily de-registered” to report changes on the ownership of the vehicle in question to the registration authority.

¹¹⁷ For more information see Suggestion 3, <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

of ELVs will be clarified by introducing mandatory criteria which will make it easier to distinguish waste vehicles from used vehicles (M19b) and hence avoid that ELVs are exported as used vehicles. It corresponds with the suggestion of the F4F opinion, acknowledging the illegal export of vehicles outside of the EU being is of the major issues with regard to the implementation of the ELV Directive¹¹⁸. Finally, **Member States would be required to establish appropriate sanctions for breaches of the legislation, especially in case of selling ELVs to illegal dismantlers, illegal export, illegal sales of used spare parts from ELVs (M17b).**

PO4B contains the following Measures 17-20 (M17b-M20):

- **M17b – Establishing of fines for the ELV sector in case of selling an ELV to illegal dismantlers, for dealers (and electronic platform) dealing with dismantled (used) spare parts from non-authorised facilities.**

Under this measure, the future legislation would provide for the obligation for the Member States to establish effective, proportionate and dissuasive penalties corresponding to breaches of the requirements under the ELV legislation, especially for:

1. owners who bring their ELV to non-authorised facilities;
2. illegal dismantling and shredding or for selling an ELV to illegal dismantlers;
3. operators (including online platform providers) trading (used) spare parts dismantled from ELVs from non-authorised facilities or illegally exporting used vehicles or ELVs.

As part of their reporting on the implementation of the new legislation on ELVs, Member States will be requested within 3 years after adoption of the new legislation to i) notify to the Commission the legal provisions setting sanctions, and ii) report how these sanctions are implemented (imposed). The Commission will prepare a report on the received information with the aim to share best practices among the Member States.

- **M19b –A clearer definition of ELV to ensure that there is a better distinction between used vehicles and ELVs**

The definition of End-of-Life vehicle would be improved to better distinguish between ELV and used vehicles. For this purpose, a list of mandatory legal criteria differentiating used vehicle from an ELV will be introduced into the new legislation, based on the Waste Shipment Correspondents' Guidelines No 9 on Shipments of Waste Vehicles¹¹⁹. Under this improved definition, a vehicle that is considered an economic total loss (in the country of first registration) will be considered as an ELV. The consequence would be that such vehicles should be delivered to ATFs and the Waste Shipment Regulation would apply to cross-border shipments of such vehicles.

The dealers of such vehicles will have to prove to the last owner of a total loss vehicle and to the competent authority of the Member State that the vehicle was actually delivered to an ATF. This could help avoiding that economic operators such as insurance companies sell “economic total loss cars” to unscrupulous operators, as they would be forced to hand over

¹¹⁸ For more information see Suggestion 2, <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

¹¹⁹ https://ec.europa.eu/environment/pdf/waste/shipments/correspondents_guidelines9_en.pdf

these cars (deemed ELVs) to ATFs, even when the cars are not shipped to another country but sold in the same country.

These new criteria (and the corresponding requirements) shall apply directly upon the entry into force of the new legislation.

- **M20 – Improving the information contained in national vehicle registries and making them interoperable to increase the transparency on the shipments of used vehicles**

This measure aims to increase transparency across the EU on the de-registration of vehicles. The lack of reliable information and the lack of exchange of information between Member States is a serious obstacle in the efforts to track “missing vehicles”. The changes described in this measure would be introduced either in the new legislation on 3R type-approval-ELV or in the legislation on roadworthiness, which is currently under review¹²⁰.

The measure would include the following elements:

1. Member States shall include in their national register information on the reasons for which a vehicle is **permanently removed from their register**.

These reasons shall be limited to:

- a. Dismantling of a car considered as an ELV at an Authorized Treatment Facility (ATF), upon presentation of a Certificate of Destruction (CoD);
- b. Export of a vehicle, upon presentation of the relevant export documents;
- c. Theft of a vehicle, upon presentation of police report;
- d. Exemptions upon specific request: e.g., a vintage vehicle is stored in a (private) museum.

This information provided in the registers shall also be directly accessible by national authorities responsible for the implementation of the EU rules on end-of-life vehicles.

2. A requirement for the owner of a vehicle which is “**temporarily de-registered**” to report changes on the ownership of the vehicle in question to the registration authority.

In this case, the original owner of a vehicle will have a duty to provide information on the details of the new owner, so that this new owner can be clearly identified and recorded in the national register of the country where a person is established.

The aim of this measure is to avoid those vehicles which are “temporarily de-registered” are transferred to owners who would dismantle or export them illegally.

3. **Set up an obligation for Member States authorities to make available to authorities (e.g., registration authorities, customs authorities, police) in all other Member States information on vehicles registered/de-registered from their register**, including the motives of vehicle de-registration. To facilitate the exchange between EU Member States of vehicle registration information needed for the future legislation on ELV and 3R type-approval, the new legislation would foresee that this exchange takes place digitally.

¹²⁰ More information available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13132-Vehicle-safety-revising-the-EUs-roadworthiness-package_en

This regulatory change will allow the authorities of one Member State to retrieve information on a vehicle present on its territory and check what its status is in another Member State. This would also increase traceability of vehicles which are moved in large number between Member States during their use phase and sometimes for the purpose of their dismantling at their end-of-life phase. This is key for the purpose of reducing the number of “missing vehicles”, but also for the functioning of “extended producer responsibility schemes” whereby car manufacturers would assume additional obligations to those already in force today, for instance for the dismantling of end-of-life vehicles, including where these ELVs are treated in a Member State different from the one where the vehicle was first put on the market. Exchange of information should be made possible through the use of the Vehicle Identification Number (VIN) and provide information on the brands of the vehicles concerned.

The changes proposed above are in line with the stakeholder views. 87% or 180 of all stakeholders who participated in the open public consultation agreed that better traceability should be established between the EU Member States’ registration systems on a legal status of a vehicle until its final deregistration.

For a consistent implementation, the new legislation will contain definitions linked to the de-registration of vehicles which is aligned with the Directive 1999/37/EC on registration documents (which is part of the “Roadworthiness package”)¹²¹.

These provisions would apply 5 years after the entry into force of this revision.

PO4C: Under this option, new provisions would be established with regard to the export of used vehicles outside the EU. First, exporters would be required to make available the **vehicle identification number (VIN)** and the information on the roadworthiness status of used vehicles to customs authorities (M19c). Secondly, only used vehicles which are verified as **roadworthy would be authorised to be exported to non-EU countries**. An exporter would be required to make available to customs authorities the information on the roadworthiness status of the vehicle. In addition, the future legislation would foresee a possibility to develop a risk-based control mechanism to check how the EU vehicles exported, comply with the specific requirements imposed by third countries regarding the environment and road safety. (M21).

PO4C contains the following Measures 19, 21 (M19c-M21):

- **M19c – Making information on vehicle identification (VIN) and roadworthiness available to customs authorities**

To improve traceability on the export of used vehicles from the EU to third countries, exporters of used vehicles would have the obligation to make available the information on the Vehicle Identification Number (VIN) and roadworthiness status of each used vehicle to customs and other relevant authorities. The presence of the necessary information will be made mandatory through new TARIC measures.

These provisions would apply 3 years after the adoption of the implementing acts, 7 years after the entry into force of this Regulation.

¹²¹ For example, the current ELV Directive 2000/53/EC refers to the undefined term “deregistration” which should be aligned with the definitions in the roadworthiness legislation.

- **M21 - Export requirements for used vehicles linked to roadworthiness status**

This measure would set out a requirement that the export of a used vehicle to third countries will only be authorised the vehicle concerned is roadworthy. The measure would apply to the vehicle categories (M1 and N1) that are falling within the current scope of the ELV Directive. The exporters placing used vehicles under the export procedure would make available to customs authorities the vehicle identification number (VIN), the information on the validity of the roadworthiness of the vehicle concerned, and the information on the Member State where the vehicle concerned was last registered .

To enable automated searching of vehicle registration data (e.g. VIN number, a Member States where the vehicle was last registered, date of first registration of vehicle, content of the roadworthiness certificate) between Member States competent authorities and customs authorities, the Commission will explore the possibility to establish the necessary digital tools to ensure that customs authorities have access to these data through the EU Single Window Environment for Customs, for example through an interconnection with the MOVE-HUB web based application, an information system which different range of functionalities have already been applied for the purpose of electronic exchange of information between the EU Member States¹²².

The measure would prevent the export outside the EU of vehicles which are not roadworthy, thereby avoiding risks that they would generate in importing countries for road safety and environmental pollution.

This requirement for the exporters shall apply 3 years after the adoption of the necessary implementing act, 7 years after the entry into force of this Regulation. Full enforcement by customs authorities will become possible only upon full interconnection with EU Single Window System; in the meantime, customs enforcement may be limited in view of the manual workload, but mitigating measures will be possible (e.g. as the VIN will be made available to customs authorities, customs will be in a position to provide on a regular basis all exports of vehicles to competent authorities through the customs Surveillance system thereby allowing competent authorities to carry out ex-post checks and possibly other follow-up actions).

In support of the measures above, a vehicle would be subject to the risk management control by the customs authorities whether a vehicle is compliant with the with the specific conditions adopted by importing countries for import of used vehicles, such as limitations based on age or compliance with air emissions like Euro emissions standards, when this information is officially communicated to the Commission by the third countries concerned.

This implementation of this requirement will be facilitated with the making available of the relevant information in the EU Single Window Environment for Customs. It shall not prevent Member States from taking implementation actions earlier on, e.g. when drawing their national risk plans. In addition, the Commission will support the Member States in providing

¹²² Such examples include interconnection of electronic registers of driver cards as regulated under the Commission Implementing Regulation (EU) 2016/68 of 21 January 2016 on common procedures and specifications necessary for the interconnection of electronic registers of driver cards, information exchange on road transport undertakings (OJ L 15, 22.1.2016, p. 51) as well as on roadside checks under the Commission Implementing Regulation (EU) 2016/480 of 1 April 2016 establishing common rules concerning the interconnection of national electronic registers on road transport undertakings and repealing Regulation (EU) No 1213/2010 (OJ L 87, 2.4.2016, p. 4)

profiling the countries of risk though engaging in dialogues with third countries at risk though bilateral and international cooperation, with the objective to reduce their level of risk.

Background information:

The measures on export are based on the fact that an increasing number of third countries importing used vehicles from the EU are introducing regulations to limit such imports by age and emission standard in order to avoid negative impacts of these imported vehicles on air quality, road safety and pollution from improper disposal. For instance, the Economic Community of West African States (ECOWAS¹²³) adopted in September 2020 a Directive to limit the import to those vehicles with a minimum Euro 4/IV emission standard and established an age limit of 5 years for light duty vehicles respectively 10 years for heavy-duty vehicles. Several other receiving countries have similar restrictions in place and, with the support of the United Nations Environment Program (UNEP), more harmonized legislation is expected between importing countries in the near future. It is important that the EU, as a major exporter of used vehicles, takes action to support these countries in implementing these requirements. Alongside this, efforts would be made at international level (global, regional and bilateral) by the EU to support the development of international commitments and rules on the global trade in used vehicles, building on the work of UNEP and Resolution 5/11 on the circular economy, adopted by the United Nations Environment Assembly in March 2022¹²⁴.

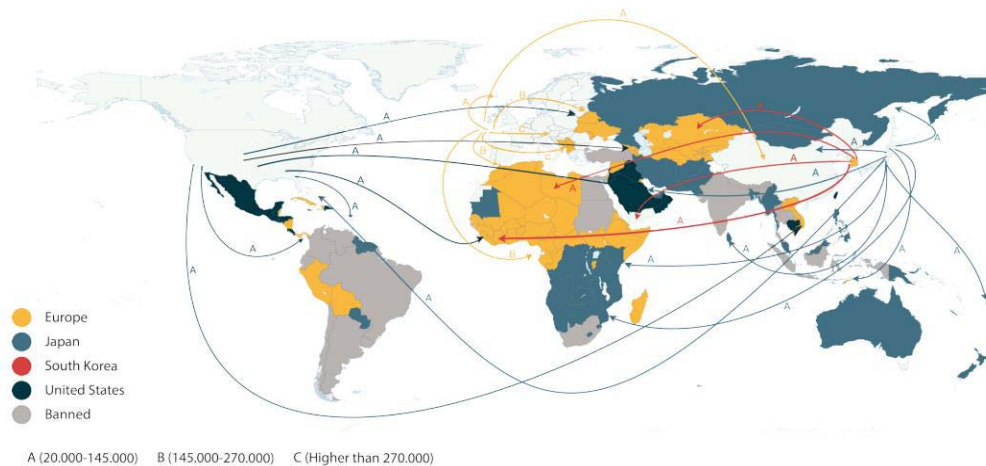
Therefore, the measure addresses the ongoing international developments in making sure that used vehicles which are imported by third countries are not contributing to high pollution levels and safety risks in these receiving countries. It enables the developing countries to receive only those vehicles from the EU that are first of all safe and authorized to be on the EU roads. Moreover, the EU national authorities will need to be more vigilant of the rules set by third countries regarding imports of used vehicles.

¹²³ Members of ECOWAS: Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, The Gambia, Ghana, guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo.

¹²⁴ UNEP/EA.5/Res.11

Figure 7.9 Map of main flows of used light duty vehicles

Map: Used Light Duty Vehicles Quantity and Flow to Main Destination Markets from the EU, USA, Japan, ROK (2020)



The majority of African countries, which are the main destination of the EU export of used vehicles, rely on imports of used vehicles to grow their fleets due to limited local vehicle production capacities. However, the lack of minimum standards and/or insufficient enforcement of adopted standards compromises the quality of used vehicles imported into the region, resulting in negative consequences on the environment, health, and road safety, as well as additional costs. Therefore, many countries have introduced, or are considering introducing, quality standards for the import of used vehicles.

In Kenya, more than 99% of vehicles added to the fleet are used vehicles, with most imported from Japan and the UK. Used vehicles must comply with Kenya Bureau of Standards (KEBS) requirements¹²⁵, including being less than 8 years old, passing a roadworthiness inspection, and being right-hand drive. In Kenya, policies were implemented that mandate a pre-export verification of conformity inspection for vehicles. This inspection is carried out at the export point to confirm compliance with Kenyan regulations. By ensuring that used vehicles meet Kenyan standards, this policy also enhances the quality of second-hand vehicles. Despite the introduction of an age limit in 2005, the growth of imported vehicles continued. However, the age limit did impact the type of used vehicles imported, with a shift towards younger and smaller vehicles that are cleaner, more efficient, and safer.

In Ivory Coast, used vehicles are mostly imported from Europe and must comply with the maximum age limits set by Decree n°2017-793¹²⁶. The age limits vary by vehicle type, ranging from five years for passenger vehicles to ten years for coaches and trucks over 10 tonnes. Ivory Coast also played a key role in getting other West African countries to adopt harmonized fuels and vehicles regulations that require minimum EURO emissions standards for used and new vehicles.

Mauritius has implemented stricter import regulations, with used vehicles required to be less than 4 year-old and meet Euro 4 emission standards. Prior to export, each car must undergo a roadworthiness inspection, which is carried out by Bureau Veritas¹²⁷. Upon arrival the vehicle is taken to the Vehicle Examination Station where a Particulars of Motor Vehicle Form is issued. Additionally to the import requirements, the initiatives have also been taken to encourage the adoption of electric and hybrid vehicles by reducing customs duty and registration tax on these vehicles.

The case study of New Zealand highlights the success of their “Clean Car Discount” policy¹²⁸, which provides discounts on new vehicles based on their emissions rating, while also increasing levies on high-emissions used vehicles. This policy has led to an increase in the import of low-emissions vehicles and a decrease in the import of high-emissions vehicles.

In Mozambique, used vehicles are commonly imported from Japan, with no age restriction on the vehicles. Only right-hand drive vehicles are permitted, with exceptions for special vehicles such as ambulances. All vehicles require a road worthiness inspection prior to export or face a fine. Importers must obtain an Importer License number from JEVIC¹²⁹, which has been awarded the contract to inspect vehicles and prevent substandard or prohibited goods from entering Mozambique.

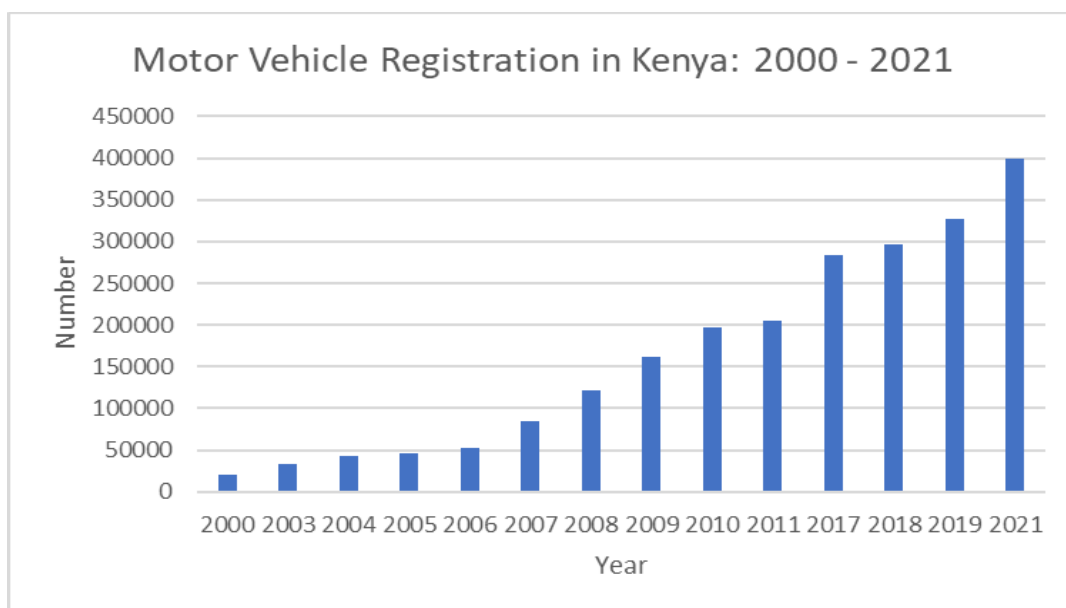
In Ethiopia, a new tax policy for vehicle imports was introduced in mid-2020, with older vehicles subject to higher taxes. The government implemented a new taxation policy concerning the import of vehicles intended for personal use. A proportional tax rate for vehicles manufactured over 7 years ago was applied, with a 500% excise tax rate imposed on vehicles exceeding 7 years of age. Consequently, most of the imported vehicles comprised of relatively recent models, including EVs. Later the import tax rate for EVs has been adjusted to 15%, without any additional taxes being levied. Currently, the automobile market is dominated by an extensive range of Chinese-manufactured vehicles, alongside a limited number of vehicles produced in South Korea, Japan. There are no existing regulations for emission standards, and no studies have been conducted to evaluate the actual impact on costs, trade, or other associated aspects.

Export of used vehicles: expected scale of impacts to the third countries

The collected evidence suggest that implementation of the export requirements would not lead to adverse long-term impacts in the receiving countries due to the expected decrease of used vehicles being exported outside the EU. These impacts to large extent could be comparable to those occurred in the receiving countries following the adoption of the import restrictions.

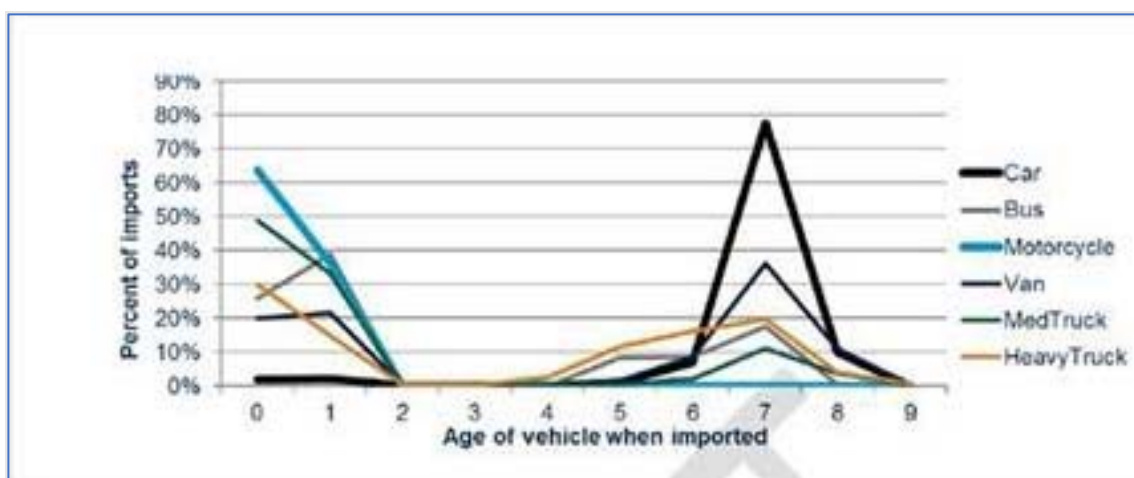
For instance, in Kenya, the age limit introduced as part of the import restrictions has incentivized the import of smaller used vehicles. As a result, the used vehicles being imported are newer and smaller, leading to a significant improvement in their efficiency and safety. The illustration below shows the number of light duty vehicles registrations in Kenya. As less than 1% of added vehicles in Kenya are new vehicles, this graph represents the trend of import of used light duty vehicles into the country from 2000 to 2021.

Figure 7.10 Motor vehicle registrations in Kenya 2000 – 2021



In 2005, Kenya introduced an eight-year age limit for import of used vehicles. The graph indicates that the policy had a minor effect on the import of used vehicles, as the growth rate of imported vehicles decreased slightly in the year after its introduction, but then picked up again after 2006. In general, the policy had a minimal impact on reducing the total number of imported used vehicles, and the import rate continued to grow after the introduction of the age limit. However, in terms of quality change, the impact on the type of used vehicles imported into Kenya was significant. Prior to the introduction of age restrictions, the vehicles imported into Kenya were generally older, with an average age of 15 to 18 years. However, with the new regulations, the maximum age limit for imported vehicles was reduced to eight years, and this has led to a significant shift in the age profile of imported vehicles. Today, the largest group of vehicles imported into Kenya has on average seven years, which is significantly younger than the vehicles imported before the introduction of the age limit. This shift towards younger vehicles has had a positive impact on the environment, as newer vehicles tend to be more fuel-efficient and emit less pollution than older vehicles.

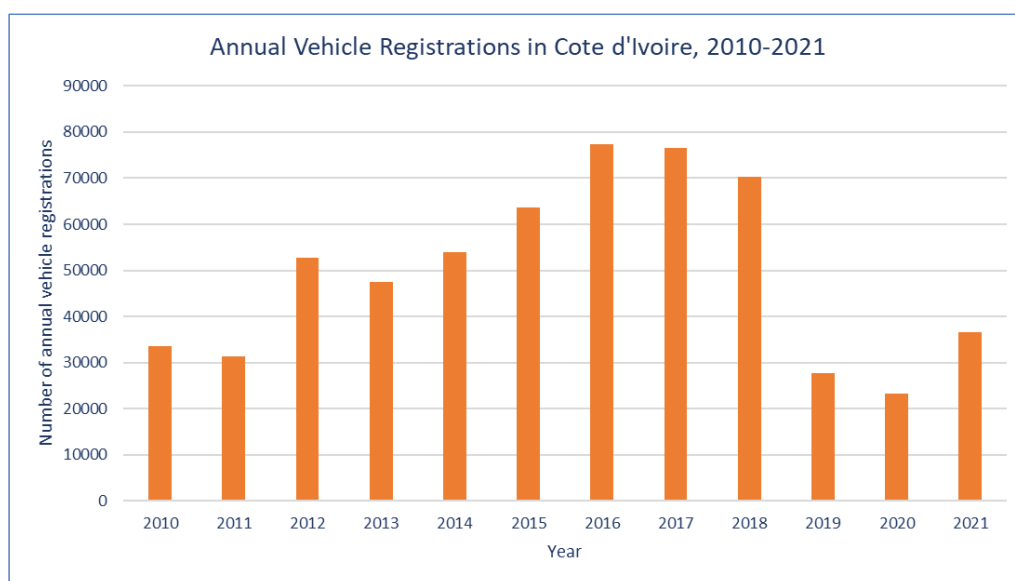
Figure 7.11. Age of imported vehicles in Kenya (UNEP)



The import of vehicles underwent a transformation, as the policy introduced an age limit that incentivized the importation of smaller, used vehicles. It is apparent that newer used vehicles carry a higher price value compared to older used vehicles. Consequently, the vehicles imported into Kenya following the implementation of the policy are not only younger and smaller, but also notably cleaner, more efficient, and safer.

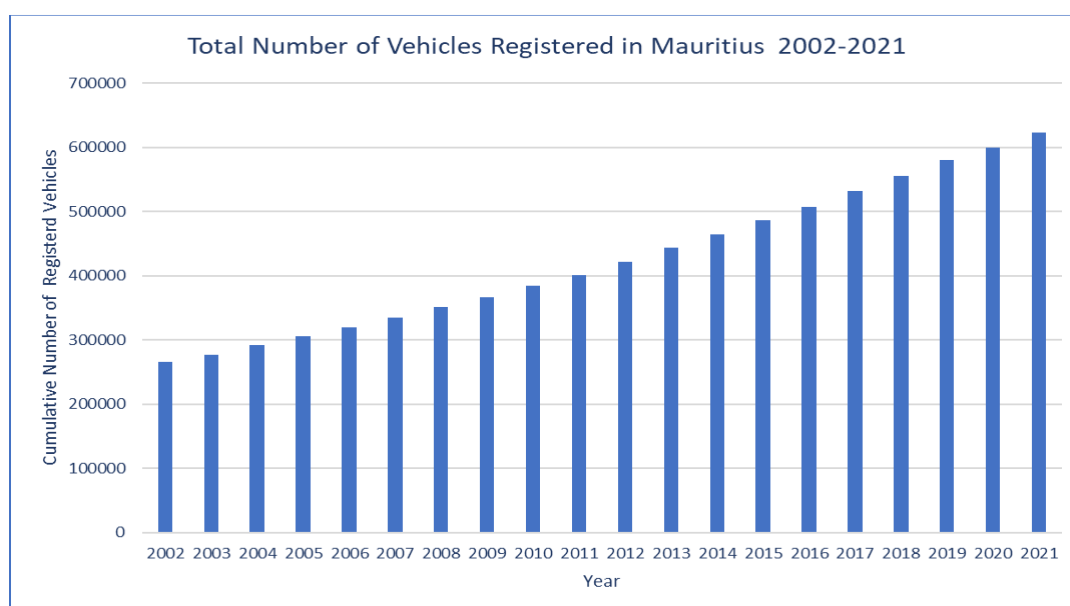
Similar developments have been observed in other countries. In Ivory Coast the quality of used vehicles has also significantly improved since the introduction of policies. In 2017-2018, the used vehicles imported into Ivory Coast were between 11 and 20 years old. Following the introduction of the restrictions, there was a notable decrease in the importation of used vehicles. Nonetheless, two important factors contributed to this trend. Firstly, the sales of pre-owned vehicles observed a surge. Secondly, the COVID-19 pandemic had a significant impact on the importation of both new and used vehicles globally, with a notable drop in demand during the initial years of the pandemic. However, as of 2021, the import of used vehicles has started to grow once again, and early indications suggest that this trend is continuing. As a result, a trend similar to what was observed in Kenya, where after the policy changes, the quality of used vehicles imported has improved, resulting in a cleaner and safer fleet.

Figure 7.12. Annual vehicle registrations Ivory Coast 2010 - 2021



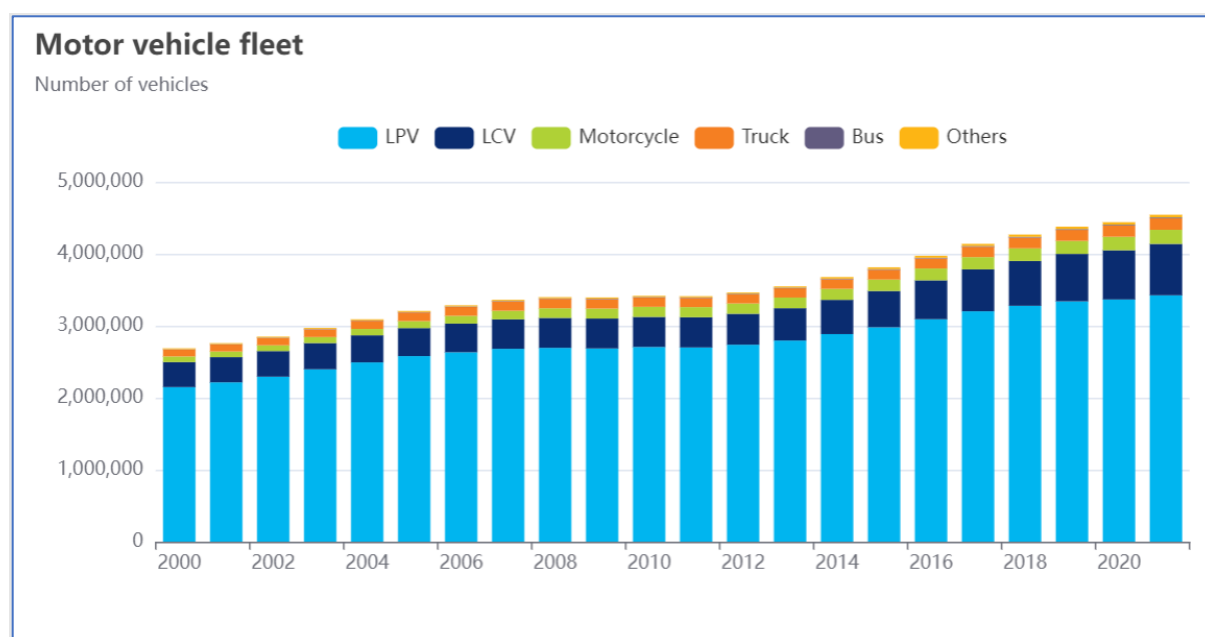
In Mauritius, the introduced measures did not impact the quantity of used vehicles imported into the country. Instead, vehicle registrations continued to rise, indicating that the policies did not have a negative impact on the number of vehicles being imported.

Figure 7.13. Total vehicle registrations in Mauritius 2002 - 2021



Similarly, in New Zealand, the policies have resulted in the import of newer and cleaner used vehicles, without a significant impact on the number of vehicles being imported. While there was a small impact visible between 2009 and 2012, imports quickly restored again, indicating that the policies did not have a long-term reducing effect on the overall number of vehicles being imported. The illustration shows the imports of new and used vehicles in New Zealand.

Figure 7.14. Motor vehicle registrations in New Zealand 2000 - 2021



In conclusion, the policy changes have not negatively impacted the number of vehicles being imported. Instead, they have resulted in a shift towards newer used vehicles, which are significantly cleaner, more efficient, and safer. Therefore, restrictive policies towards used vehicles were beneficial for the promotion of cleaner and safer transportation, which accordingly resulted in a renewed fleet with a higher economic value.

It suggests that the enforcement of EU roadworthiness requirement for the used vehicles, is expected to shift towards higher quality exports, that will continue meeting demand in third countries, without causing a long-term trade diversion. This implies that the EU would remain an important player in the global trade in used vehicles while ensuring that third countries have access to a more efficient and environmentally friendly used vehicles.

The experience of the importing countries also demonstrates that setting standards in the importing countries and imposing EU standards on the export of vehicles are not mutually exclusive.

As a result, export related measures proposed would be mutually reinforcing to address the quality of used vehicles in both types of countries where the import standards are established and those where import of used vehicles is currently not regulated. In this regard, by setting a roadworthiness requirement for the used vehicles, the EU would be able to ensure that vehicles sent to more vulnerable third countries, such as Africa, which is the key destination for the used vehicles being exported from the EU, meet the necessary safety, environmental, thereby reducing the costs and environmental impacts of not admitting, scrapping or re-export elsewhere.

In this regard the mandatory requirements on the export of used vehicles would also contribute to the implementation of the “**waste hierarchy**”, the core principle governing management of waste at the EU, by prioritising the management ways in an order reflecting their environmental impact. Avoidance of export of non- roadworthy vehicles would respect the waste hierarchy in a sense that non-driving vehicles, which are at the end of their useful life, would be prevented from being disposed in the receiving countries where often substandard treatment of ELVs causes environmental damages, such as oil spillage, unsound treatment of refrigerants or improper removal of hazardous substances and of components for higher quality of recycling. Remaining in the EU, these non-authorised vehicles, meeting ELV requirements, would be instead directed to the final treatment operations at the EU, prioritising treatment operations which are higher up waste hierarchy and contribute to circular economy objectives.

Additionally, EU climate change policy towards to reducing CO₂ emissions from vehicles shall also be taken into account while considering the long-term changes to the EU overall fleet¹³⁰. It suggests future EU vehicles will have lower emission level and eventually will replace and renew the share of the fleet that is currently directed for the export to third countries¹³¹. As new vehicles become available in the EU, the supply for export would inevitably increase, which will automatically decrease in the demand and export of older, less efficient vehicles. Implementation of the preferred option in this context, would allow to further tackle the primary concern to ensure that used vehicles traded are road-worthy and non-polluting, without undermining the importance of strengthening a mutual responsibility of the exporting and importing countries, which is essential.

Such approach is aligned with the continuous EU efforts and commitment to support international partnerships, in achieving common sustainability objectives, through different formats of global activities. One of the platforms is the Global Gateway, where the EU is

¹³⁰ https://climate.ec.europa.eu/eu-action/transport-emissions/road-transport-reducing-co2-emissions-vehicles/co2-emission-performance-standards-cars-and-vans_en

¹³¹ According to ACEA, average new car emissions are 116.3g CO₂/km, which shows 16.6% decrease since 2010: <https://www.acea.auto/fact/fact-sheet-cars/>

working towards promoting the worldwide infrastructure investments that create sustainable, smart, resilient, inclusive and safe networks in all modes of transport. One of the ambitions of GG Ambition, Europe Investment Package for Africa, is by 2030 is to integrate the African and European multimodal transport networks in line with the regional and continental frameworks and tailor these networks to the economic potential of an African Continental Free Trade Area¹³².

PO4D: Under this option, **all** measures (M17 to M21, see descriptions before) from PO4A, PO4B and PO4C are combined to most effectively achieve the objective ‘**Collect more**’. The timeline is the same as expressed in the section before in the description of the measures. The combination thus includes incentives and / or penalties to make use of CoDs, improvement of registration and deregistration procedures, better statistics / monitoring on vehicle stock and import / export and the fight against illegal export of ELVs and environment, health and safety related problems in the receiving countries. Some overlapping elements like the reporting under M17a and synergies between these measures are taken into account.

7.2.5 7.2.5 Policy Options 5A, 5B and 5C Provide appropriate financial and organisational incentives to increase circularity in the automotive sector and improve the collection of ELV (related to specific objectives 1 to 4)

PO5A, PO5B and PO5C aim at establishing economic incentives and organisational arrangements contributing to meeting the first four specific objectives of the initiative to ensure proper implementation. They are cumulative.

- **PO5A requires Member States to establish specific Extended Producer Responsibility (EPR) schemes for vehicles¹³³, aligned with the minimum requirements applicable to other sectoral waste streams, as specified in the Waste Framework Directive¹³⁴.** This means that Member States would require vehicles manufacturers to bear financial and organisational responsibility for the management of the waste stage of the vehicle life cycle, including sorting and treatment operations, in addition to the costs of collection which are already included in the EPR under the current ELV Directive. The F4F opinion in particular recommended to focus on proper implementation of polluter pays principle through addressing the mandatory treatment operations that are not economically viable¹³⁵. Member States would have to establish such schemes, or extend the scope of existing ones, to ensure that vehicle manufacturers provide for advanced measures to guarantee that legal requirements for collection and treatment of ELVs are achieved (M22). When it comes to collection of ELVs, this would include **digitalisation of reporting of ELVs collected and treated in ATFs and shredders**, and **dedicated awareness-raising campaigns** designed to improving the collection of ELVs. When it comes to treatment, **vehicle manufacturers will be made responsible for the costs related to the difference between revenues generated by the sale of**

¹³² https://international-partnerships.ec.europa.eu/policies/global-gateway/transport_en

¹³³ There are already provisions on cost coverage of delivery/take-back of an ELV by producers (Article 5(4) ELVD).

Although not a fully-fledged EPR scheme, the basics of cost coverage already exist and are explicitly referred to in the WFD (article 8a(4)). This means that PO5 would not necessarily entail starting up completely new EPR schemes

¹³⁴ See Articles 8 and 8a of the Waste Framework Directive (Directive (EU) 2018/851).

¹³⁵ For more information see Suggestion 7 at <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>;

parts/components/materials resulting from the dismantling/recycling processes and the costs linked to their **mandatory dismantling and recycling** and other treatment requirements that are net cost negative. (M23).

PO5A contains the following Measures 22-23 (M22-M23):

- **M22 – Requirement for the Member States to establish collective or individual national EPR schemes, including monitoring compliance costs and minimum financial obligations**

The measure would address to the objective to ensure a fair allocation of ELV treatment related costs, by specifying the obligations of the vehicles producers to contribute organisationally and financially to all necessary operations relevant to collection, treatment and recycling of ELVs.

The ELV Directive already contains provisions concerning financial responsibility of the vehicle producers for the end-of-life stage of their vehicles, regarding mainly the coverage of costs of setting collection schemes for ELVs. However, the Directive does not take into account the general minimum requirements for EPR established in Articles 8 and 8a of the Waste Framework Directive and does not directly oblige vehicle producers to cover costs of the treatment of ELVs.

This measure would oblige all Member States to establish national EPR schemes on the ELV in compliance with the specification of the general minimum requirements established in Articles 8 and 8a of the Waste Framework Directive in order to fully effectuate the polluter pays principle in the automotive sector. Producer responsibility may be organised collectively or individually, while setting uniform conditions for the modulation of the financial contributions to avoid distortion of the internal market and to limit administrative burden, where necessary.

These obligations for the manufacturers would cover the following costs:

- costs of the recycling sector, linked to requirements for higher amount and/or quality of recycling. These would cover the costs linked to the difference between revenues generated by the sale of these materials and costs linked to the attainment of the mandatory ELV treatment targets established in the new legislation.
- costs for communication/awareness-raising campaigns designed to improve the collection of ELVs;
- establishment of a notification/ reporting system for ELVs, CoD and final cancellation of the registration;
- reporting, via digital means, on the attainment of the recycling/reuse targets set out in EU legislation.

The measure introduces the obligation for the Member States to appoint an independent competent authority (“clearing house”) to monitor compliance of the producers with the mandatory requirements on the end-of-life treatment of ELV. The new legislation will set the mechanism for the calculation of the fees that producers would have to pay to compensate for the costs linked to the implementation of necessary (minimum) ELV treatment obligations, notably on the collection, depollution, dismantling and recycling of ELVs. Member States will be requested to lay down the details on the organisation and operation, including the administrative and procedural rules to ensure: i) registration of producers; ii) authorisation of producers and producer responsibility organisations; iii) oversight of implementation of

extended producer responsibility obligations; iv) collection and publication of data, including public awareness campaigns.

In addition to alignment with the general criteria set out in the provisions of Articles 8 and 8a of the Waste Framework Directive¹³⁶, the Regulation will set minimum requirements for the governance of the EPR ensuring that the interests of all the stakeholders are duly and evenly represented in the decision-making bodies of EPR. In addition, the designated independent competent authority will have to monitor the average costs for the obligatory compliance operations and the revenues from these obligatory compliance operations and to define, as necessary, financial compensation of compliance operation to ATFs and moderate the implementation of the fee modulation.

On this basis, Member States shall monitor the costs for collection, recycling infrastructure, depollution, dismantling, and reuse in relation to revenues from these obligatory operations and set out necessary minimum financial contribution of producers to ATFs. The producers will have to offset compliance cost if these costs are not recovered by the result of the distinct operation. The decision on the required level of the offset shall be discussed in close cooperation with the stakeholders. The national competent authority / clearing house shall establish procedures for the cooperation, moderate this cooperation and take and publish regular decisions on the level of the offset for different compliance operations.

Analysing the feedback received during the open public consultation, the majority of stakeholders agreed that in order to ensure a high quality of recycling, it is necessary to compensate the ATFs for their dismantling efforts, which are not economically viable under the current conditions. Such position was shared by all environmental NGOs and the majority of waste management operators (80%), public authorities (73%) and citizens, other (55%) and consumer organisations (52%). Out of 18 individual respondents who identified themselves as vehicle producers, suppliers or importers, 8 individuals disagreed with such approach.

The measure will set a delegated power to the Commission to develop a secondary legislation specifying the (uniform) requirements for the EPR.

These requirements shall apply 3 years after the entry into force of a new legislation.

- **M23 – Reporting obligations for producers**

The measure introduces an obligation for the individual producers and PROs to report to a competent authority on the performance of the producer responsibility tasks. These annual reports shall contain the information on the financial and organisational responsibility taken in achieving mandatory targets (e.g. recycling) and the end-of-life treatment operations (e.g. depollution, removal of components, recycling and information campaigns).

Based on the monitoring of material flows of end-of-life treatment operations, producers will be responsible to demonstrate compliance with targets on recyclability, reusability and recoverability of a vehicle as provided in the type-approval documentation. This evidence shall be obtained and documented through the interface with the ATFs.

¹³⁶ Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312 22.11.2008, p. 3).

Under this measure, producers shall also be engaged into support of monitoring and reporting on illegal activities in the sector to responsible authorities (i.e., police and environmental inspectorate) by providing the reporting data and any necessary documentation concerned.

These requirements shall apply 3 years after the entry into force of a new legislation.

PO5B: Policy option 5B complements the obligation for Member States to establish EPR schemes for ELV with harmonised requirements designed to ensure a uniform and fair implementation across the EU single market. To avoid that Member States apply diverging methodologies relating to the responsibilities of the vehicle manufacturers, **harmonised criteria for the modulation of fees to be paid by vehicle manufacturers would be set, based on circularity features**, such as the weight of a vehicle, the dismantling time for key parts/components like batteries, the expected level of recyclability/re-usability and the level of recycled content (M24). These elements comply with the recommendations of the F4F recalling that including recyclability and durability criteria in vehicle design can facilitate dismantling and lift implementation burden from ATFs¹³⁷. Taking into account the large volume of used cars shipped between EU Member States and the need for fair cost allocation intra-EU, **specific requirements are put in place to make sure that vehicle manufacturers contribute to the costs of dismantling and recycling of vehicles which become ELVs in a Member State different from the Member State where it was first registered (“cross-border EPR”)** (M25).

PO5B contains the following Measures 24-25 (M24-M25):

- **M24 – harmonised modulation of EPR fees**

This measure establishes the conditions to create economic incentives for the manufacturers that take additional efforts to advance the reusability, remanufacturing, and recyclability of a vehicle compared to the standard vehicles placed on the market. For this purpose, the new EU legislation will introduce harmonised fee modulation for collective EPR schemes based on the specific criteria of a vehicle, taking into account the following:

- Weight of a vehicle (the production of a heavier vehicle requires the use of more primary resources than the production of a lighter one),
- Dismantling time of parts which need to be removed prior to shredding under the new legislation to allow for re-use, remanufacturing or recycling of a vehicle,
- The expected level of recyclability/ re-usability of materials and components, based on the 3R type-approval declarations,
- Share of materials preventing high-quality recycling process,
- Share of recycled content (metal, plastics, CRMs, other),
- Presence and location of hazardous substances.
- Type of vehicles (combustion engine vehicles, BEV, HEV, PHEV, FCEV, others),

Producers would be requested to provide the national competent authority, i.e., a clearing house, with data relevant for the fee modulation. Based on this data, the national competent authority (clearing house) shall propose/ publish criteria for the fee modulation in close and transparent cooperation with the producers and the stakeholders of the dismantling and recycling sector. The producers shall provide this information together with the information

¹³⁷ Ibid.

document they provide on reusability and recyclability in the context of the European Union vehicle 3R-type approval. For vehicles type-approved before these provisions entered into force, the producers shall provide these data for all type-approved vehicles within 5 years after this obligation entered into force.

- **M25 – Transfer of the EPR fees and financial guarantee between Member States (cross-border EPR)**

The measure addresses the differences in allocating the fees between Member States and to establish a level playing field between the authorised ELV operators in complying with the EU level ELV treatment requirements. To ensure a fair attribution of costs between the economic operators established in different EU Member States, it is suggested to introduce a transfer of the information and EPR fees together with a cost settling mechanism in country of final destination and countries of origin.

With a view to ensure equal functioning conditions at the EU, the Commission will be empowered to develop criteria to ensure cross-border cooperation concerning extended producer responsibility schemes for ELVs in accordance with Article 8(5) of the WFD. This mechanism will help to ensure that (individual or collective) EPR schemes properly cover the end-of-life treatment costs of a vehicle in a Member State which is different from the Member State where it was first registered.

These requirements shall apply 3 years after the entry into force of a new legislation.

PO5C includes **advanced economic incentives** to increase the collection of ELVs and promote the market for vehicles manufactured in a circular manner. It gives the discretion for the Member States to establish “**deposit return schemes**” based on the common EU wide criteria, whereby a lump sum of money is given to the last owner of an ELV upon its delivery to an ATFs (M26). This measure reflects the suggestion of F4F platform¹³⁸. The second component of this option is the possibility to establish harmonised **Green Public Procurement (GPP) criteria for the purchase of all vehicles**, based on circularity criteria described for PO5B, and consistent with the Clean Vehicles Directive¹³⁹(M27).

PO5C contains the following Measures 26-27 (M26-M27):

- **M26 – Establishment of national deposit refund schemes**

The measure aims to introduce the Deposit Refund Schemes (DRS), as a complementary instrument, either managed by public authorities or as a part of the mechanism relevant with the extended producer responsibilities.

The vehicle owners would pay a deposit fee to the government upon the first registration of a vehicle. Member States will bear a discretion to define the conditions for the functioning of the DRS, including the level of deposit fees for the owners and premium to be granted in return/exchange of a vehicle.

¹³⁸ For more information see Suggestion 5 at <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>; RegHub consultation on the implementation of the end-of-life vehicle Directive, 2022;

¹³⁹ [Directive \(EU\) 2019/1161](#) of the European Parliament and of the Council of 20 June 2019 amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles (OJ L 188, 12.7.2019, p. 116–130). A review of this Directive is foreseen by the end of 2027.

The Commission will be empowered to develop harmonised criteria for the functioning of the DRS within 5 years after entry into force of a new legislation.

Member States will be required to report to the Commission on the efficiency of the DRS, including the level of premiums applied.

- **M27 – Introduction of minimum mandatory green public procurement criteria**

The measure aims to empower the Commission to establish minimum harmonised mandatory green public procurement criteria regarding vehicles' circularity as under the Clean Vehicle's Directive¹⁴⁰, that is to be revised in 2027.

These criteria would consider the eco-design of a vehicle, notably the recyclability, reusability and recoverability (i.e. circularity characteristics, including the aspects being assessed under the modulation of EPR fees, as described in Measure 24 (e.g. weight, dismantling time of parts). Following the establishment of mandatory criteria, the contracting authorities would be obliged to apply these requirements when procuring the vehicles. The fulfilment of those criteria shall be included in technical specifications and award criteria of the tender.

The measure aims to ensure that during the public procurement, the vehicle chosen among other vehicles represents the significantly lower environmental impacts and considerably highest compliance with the eco-design (circularity) criteria of vehicle.

Interlinkages between the new Regulation replacing ELV and 3R type-approval Directives and the Clean Vehicles Directive is described in detail in Annex 10.

7.2.6 7.2.6 *Policy Options 6A, 6B and 6C (related to specific objective 5 'cover all vehicles')*

PO6A, PO6B and PO6C target the specific objective 6 '**Cover more vehicles**' with an increasing level of ambition. These options are cumulative.

PO6A includes a **limited extension of the scope** of the new legislation to additional categories of vehicles including L3e-L7e-category vehicles, lorries, buses and trailers¹⁴¹. The manufacturers of these vehicles would be required to **provide information** on the vehicles placed on the market, collected and treated and compositional information **to dismantlers and recyclers**, through existing or new platforms, **to facilitate depollution, dismantling and recycling** of these vehicles including CRMs. This shall include at the minimum information on the location of substances of concern as well as instructions on dismantling (M28). These requirements **would not be applicable to special-purpose vehicles, multistage and vehicles produced in small series**.

PO6A contains the following Measure (M28).

- **M28 – Provision of information to dismantlers and recyclers**

This measure extends the basic information provision requirements (as described in Measure 3) for manufacturers of L3e-L7e-category vehicles as defined in Article 4(1) and (2) of

¹⁴⁰ [Directive \(EU\) 2019/1161](#) of the European Parliament and of the Council of 20 June 2019 amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles (OJ L 188, 12.7.2019, p. 116–130).

¹⁴¹ Respective vehicle categories L including e.g., microcars, M2, M3, N2, N3.

Regulation (EU) No 168/2013¹⁴² and lorries, buses and trailers falling under the categories M2, M3, N2, N3 and O, as defined in Article 3 point 15 of Regulation (EU) 2018/858¹⁴³.

The new provisions would list the elements and harmonise the format in which data is to be provided, including the instructions on depollution, location of components that are worth dismantling for reuse or separate collection and recycling. Concrete requirements would be detailed in a delegated act. OEMs would maintain the right to decide how the information is to be provided to waste operators (e.g., elaboration of IDIS, access upon request to systems that currently use other stakeholders (IMDS, RMI) or development and access to new systems).

The requirement shall apply within 5 years after the entry into force of the Regulation.

PO6B consists of a **broad extension of the scope of the new legislation**. In addition to the requirements set out in PO6A, it includes a **mandatory requirement that end-of-life L-category vehicles (which includes motorcycles), lorries, buses and trailers are treated in an ATF**, with their dismantling accompanied by a CoD similar to PO4A (M30a). To complement this measure and ensure traceability of used vehicles, used **lorries and buses** should be subject to similar requirements than passenger cars **with regard export related requirement based on roadworthiness** (M30b). **Manufacturers of lorries, buses and L vehicle categories should also be requested to assume the responsibility for the collection and reporting obligations set for these vehicles (basic EPR scheme)** (M31). Finally, a review close for a phased-in future scope extension is included when more information is available (M32).

PO6B contains the following Measures 30-34 (M29b-M32):

- **M30a – Mandatory treatment of end-of-life L category vehicles (L3e-L7e), lorries (N2,N3) and buses (M2, M3) and trailers (O) at ATFs + CoD**

The measure extends the current Article 5(2) of the ELV Directive obliging the Member States to take the necessary measures to ensure that all end-of-life vehicles are transferred to authorised treatment facilities. The requirement to deliver and treat all end-of-vehicles would be extended to L-category vehicles¹⁴⁴, lorries, buses and trailers.

Authorised treatment facilities will have to treat these vehicles in accordance with the mandatory requirements, such as depollution, removal and storage of parts and components prior further treatment. Member States will have to take necessary measures ensuring that any establishment or undertaking carrying out treatment operations obtains a permit, defining general technical, safety requirements.

Authorised treatment facilities shall issue a CoD proving that end-of-life L-category vehicles, lorries, buses and trailers have been treated in compliance with the requirements set out in the

¹⁴² Regulation (EU) No 168/2013 of the European Parliament and of the Council of 15 January 2013 on the approval and market surveillance of two- or three-wheel vehicles and quadricycles (OJ L 60, 2.3.2013, p. 52).

¹⁴³ Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, amending Regulations (EC) No 715/2007 and (EC) No 595/2009 and repealing Directive 2007/46/EC (OJ L 151, 14.6.2018, p. 1).

¹⁴⁴ L-category vehicles include light 2-wheel powered vehicles (category L1), three-wheel mopeds (L2), two-wheel motorcycles (L3), two-wheel motorcycles with sidecars (L4), powered tricycles (L5), light quadricycles (L6) and heavy quadricycles (L7).

new legislation. The measure also includes new provisions on reporting on the registration and de-registration of L-category vehicles, lorries, buses and trailers based on the issue of certificate of destruction (CoD). This certificate shall be issued to the holder and/or owner when the end-of-life vehicle is transferred to a treatment facility. The new legislation will oblige the owner of a vehicle to request the national vehicle registration authority to de-register a vehicle by presenting a CoD.

ATFs will have to report to the competent authority on the number of CoDs issued per year. A CoD must include a VIN code of a vehicle delivered to an ATF.

- **M30b – Export requirements for lorries (N2, N3) and buses (M2,M3) and trailers (O) linked to roadworthiness**

The measure extends the requirements described in PO4 (M19c, M21) to buses. Lorries and trailers. New provisions will be foreseen, by obliging the actors exporting the used buses and lorries from the EU to third countries to make available to customs authorities the information on a vehicle status via electronic system. To ensure traceability of used vehicles, the Vehicle Identification Number (VIN) and the information on the Member State where the vehicle was last registered should be made available to customs authorities. Only those lorries and buses which are roadworthy will be authorised to be exported to non-EU countries. To facilitate the distinction between waste vehicles and used vehicles, a special list of mandatory legal criteria will be introduced into the new legislation, based on the Waste Shipment Correspondents' Guidelines No 9 on Shipments of Waste Vehicles¹⁴⁵. Under this improved definition, a vehicle that is considered an economic total loss (in the country of last registration) will be considered as an ELV. The consequence would be that such vehicles should be delivered to ATFs and the Waste Shipment Regulation would apply to cross-border shipments of such vehicles.

These requirements shall apply within 5 years after entry into force of a new legislation.

- **M31 – Minimum EPR requirements for end-of-life L-category vehicles (L3e-L7e), lorries (N2, N3) and buses (M2,M3) and trailers (O)**

The measure foresees a basic application of the extended producer requirements to L-category vehicles, lorries, buses and trailers. These would namely include requirements for the Member States to establish collective or individual national EPR schemes in alignment with Articles 8 and 8a of the WFD, as described in M22 and M23. The requirement shall apply within 5 years after the entry into force of the Regulation.

- **M32– review clause on the regulatory extension of scope to new vehicles**

Based on evaluation of the reported data on the implementation of the measures listed under the PO6A and PO6B, the Commission shall provide an evaluation report on the possibility to fully include L-category vehicles, buses and lorries in the scope of the new legislation. This would also include the application of the relevant type-approval procedures on circularity requirements in those vehicles. The report shall be prepared within 7 years after entry into force of the Regulation, accompanied, if appropriate, by a legislative proposal.

¹⁴⁵ https://ec.europa.eu/environment/pdf/waste/shipments/correspondents_guidelines9_en.pdf

PO6C: Policy sub-Option 6C includes a full scope extension, with all requirements for M1 and N1 vehicles equally applying to the additional vehicles categories as well in the medium term. This implies full application of the modernised 3R type approval procedure and requirements on reusability, recyclability and recoverability as specified in PO1A-C, the recycled content requirements of PO2A-C, the advanced waste treatment requirements of PO3A-C (M33) and finally, the **establishment of EPR schemes**, including compliance cost offsetting and the other minimum EPR requirements as under PO5A-C, for motorcycles, lorries, buses and trailers (M34).

PO6C contains the following Measures 31 - 33 (M31c M33):

- **M31c - Full application of the extended producer responsibility (EPR) and advanced economic incentives of PO5**

The measure foresees a full application of the extended producer requirements to L-category vehicles, lorries, buses and trailers. In addition to the obligation for the Member States to establish collective or individual national EPR schemes in alignment with Articles 8 and 8a of the WFD, there would be additional requirements foreseen, namely, modulation and transfer of EPR fees from one Member State to another Member State, harmonized criteria for GPP and national Deposit Refund Schemes.

These requirements would not be applicable to special purpose vehicles, multistage and vehicles produced in small series.

These requirements shall apply after 7 years after entry into force of a new Regulation.

- **M33 – Full scope application of the new 3R type-approval and end-of-life treatment requirements to additional vehicle categories**

i) application of the 3R type-approval requirements from PO1

This measure extends the new design, production and end-of-life requirements to L-category vehicles, lorries and buses under the type-approval procedure. It means that only those L-category vehicles, lorries, buses and trailers which comply with the revised circularity related standards (as currently applied to M1 and N1 vehicle categories, including reusability, recyclability, recoverability and recycled content) shall be placed on the EU market.

For the purpose of calculating the compliance with reusability, recoverability, recyclability, a specific calculation methodology to be developed by the Commission within 3 years following the adoption of a Regulation, would be applied to the extended scope of vehicles. This methodology will instruct the vehicle manufacturers how they should demonstrate compliance with the recyclability and reusability of new vehicles, while taking into account the ongoing technological progress of the ‘proven technologies’ that exist at the moment of vehicle placement into the market.

The manufacturers of the extended vehicles would also be obliged to implement the information requirements, i.e., to provide information on dismantling and composition of vehicles.

The 3R type-approval procedures would enter into force after 7 years after adoption of the Regulation.

ii) full application of the recycled content targets from PO2

Mandatory recycled content targets would be extended to L-category vehicles, lorries, buses and trailers, as described in M9.

The requirements would enter into force after 7 years after adoption of the Regulation.

iii) full application of the reuse, recovery and recycling targets from PO3

The measure extends a mandatory 30% of recycling target for plastic to L-category vehicles, lorries, buses and trailers, based on the revised definition of “recycling” as aligned with the Waste Framework Directive. As in the case of M1 and N1 vehicle categories, it would be implemented in a combination with the additional requirements of the mandatory removal prior to shredding/PST (M13b), disposal ban of light-weighted automotive fractions (M16a), regulation of shredder/ post-shredder facilities (M16b, c).

The measure also introduces a new requirement for the Member States to collect and report data on the type and share of used or remanufactured automotive components of extended vehicle categories(14a). Such reporting obligation will allow to monitor the total level of reuse and remanufacturing at both national and the EU level per year. To ensure harmonized monitoring conditions, the new legislation will set out reporting requirements for ATFs, which will be obliged to provide information on all parts and components that were 1) dismantled and reused or 2) dismantled and remanufactured. Complementary provisions on the market support for the use of spare parts would be also foreseen (14b).

These requirements shall apply 5 years after entry into force of a new Regulation.

iv) full application of the collection, export and vehicle registration requirements of PO4

The measure extends the obligation for the Member States to annually report on the national vehicle stock and detailed changes to additional vehicle categories. The reporting elements will include the following data: i) total number of L-category vehicles, lorries and buses registered; ii) new registrations; iii) imports and exports of used L-category vehicles, lorries, buses and trailers; iv) temporary de-registrations, and v) permanent de-registrations.

The measure includes additional requirements for the export to non-EU countries, as well as full procedural requirements regarding the notification and share of information on the status of vehicles between Member States competent authorities, as provided in PO4C.

These requirements shall apply 5 years after entry into force of a new Regulation.

7.3 Description of discarded measures per policy option

7.3.1 7.3.1 Measures discarded for Policy Options 1: Strengthen the type-approval framework and reduce hazardous substances in vehicles

- **M34 - Voluntary pledges campaign to increase circularity**

This measure aims to motivate producers to increase circularity of their produced vehicles through voluntary commitments related to eco-design. To facilitate the exchange of information, the Commission would establish a platform for holding campaigns by targeting different areas where the circularity of vehicles can be addressed. In cooperation with the automotive sector (producers, waste management), sectoral targets would be set for each of these areas with a concrete timeline.

At the initial phase, a survey would be carried to collect information on the current state of play. Individual operators (producers, suppliers, waste operators) will be asked to participate

by submitting relevant information, including the confidential data. This data will be aggregated to assess the current status of existing circular practices with a view to set targets for a mid-term timeline. On this basis, campaigns will be held on the platform, inviting car manufacturers and suppliers to commit (i.e., to pledge) to achieving a certain share of the mutual target within the five-year timeframe.

The following areas are to be targeted in this manner:

Increase the rate of materials used in new vehicles, which are easy to re-use and recycle: In this respect, materials are to be targeted that increase the durability of parts (i.e., increasing potential for reuse) and/or that can be recycled at high efficiency and with no or minimum loss in quality (i.e., no downcycling) with the current capacities of the ELV waste management value chain. The ELV waste operators shall be consulted for this purpose in the identification of relevant materials and in the consideration of targets together with representatives of the automotive manufacturing sector that can be achieved in the mid-term.

Apply composite or materials for which no recycling/re-use is currently possible only when justified from a life cycle perspective: Materials which have a negative impact on the achievability of the ELV recycling targets shall be identified in cooperation with the automotive producers and the respective waste management sector. For such materials, the sector shall pledge to investigate impacts along the life cycle, use such materials only where use benefits set-off end-of-life costs and to provide funding for developing recycling capacities within a mid-term timeframe.

Increase the rate of recycled materials used in new vehicles: Together with the automotive manufacturing sector the current amounts of recycled materials used in the vehicle sector shall be established for e.g., steel, aluminium, copper, REE magnets, plastic (specific polymers), glass, rubber. For each of these materials, targets (sector amounts) for the mid-term shall be considered and set for increasing the amount of recycled content in vehicles.

Develop remanufacturing as part of their production process: vehicle manufacturers and their suppliers would be asked to report on the current level of use of remanufactured parts in the production of new vehicles and of “as good as new” spare parts. A target shall be set to increase the use of remanufactured parts, identifying specific components where the potential for remanufacturing is high and mainly depends on the level of demand. Manufacturers and their suppliers will commit to apply a larger share of remanufactured parts instead of new parts for repair but also in the assembly of new vehicles.

At the end of the five years, economic operators that have participated in the campaign would be asked to report on the implementation results. Based on the collected data, it will be monitored to what degree the set targets were achieved. In areas where the campaigns do not lead to significant results, the Commission would consider possibility to introduce the obligatory measures.

This measure has been discarded, as it is not deemed to be efficient as it will create extensive administrative burden for the vehicle producers and suppliers while still remaining non-mandatory obligation. It leaves uncertainty how many producers would be participating in the campaigns and to which extent the collected data would be comparable. Therefore, this measure is considered to be disproportionate and ineffective in terms of the results to be achieved.

- **M35 – Preparation of non-binding guidelines to improve circularity of vehicles**

Under this measure, the Commission would prepare the non-binding guidelines with recommendations for improving circular design and production of vehicles. The document shall be developed based on consultation with frontrunners of the sector explaining the relevant actions, their expected achievements, expected relation of costs and benefits of the action, potential cross-media affects to be avoided, benchmarks, etc. The guidelines would focus on the following aspects:

Design practices that support dismantling (by shortening dismantling time, increasing dismantlability with common ATF tools, avoiding of damage to component removed or environment),

Design practices that support high quality recycling (by promoting use or avoidance of certain materials or the mass of materials used in parts that are commonly removed prior to shredding),

Environmental management practices that encourage exchange of information between designers and dismantling facilities.

The preparation of the guidelines would be supported by dedicated studies (e.g. JRC¹⁴⁶).

This measure was discarded due to its non-binding nature, also taking into account that similar guidance documents like EMAS exist for other sectors. The measure is disproportionate in terms as the development of the guidelines would create intensive administrative burden, although its effectiveness of the practical implementation cannot be proved.

- **M36 - Obligatory due diligence requirements for materials used in vehicles**

The measure aims to introduce specific due diligence obligations for the raw and secondary materials used in manufacturing a vehicle and its components. These requirements would apply to vehicle manufacturers and suppliers.

This regulatory framework addresses the global nature of the automotive supply chain where the materials constituting a vehicle are sourced from diverse non-EU countries. It is not always known to which extent local governing conditions and/or the level of performance of mining and processing facilities comply with the protection of human rights, public health, labour safety requirements. High dependency on material sourcing from such countries contributes to adverse impacts on society and on human health and the environmental. To prevent it, vehicle manufacturers and suppliers would be requested to perform due diligence when sourcing materials from high-risk countries. That include raw materials sourced from conflict-affected or high-risk areas and secondary materials from countries not complying with a minimum level of environmental performance and minimum social working conditions. Manufacturers and suppliers would be obliged, as part of the type-approval process¹⁴⁷, to provide declarations, including third party verification proof, demonstrating that materials present in a manufactured vehicle are sourced diligently. A list of materials to be covered under the due diligence requirements would be included in a dedicated annex to the

¹⁴⁶ JRC Report (2020): Sustainable use of Materials through Automotive Remanufacturing to boost resource efficiency in the road Transport system (SMART); JRC /2917) report: Best Environmental Management Practice for the Car Manufacturing Sector

¹⁴⁷ Documentation should also be provided to the Member States inspections.

Regulation, including the thresholds for the total amount of the materials above which the due diligence obligation would comply. The annex would be updated on a regular basis.

Following the preliminary assessment, the potential measure has been discarded as the due diligence requirements for the automotive sector are applied through other the EU legislations:

i) In relation to the sourcing of minerals from conflict-affected or high-risk areas, Regulation 2017/821/EU¹⁴⁸ already lays down supply chain due diligence obligations for the EU importers of tin, tantalum and tungsten, their ores, and gold originating from such areas. Therefore, sourcing of e.g., tin, tungsten, tantalum, niobium and gold minerals and metals for vehicle manufacture are already addressed through this Regulation, making the new obligation redundant. In parallel, the European Commission is planning to review the current Regulation 2017/821/EU, which eventually lead to adaptations in both future due diligence requirements as well as in the materials for which such requirements are necessary.

ii) The Commission proposal for a Directive on corporate sustainability due diligence¹⁴⁹ cover the companies and operations relevant for the manufacturing of vehicles. The core elements of this duty are identifying, bringing to an end, preventing, mitigating and accounting for negative human rights and environmental impacts in the company's own operations, their subsidiaries and their value chains. The new rules aim to ensure that businesses address adverse impacts of their actions, including in their value chains inside and outside Europe. Therefore, additional due diligence requirements for the automotive industry are considered to be redundant.

Description of other measures corresponding to the voluntary activities of vehicle manufacturers and their suppliers to promote the circularity in vehicles, including reused and remanufactured components, are provided in the supporting study of the impact assessment.

7.3.2 7.3.2 Measures discarded for Policy Options 2: Increase the use of recycled materials in new vehicles

- M37 - Higher than 30% of recycled content target for plastics in 2030

The description of measure builds on the same content elements as in those presented under PO2A-C. The level of targets is deemed to be too far reaching. Therefore, the measure is discarded, as it creates high risk of supply – demand misbalances and disproportionate additional costs to the sector.

- M38 - Recycled content targets for copper

With targeted measures for copper separation for improving the quality of steel and aluminium scrap, once removed, there is sufficient intrinsic value and thus no remaining secondary raw material market failures to be addressed to ensure better uptake of copper fractions and thus no need for a recycled content type of target.

¹⁴⁸ Regulation (EU) 2017/821 of the European Parliament and of the Council of 17 May 2017 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas (OJ L 130, 19.5.2017, p. 1).

¹⁴⁹ Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Corporate Sustainability Due Diligence and amending Directive (EU) 2019/1937 (COM/2022/71 final)

- **M39 - Recycled content targets for glass**

Due to high specifications for automotive glass, using recycled content is not foreseen to be technically feasible. Removing window glass from the vehicles under **PO3A** removal obligations is selected as the best type of measure: A relatively clean fraction is obtained for further use in container glass or in the ceramics industry without the need for further economic support. In addition, with improving the recycling definition, backfilling of ASR and the landfill ban as well as high landfill costs will steer these glass fractions to recycling processes. Removal of windows further supports less maintenance for shredders/ PST operators. The measure introduces a requirement to use a minimum share of recycled materials (glass) in newly designed and type-approved vehicles. Requirements for a recycled content target to be reached within a given timeframe in compliance with additional parameters specifying the origin of secondary materials (e.g., pre-consumer vs. post-consumer; ELVs vs. other end-of-life product streams).

Therefore, the possible measure to set a recycled content target for glass is discarded, as other more effective measures are proposed to promote high quality recycling of automotive glass (e.g., excluding backfilling from recycling, obligations for ATFs to dismantle glass prior to shredding operations, recycling target for glass). Furthermore, setting a material specific recycled content target for glass under this PO2 is not regarded as the right type of measure and excluded from further considerations.

- **M40 - Recycled content targets for rubber/ tyres**

To ensure a coherence between sectoral legislation, possibility to set a recycled content for rubber will be examined under the Ecodesign for Sustainable Product Regulation (ESPR), together with other potential design-related requirements for tyres, e.g. recyclability. Therefore, this measure is discarded in the context of this review.

Aspects to be taken into account: there is significant improvement potential in the case of rubber recycling from tyres and (chlorinated) rubber from ELV fractions originating from for instance seals and hoses. Key focus for rubber is to ensure higher quantity and quality of recycling of ELT (End-of-life Tyres) products in various applications like use as artificial turf, infills in road construction products, devulcanization processes, chemical recycling and energy recovery processes like use in cement production, etc. For the 'higher quality' routes there is a need to take into account adequate measures to avoid the release of PAHs (Polycyclic aromatic hydrocarbons) and microplastics from recycled products¹⁵⁰.

7.3.3 7.3.3 *Measures discarded for Policy Options 3: Increase the quantity and quality of materials re-used, remanufactured and recycled from ELVs*

- **M41 – setting specific recycling targets for metals**

Following a preliminary assessment of economic, social and environmental impacts, measures are considering material-specific recycling targets for metals have been discarded:

- Steel: concerns focus more on the quality of ELV steels,

¹⁵⁰ Mechanical Tyre Recycling Fact Sheet – EuRIC, 2022

- Copper: high administrative burden, complicated sampling and other measures expected to be much more efficient (mandatory removal and quality requirements).
- Aluminium: a general recycling targets is discarded for the same reasons as for copper.

- **M42 – setting specific recycling targets for non-metal materials**

For other materials, certain specific recycling and reuse measures are discarded due to other approaches being assessed more effective in reaching similar or better results:

- Electronics: Aiming at improved recovery of electronic components via setting PST treatment requirements is discarded as other measures related to copper removal and manual dismantling are more effective.

Voluntary activities of vehicle manufacturers and their suppliers to promote the application of reused and remanufactured components is discarded because improving the conditions for the use of spare parts is expected to be more effective.

7.3.4 7.3.4 Measures discarded for Policy Options 4: Increase the collection of ELVs in the EU

A range of voluntary measures have been discarded due to low expectation on their effectiveness, important feasibility challenges, subsidiarity reasons or legal obstacles. These measures include the following:

- **M43 - Establish a mandatory collection target of ELVs based on the reporting obligations on the national vehicle market**

The measure is based on Article 5 (2) of the current ELV Directive stipulating that “Member States shall also take the necessary measures to ensure that all end-of life vehicles are transferred to authorised treatment facilities.” This implies, 100% of the generated ELVs should be collected. Therefore, this measure would expressively set this level mandatory collection target.

Implementation of this target would require a detailed reporting by the Member States on the national fleet, including precise traceability of export and import per year. Due to the lack of the comparable reporting mechanism at national level and data for intra EU trade, it is not possible to assess the feasibility to achieve 100% collection target. Therefore, setting a mandatory collection target for ELVs is considered to be premature.

- **M44 - Voluntary campaigns on export of ELVs with a focus on the current waste shipment correspondents' guidelines No9 on distinction between ELVs and second-hand vehicles**

The Waste Shipment Correspondents developed the Specific guidelines No 9¹⁵¹ to assist enforcement and customs officials in implementing the rules on the export of ELVs, and especially to distinguish between ELVs and used cars. According to these guidelines, the distinction between waste vehicles and used vehicles, first of all, depends on the answer to the question whether the holder of the vehicle intended to discard it or not. In practice, as the

¹⁵¹ Correspondents' Guidelines No 9 on shipment of waste vehicles:
https://ec.europa.eu/environment/waste/shipments/pdf/correspondents_guidelines9_en.pdf

guidelines are not legally binding and contain advice rather than straightforward criteria to distinguish between waste and non-waste, they are not applied consistently across the Union. Furthermore, the guidelines refer to a case-by-case approach according to a number of characteristics.

To support the enforcement of these Guidelines, the measure introduces voluntary campaigns to be performed by the Member States authorities¹⁵². These campaigns should be helpful in detecting illegal cases and failure in recognizing the status of a vehicle. Implementation scale of the campaigns depends on additional funding and allocation of additional human resources by the Member States. Taking into account that this measure would be based on a voluntary model, its effectiveness would remain negligible as it would not establish a systemic effect across the EU. Therefore, the measure has been discarded. Instead, minimum inspection requirements accompanied with the mandatory criteria distinguishing ELV from an used vehicle are proposed for the future Regulation.

- **M45 – Establishing a central EU vehicle registration database, including a conclusive list of conditions for permanent cancellation of the registration and management of temporary deregistration, establishment of a notification system for ELV, CoD and a conclusive list of conditions for permanent cancellation of the registration**

The measure foresees the establishment of a central EU vehicle registration database, which would enable an electronic notification procedure between Member States when a CoD is issued for a vehicle last registered in another Member State. The Member States where the CoD is issued but the vehicle was not registered (respectively not registered the last) is obliged to inform the Member State where the vehicle was last registered. Member States shall jointly establish a data exchange, making it possible to submit such information and to search by VIN for a vehicle, when the last owner (respectively country where the vehicle is been registered last), cannot be detected from accompanying (respectively missing) registration documents.

The measure has been discarded as unproportionate and unfeasible to implement.

- **M46 - Exchange of Member States on the implementation of incentives supporting effectiveness of the Certificate of Destruction (CoD)**

Under this measure, the future Regulation would require the Member States to report on the implementation of minimum one of the economic incentives listed in the revised legislation to encourage the last owner of an end-of-life vehicle to deliver it to an ATF and receive a CoD in return. Three alternative options might apply for such incentives:

¹⁵² Today only few Member States are known to perform special campaigns on the illegal export of ELVs: A study commissioned by the German UBA in 2006 titled “Improving precious metal cycles: analysis of export flows of used cars and electrical (electronic) equipment at the Port of Hamburg” Verbesserung der Edelmetallkreisläufe: Analyse der Exportströme von gebrauchten-Pkw und –Elektro(nik)geräten am Hamburger Hafen; Used vehicles exported to Africa: A study on the quality of used export vehicles (2020). Netherlands Human Environment and Transport Inspectorate, Ministry of Infrastructure and Water Management. available at: <https://www.ilent.nl/binaries/ilt/documenten/rapporten/2020/10/26/rapport--used-vehicles-exported-to-africa/RAPPORT-+Used+vehicles+exported+to+Africa.pdf>.

1. Link the (end of the) payment of insurance¹⁵³ schemes to provision of CoD;
2. Link the end of administrative fees to provision of CoD;
3. Member States set up other financial incentives (premium / pay out) for last owners to hand over ELVs to ATFs, possibly as part of EPR scheme

There is a risk that implementation of this measure might raise the subsidiarity concerns. Moreover, it would be difficult to ensure a proper implementation control of the actions and prevent the illegal activities. There are cases when the fraudulent contracts are presented to the insurance companies and the vehicle is instead delivered to an illegal dismantler at a higher profit than if offered to an ATF.¹⁵⁴ This demonstrates that this measure would not be sufficient to reach the desired effect. Therefore, the measure is discarded as disproportionate and inefficient.

- **M47 - Support / software interfaces to international notification system**

The measure aims to establish an internationally operating notification system for vehicles, where all the relevant registration information, including CoD and final cancellation would be available. The governance role and operating costs of the system would be attributed to the producers. Following the preliminary assessment, the implementation of the measure may raise subsidiarity concerns as processing of data related to the vehicle registration falls under the competence of national registration authorities. The producers shall not interfere in the cooperation of the national registration systems. Furthermore, it is technically challenging to shift this obligation to producers. As a result, the measure has been discarded.

Description of other measures contributing to the collection of ELVs in the EU is provided in the supporting study of the impact assessment. These measures include the following: exchange on Member State best-practice on national implementation and enforcement; enforcement actions by Member States through EU funding and EU enforcement actions against environmental crime; promote international non-binding actions at the international level (through UN Environmental and road safety programmes).

- **M47a – Setting maximum threshold for age and minimum level of emissions for the export of all used vehicles from the EU to third countries**

As an alternative to the requirement for the exporters to non-EU countries to provide the information on the roadworthiness status of the used vehicles (M19c), another measure was considered, according to which a maximum age of the vehicle or a minimum EU emission standard would be established for export of all the EU used vehicles to third countries. However, this measure was considered to have a disproportionate effect of banning all the export of used vehicles in manner which would not allow to take into account the specific import requirements for the used vehicles, when these are applied and communicated by the import countries. Instead, it was suggested to apply a phase-in approach. First, all vehicles which are exported from the EU to third countries would need to be ‘roadworthy’ in

¹⁵³ Directive 2009/103/EC of the European Parliament and of the Council of 16 September 2009 relating to insurance against civil liability in respect of the use of motor vehicles, and the enforcement of the obligation to insure against such liability

¹⁵⁴ Such cases are known in the Netherlands where the assumption is that around 30 000 ELVs are reportedly exported but remain in the Netherlands and are treated in substandard treatment facilities. More information is available: Janet Kes & Pieter Kuiper (2016): De-registration and monitoring of ELV's in NL; Presentation at the stakeholder workshop organised by the EC: assessment of the implementation of directive Directive 2000/53/EU on end-of-life vehicles with emphasis on the end-of-life vehicles of unknown whereabouts; Date: 21 November 2016

accordance with Directive 2014/45/EU¹⁵⁵. This would ensure that these vehicles comply with the EU stringent environmental and safety standards. Moreover, such approach would ensure that the vehicles which are exported with the aim to continue their service in third countries, are not of lower quality than those which are authorised to be on the EU public roads. Furthermore, the future legislation would foresee a possibility to develop a control mechanism to check how the EU vehicles exported under these procedures, comply with the specific requirements imposed by third countries regarding the environment and road safety. Such control approach would be subject a follow up communication between the EU and the third countries on the import requirements that adopted and enforced in the destination countries.

Measures discarded for Policy Options 5: Provide appropriate financial and organisational incentives to increase circularity in the automotive sector and improve the collection of ELV

- **M48 - establishment of the EU wide scheme on the extended producer responsibility**

The measure aims to establish a single EU-wide EPR scheme for ELVs. This approach would replace national EPR systems.

Despite the existence of comprehensive EU legislation and the responsibility being directed to producers under EPR schemes, the governance of waste management (including ELVs) is organised at national level by each Member State, leaving them the discretion to choose how to regulate and arrange the relationship between waste operators and producers of specific products. This is notably due to the fact that the functioning of EPR schemes is dependent on a combination of market factors, e.g. level of labour costs, distribution/territorial coverage of waste treatment infrastructure or prices for spare parts or recyclates, which are variable throughout the EU.

While there could in principle be merits in considering the adoption of EPR scheme at the EU scale for ELV, in view of the integration of the EU market for the automotive sector and important movements of used vehicles between EU Member States, this would represent considerable changes compared to the current organisation for such schemes. This would first deprive Member States of their ability and freedom to organise the relations with the various actors in the waste sector. This would also require that this organisation and the scrutiny on how the EPR scheme operate and comply with the EU requirements is done at the EU level through a new EU body. This would have financial and resources implications, which are not factored in in the current Multi-Annual Financial Framework. Leaving the governance of EPR for ELV at the national level (where Member States often already have a department in their Ministries or Agencies dealing with EPR issues) would on the other hand build on their expertise and experience and respect the subsidiarity principle.

The proposed measure is therefore not considered further. It should be stressed that the cross-border dimension of EPR schemes for ELV is addressed through measure 25, allowing national EPR scheme to take account of the EU dimension of the problem. In addition, measure 22 clarifies that producers would be entitled to develop individual schemes at national level, if they so wish.

¹⁵⁵ Directive 2014/45/EU of the European Parliament and of the Council of 3 April 2014 on periodic roadworthiness tests for motor vehicles and their trailers and repealing Directive 2009/40/EC (OJ L 127, 29.4.2014, p. 51)

- **M49 - European-wide deposit refund scheme for vehicles supervised by a single European body**

Under this measure, Member States or vehicle producers would be obliged to pay into a European fund a minor amount per year for each new vehicle placed on the market in the EU. An EU level authority would be assigned to supervise the EPR funds. The European fund would pay out a fixed amount to the last owner of a vehicle when it becomes an ELV and a CoD is issued. Preliminary assessment concluded that such European-wide approach would be more beneficial for the Member States importing a high share of used vehicles. Upon it, all vehicle drivers would pay the same fee and get the same pay out as the last owners. However, this measure does not address the differences across the EU Member States of the ELV treatment costs and could lead to cases of fraudulent issuance of CoDs, e.g. for vehicles that are actually exported to non-EU countries. The approach requires strictly harmonized rules for registration and deregistration vehicles, as well dissuasive penalties, which are currently lacking. Taking all these aspects into account, the measure is discarded as premature and disproportionate to the expected results.

- **M50 - Collection of vehicles at holder's premises and abandoned vehicles free of charge for the last holder**

The measure sets an obligation for producers to collect vehicles at holder's premises and abandoned vehicles free of charge for the last holder. The measure extends the current legal provision where the last holder is obliged to deliver the vehicle to an ATF or collection point. Producers are responsible to offer ATFs/ collection points sufficiently close coverage. Following the preliminary assessment, it is considered that the implementation of this measure might lead to inefficient cost. Moreover, such regulatory approach might influence an undesirable behavioural pattern of last holders by discouraging them to deliver a vehicle to an ATF and instead abandon it. Consequently, this measure has been discarded.

7.3.5 7.3.5 Measures discarded for Policy Options 6: Encourage the transition to a circular economy in sectors which are currently outside the scope of the ELV and 3R type-approval legislation

- **M51 - Extension of new requirements to special purpose, multistage vehicles and vehicles produced in small series**

Under this measure, additional vehicles would be phased-into the Regulation through an extension of the vehicle category scope, namely type-approved vehicles of categories Le1-Le7 (motorcycles), M2 and M3 (buses), N2 and N3 (lorries) and O1-O4 (trailers and semi-trailers). Special-purpose vehicles¹⁵⁶ and multi-stage built¹⁵⁷ vehicles of category M2, M3, N2, N3, and O (considered not relevant for L-category vehicles) or such vehicles built in

¹⁵⁶ According to Regulation 2018/858/EU: 'special purpose vehicle' means a vehicle of category M, N or O having specific technical features that enable it to perform a function that requires special arrangements or equipment, and characterised through Regulation 2018/585/ EU, Annex 1, Part A, point 5.

¹⁵⁷ as referred to in Regulation 2018/858/EU. The multi-stage procedure (described in article 22(1) of the mentioned Regulation) is a procedure where "one or more approval authorities certify that [...] an incomplete or completed type of vehicle satisfies the relevant administrative provisions and technical requirements" (Regulation 2018/858/EU, article 3(8)).

small series¹⁵⁸ which are currently not covered would subsequently be covered. There is a lack of information that would allow the quantification of the costs and benefits for their inclusion.

Taking into consideration findings of the impact assessment, including the stakeholder comments, the measure has been discarded as disproportionate and premature. It is thus concluded to completely exclude small series, special purpose vehicles and multi-stage built vehicles from the requirements related to the 3R type-approval and end-of-life treatment.

- **M52 – A full regulatory 3RTA scope extension to all vehicle categories**

The measure foresees a full scope application of 3R type-approval and end-of-life treatment requirements to all vehicle categories which are currently excluded from the regulatory scope. These vehicles also include ships, planes and trains, agricultural and mobile machinery, military and space vehicles, and non-type approved (electric) bicycles. These vehicles are regulated by other EU legislation. Their type-approval procedure is separate from that of road vehicles and does not address objectives of the 3R. Potential changes to the current provisions of 3R type-approval regulation will not impact the increase of circularity of these vehicle categories, as ISO:22628 standard applies only for road vehicles. It is questionable whether the new Regulation would be the most efficient to regulate other vehicle categories, notably non-road vehicles. Similar concerns are identified with regard to end-of-life treatment requirements. There is no data available to prove to which extent all vehicles contribute to the problems defined in the impact assessment and what EU level intervention is needed to address them. As a result, this measure is discarded as disproportionate and premature.

Table 7.3 Additional information on non-road vehicles

Additional information on non-road vehicles:

- Non-type approved e-bikes are regulated under Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) and Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE), and its batteries to be regulated by the Battery Regulation.
- Ships: The end of life of ships is covered by Regulation (EU) No 1257/2013 on Ship Recycling;
- Planes: they are not disposed of in the EU; a lot of parts are leased so there is a huge remanufacturing scene/market; high shares of composites, GLARE¹⁵⁹, titanium and specific alloys (corrosion resistant, high strength, low weight like Al-Li, etc.)
- Trains are few, e.g., there are ~300 operating long-distance trains in Germany that run for 40 years approximately. That is considerably less than the annual limits of the definition in the type approval of what are small series, which are specially exempted. Generally, there is little waste, and a high recyclable fraction is expected
- Agricultural and non-road mobile machinery (NRMM): These are low volume, high variety vehicles, meaning that it is typical for such vehicles to be produced in small series and in a wide range of models for specific purposes. Vehicles are for the most part heavy duty with long service life. These are difficult to address with “general”, overarching measures, Vehicles used in agricultural and forestry activities such as

¹⁵⁸ In the Regulation 2018/858, the general type-approval regulation in force today, the annual limits per Member State are 500 units for O1, O2, and 250 for M1, M2, M3, N1, N2, N3, O3, O4. The EU-wide annual limits are 1 500 for M1, N1, N2, N3, and 0 for other categories.

¹⁵⁹ glass-reinforced aluminium laminate

all-terrain vehicles (ATVs) and Side-by-sides (SbS) belong to the so called “T-category” and are subject to a specific type-approval regulation (Regulation (EU) No 167/2013);

- *Military purposes & space: Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) and Regulation (EC) 1907/2006 on REACH do not apply to applications designed solely for military purposes and/or for space.*

ANNEX 8: OVERVIEW OF IMPACTS OF POLICY OPTIONS AND MEASURES

In the next sections, the impacts are presented for 2030, 2035 and 2040. Data for 2025 is not provided with most measures not expected to be (fully) implemented. The main year for comparison is 2035 as around that time the measures with long timelines are expected to be fully implemented.

8.1 Environmental impacts

7.3.6 8.1.1 Design circular: Improve reusability, recyclability and recoverability, 3R type-approval

For PO1 only a qualitative assessment was possible. The actual benefits are of a long term and preventative nature which is materialising when the vehicles become waste many years later. It is therefore difficult to quantify the exact environmental benefits and value for the long-term future. Nonetheless, the value of the measures can be compared qualitatively against the current baseline, where past design choices frequently hinder nowadays recycling attempts.

The general reusability and recyclability of vehicles placed on the market following the **PO1A - improved 3R type-approval compliance verification** requirements are expected to improve the level of reuse and recycling rates with around 5%. Reuse and recycling rates could increase further in the long term due to requirements on the use of digital keys and interchangeable components and/or from the dismantling tests that OEMs will need to perform and submit documentation for. The qualitative analysis due to its long-term prevention character only generates results many years later when vehicles become waste. The **PO1B - Circularity Strategy** will have more immediate effects. The design for dismantling requirements and increased cooperation with recyclers, will jointly enhance recycling of increasing shares of lightweight non-recyclable materials in the medium-term (within 7 years after initial type approval). The **PO1C – Digital Product Passport** provides necessary reuse and dismantling information to address existing information gaps to match supply and demand for spare parts in particular. The additional mandatory declaration on the use of recycled content for all materials provides better substantiation of such claims to the consumer and verifiable information to the decarbonisation achievements of manufacturers in comparison.

Table 8.1 Summary qualitative assessment of the environmental impacts for policy options 1.

Environmental impacts (2035, compared to baseline)	PO1A	PO1B	PO1C
3R type-approval - Circularity	(+)	(++)	(+++)
Hazardous substances (see Annex 9)	(++)	(++)	(++)

The analysis for hazardous substances is conducted qualitatively as well. For the provisions on the four substances currently restricted under the ELV Directive, it can be concluded that, under the current ELV Directive, significant environmental benefits have been achieved: An ex-post analysis on the four heavy metals shows environmental benefits of past restrictions:

lifecycle emission reductions between 2000 – 2005 for Pb were estimated at 99,6%, for Cd at 96% and for CrVI at 99,99%¹⁶⁰. Remaining exemptions without an expiry date¹⁶¹ still require future reviews. No significant difference in environmental impacts is expected for each of the suboptions under PO1. The options ‘restriction under REACH and other existing legislation’ and the ‘hybrid approach’, for restricting new hazardous substances, their efficiency and effectiveness in addressing the environmental impacts of the substances concerned is expected to be broadly similar to that of the enhanced assessment defined in the measure ‘maintain under ELV’, given in all cases risk and socio-economic assessments, as well as analysis of alternatives is enhanced, as compared to current provisions under the ELV Directive, and the assessment is carried out with the support of ECHA. More detailed assessment and impacts information can be found in Annex 9.

7.3.7 8.1.2 Increase the use of recycled content – plastics and steel

PO2A – plastic recycled content targets¹⁶² of 10% in 2035 based on the **fleet level** create a final demand for recyclates in the automotive industry of 240 ktons in 2035¹⁶³. **PO2B – targets** of 25%¹⁶⁴ starting in 2030 **for newly type-approved** vehicles correspond to an additional demand of recyclates of 713 ktons for 2035. This should boost the recycling of plastics from ELVs, as this means that 53% of ELV plastics recyclates would have to be reintroduced in the automotive sector. **PO2C – targets** of 30% in 2035 correspond to a demand of recyclates of 872 ktons in 2035¹⁶⁵. The target would represent an effective recycling rate of available ELV plastics of 64% which poses a supply – demand imbalance risk. The GHG savings linked to **PO2B** would be 314 ktons of CO₂-eq, and 376 ktons of CO₂-eq for **PO2C**.

The summary of the main environmental impacts for the PO1 and PO2 affecting the design and production stages are visualised in Table 8.2.

Table 8.2 Summary environmental impacts for the plastic recycled content targets

Environmental impacts (2030, 2035, 2040, compared to baseline)	Baseline	PO1A	PO1B	PO1C	Preferred
Design and production stage					
3R type-approval - Circularity		(+)	(++)	(+++)	(+++)
Vehicles placed on market (N1,M1)		15,024,844			
JRC report scenario nr	JRC3a 10% in 'fleet' 2035	JRC4b 25% of newly TA from 2030	JRC 4c 30% of newly TA from 2030	JRC4b 25% of newly TA from 2030	
2030					

¹⁶⁰ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

¹⁶¹ The lead in alloy exemptions 1(a), 2(c)(i), 2(c)(ii) and 3 and special exemptions for lead in solders such as 8e and lead in glass or ceramic materials (exemption 10(a) and 10(b))

¹⁶² Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

¹⁶³ Corresponds with the scenario JRC3a of the JRC study (JRC129008).

¹⁶⁴ Corresponds with the scenario JRC4b in the Annex of the study (JRC129008).

¹⁶⁵ Corresponds with the scenario JRC4c in the Annex of the study (JRC129008).

Recycled content plastics (kton)	92	+111	+505	+608	+505
Reduced decease incidence PM	1.6	+1.8	+8.1	+9.7	+8.1
Energy savings (GWh)	868	+1,067	+4,854	+5,844	+4,854
BOE (million Barrel of Oil equivalent)	0.5	+0.6	+2.9	+3.5	+2.9
CO2 savings (kton) (allocated, plastics)	35	+48	+250	+295	+250
2035					
Recycled content plastics (kton)	123	+240	+713	+873	+713
Reduced decease incidence PM	2.1	+4.1	+13	+16	+13
Energy savings (GWh)	1,161	+2,264	+7,283	+8,740	+7,283
BOE (million Barrel of Oil equivalent)	0.7	+1.4	+4.5	+5.4	+4.5
CO2 savings (kton) (allocated, plastics)	46	+90	+314	+376	+314
2040					
Recycled content plastics (kton)	123	+240	+713	+873	+713
Reduced decease incidence PM	2.1	+4.1	+13	+16	+13
Energy savings (GWh)	1,161	+2,264	+7,283	+8,740	+7,283
BOE (million Barrel of Oil equivalent)	1	+1.4	+4.5	+5.4	+4.5
CO2 savings (kton) (allocated, plastics)	46	+90	+314	+376	+314

PO2: The level of confidence in the analysis of plastics – recycled content targets is high due to the substantial quantification effort and depth of the technical analysis by the JRC. The stocks and flows assessment and underlying assumptions are extensively tested and validated by stakeholders¹⁶⁶. The forward-looking analysis of supply and demand of automotive plastics is of a lower confidence as dependent on future market fluctuations. The original study focused on the application of the measures to the entire vehicle fleet placed on market represented by the JRC ‘scenarios 3’ and did not include the smaller subsection of light commercial vehicles (N1). The later choice for the target applying to newly type approved vehicles is represented with the JRC ‘scenarios 4’ in below Figure 8.1.

¹⁶⁶ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

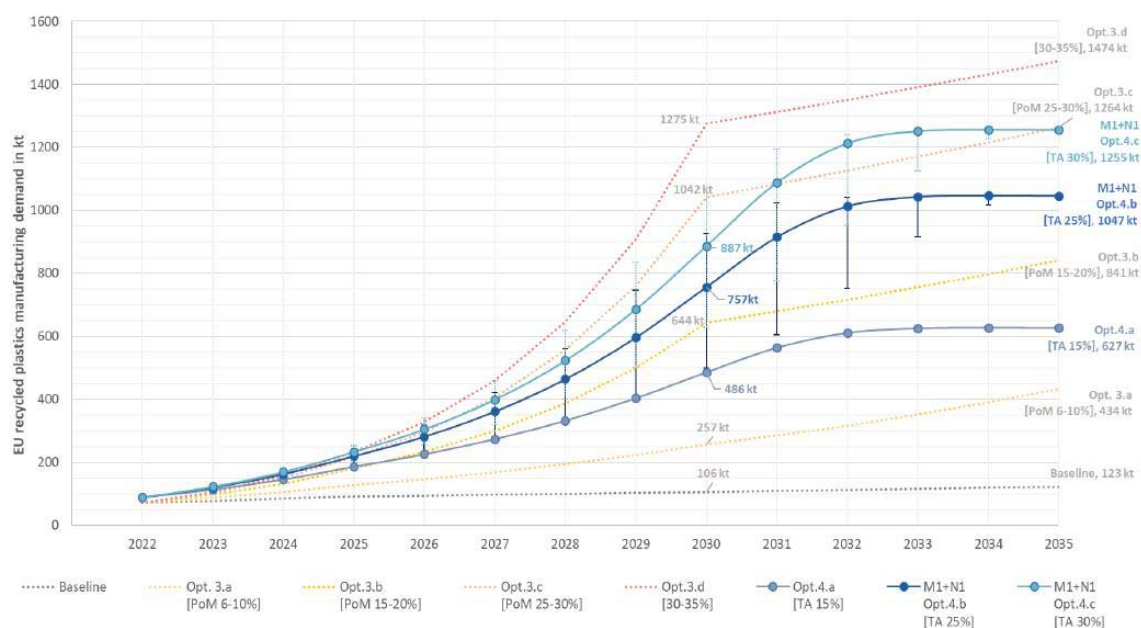


Figure 8.1 Comparison of plastics recycled content volumes in the JRC study until 2035

The increase of the demand regarding recycling plastics is plotted in Figure 8.1 for each of the scenarios 4 and then compared to the previous options 3. As anticipated, **the demand growth is more progressive in the case of the newly type approved targets** compared to the scenario 3 fleet requirements originally computed. Late and early adoption scenarios are depicted in Figure 8.1 with the uncertainty bars for options 4.b and 4.c. **Overall, option 4 series postpone the final level of the demand for recycled plastics by around 5 to 6 years, i.e., 2035 instead of 2030 in case of an application date in 2030.** In the best case (early adoption), it will delay the demand by only one year. As expected, the previous option 3.c (25 % in 2030 and 30% in 2035) corresponds in terms of ambition to the option 4.c (TA 30% in 2030) with a demand raising to 873 kton for the share placed on the EU market in 2035. **Option 4b (TA 25% in 2030) is more ambitious than the previous option 3.b,** with a demand of 713 kton in 2035.

Compared to previous options analysed (options 3 series), the new policy options developed according to the **TA procedure (options 4) postpone by around 5 to 6 years the demand for recycled plastics.** This is modelled through an S-curve depicting the penetration of newly TA vehicles in the fleet of newly registered vehicles (for more information see figure A5.2 in the JRC study¹⁶⁷). In the best case (early adoption), it will delay the demand by only one year (see Figure A5.3 Option 4.c upper bound in 2031 compared to Option 3.c in the JRC study).

Regarding **recyclates production from ELV sources**, the revised fleet model including M1 and N1 forecasts a more limited growth of vehicles manufactured and registered in Europe while anticipating a higher ELV collection rate, which will allow recyclers to produce more recycled plastics from ELV sources. This has some implications favouring the supply/demand

¹⁶⁷ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

balance by lowering the demand and maintaining approximately the same level of recycled plastics produced (e.g., same estimation regarding the amount of recyclates produced for 2030).

The balance between demand coming from the closed loop criteria (25% of the demand) and the production capacity does not seem at risk for option 4.c and 4.d when sufficient recycling yields for PP, PE and ABS are achieved (i.e., total recycling rate >25%). It should be noted that several front-runners already achieve a 25% recycling rate in 2022 based on PP, PE and ABS recycling. The plastics recycled content options here are flanked by measures under PO3B, where a mandatory plastics recycling rate is proposed of 40% recycling ensuring the balance would be even more favourable.

Table 8.3: Summary table of the JRC scenarios 3.b, 3.c. and 4.b, 4.c for 2030 and 2035. The numbers with a () have been estimated from previous assessment related to option 3 series.*

	2022	2030				2035			
Criteria	Baseline	3.b	3.c	4.b	4.c	3.b	3.c	4.b	4.c
Rec. content targets	-	15%	25%	25% (TA)	30% (TA)	20%	30%	-	-
1) Annual growth rate of recycled plastics content	3%	29%	37%	26%	28%	6%	4%	-	-
2) Demand of recycled plastics (kt) *	89	644*	1042*	757*	887*	841*	1264*	1047*	1255*
3) Demand compared to CPA 10 Mtonnes (%) *	1%	6%	10%	8%	9%	8%	13%	10%	13%
4) Maximum consumption of ELV recyclates to fulfil the demand (% for FRS sc.)	10%	43%	69%	50%	59%	43%	64%	53%	64%
5) Estimated maximum open-loop demand (kt)	67	483	782	568	665	631	948	785	942
6) Estimated CO2 savings (kg CO2 eq., per car)	0	-14	-26	-19*	-22*	-19	-31	-26*	-31*
7) Estimated recyclers additional profitability (M€)	0	+250	+402	+310	+374	+296	+425	+318	+393
8) Estimated extra-cost per vehicle manufactured (€)	0	+18	+34	+24*	+34*	+24	+49	+34*	+49*

Source: JRC own elaboration

* The numbers are for all vehicles produced in Europe (19.7 million), the impact assessment allocates the relative share to the vehicles placed on the EU market (15.0 million).

Option 4.c seems to perform the best and allows the car manufacturers a more progressive uptake in term of recycled plastics compared to 3.c. However, it appears crucial to combine the recycled content targets measure with complementary provisions such as better implementation of the design for recycling, wider deployment of the PST, minimum recycling rate for ELV plastics or reduction of unknown whereabouts flows. The additional costs per

vehicle is also slightly higher in the case of a 4.c compared to, e.g., 4.b. The investment needed in R&D could be compensated by economic incentives mechanisms such as EPR modulation fees. The option 4.b might be easier to implement because of the slightly lower ambition in the mandatory recycled content level.

In both cases, a transition period thanks to an early deployment of option 2.a (mandatory declaration coupled with EPR fee modulation) is suitable to boost the recycled content demand and prepare the automotive supply chains in anticipation of the application date, i.e., in 2030 for all newly type approved vehicles.

*Table 8.4 Performances of policy options regarding each field investigated in the impact assessment
Option 2.a, option 3.b, 4.b, 3.c and 4.d. of the JRC study*

Policy options	Option 3.b	Option 4.b	Option 3.c	Option 4.c
	Ambitious level targets (15-20%)	Ambitious level aligned with TA (25%)	Very ambitious level (25-30%)	Very ambitious level aligned with TA (25%)
Uptakes of recyclates (also considering supply capacities)	Good performance	High performance	Very high performance, conditional with the combination of other ELVD provisions.	Very high performance, conditional with the combination of other ELVD provisions
Environmental assessment	Intermediate performance	High performance	Very high performance	Very high performance
Economic assessment (profit for recyclers)	Good performance	Good performance	Very good performance	Very good performance
Economic assessment (additional manufacturing costs)	Limited additional costs	Moderate additional cost	Medium additional costs	Medium additional costs

Recycled content for steel

Following the approach specified in Annex 4.8, the following quantities are used from the modelling in the main impact assessment study.

Table 8.5: Estimated steel volumes available for recycled content, 2035

Supply and demand for steel recycled content targets (in ktons, except for nr. of vehicles)						
2035	Baseline	PO2A	PO2B	PO2C	Preferred	Combined +EPR
DEMAND new vehicles	15.2 M vehicles					
All Steel	11,779	11,779	11,779	11,779	11,779	11,779
Flat Steel	9,255	9,255	9,255	9,255	9,255	9,255
Long Steel	2,524	2,524	2,524	2,524	2,524	2,524
Long - Post Consumer	1,515	2,356	3,534	4,712	3,534	3,534
Long - Closed Loop	106	353	530	942	530	530

Supply ELVs	9.6 M	9.7M	10.1M	10.7M	11.3M	11.7M
All ELV steel	6,199	6,273	6,522	6,894	7,308	7,556
Flat products ELV	4,871	4,929	5,124	5,417	5,742	5,937
Long products ELV	1,328	1,344	1,398	1,477	1,566	1,619
Flat (Export reduction potential)	1,876	2,726	3,925	5,262	5,982	4,518
Flat (Dismantled Pre-Shredder)	108	431	807	1,076	807	968
All mixed in E40	18,784	19,010	19,763	20,892	22,146	22,898
Long + Flat products (Shredded)	14,432	13,630	13,082	13,154	14,955	15,059
Long products in E40	4,025	4,074	4,235	4,477	4,746	4,907

Uncertainty in setting an appropriate target level for steel

The analysis revealed a number of uncertainties in setting an appropriate target level that significantly increases the uptake of post-consumer steel fractions. These main uncertainties are:

1. An uncertain share of long products in (future) EVs. Current ELVs have a relative stable content of around 20% of long products for which the copper tolerances and thus the scrap utilisation rates can be higher¹⁶⁸. For new EVs it is not entirely clear which share of long versus flat products including more advanced high strength steels can be expected.
2. Uncertainty in possible uptake levels of post-consumer scrap in flat production, both for BF and EAF routes. Various studies available provide different views on current and future scrap utilisation rates¹⁶⁹.
3. Uncertainty about the share of pre-consumer versus post-consumer in current scrap use rates which is very relevant for future carbon pricing under ETS/CBAM. Here, current declarations of manufacturers are difficult to compare due to varying definitions of recycled content and lacking classifications to distinguish post- versus pre-consumer scrap, and finally;
4. Uncertainty on the economic effect of automotive recycled content demand on the availability and pricing of scrap to other sectors. For the EU, there is a net-export of scrap to non-EU member. It is however not entirely clear what the shares of low versus high quality scraps are in relation to higher EAF shares in the production mix outside the EU in the case of Turkey and the US for example. This may affect the availability and affordability of both low and high value scrap and thus the estimates for the costs and revenues between recyclers and steel producers in particular.

For the purpose of PO2C, in below table, a check on the supply and demand balance is performed to ensure the targets do not create a supply-demand balance resulting in insufficient secondary supply to meet the closed loop percentage in particular. The first row is a minimum availability scenario where solely long products are accounted to achieve the targets. The second row is regarded as the most realistic scenario where in time at least a certain amount of ELV flat products is available for use in EAFs. In above table (row Flat-dismantled pre-shredder) it should be noted that from the impact assessment report, an

¹⁶⁸ Arcelor Mittal, New steels driving the circular economy, innovative solutions for future mobility, International Automotive Recycling Conference, Vienna, 14-03-2018, slide 6

¹⁶⁹ R. Su and A.Assous, Starting from scrap - The key role of circular steel in meeting climate goals, Sandbag, June 2022;

additional amount of removed flat products with lower copper content is available from the removal requirements of **PO3** are implemented, providing possible 400 to 1,000 tons of pre-shredder flat parts. The last row indicates future upwards potential where more ELV flat products find their way as recycled content with effectively a net reduction of low value scrap to non-EU countries. The supply/ demand balance in that case clearly significant upwards potential for higher uptake levels beyond 40% in the future. For all routes, it should be noted that the calculation and verification methodology will have to take into account that EAFs can be batch loaded more flexibly in time allowing for a mass-balance approach, whereas BF/BOF routes are more continuous operation with more diverse mixing of various primary and scrap inputs.

Table 8.6: Supply/ demand check for the proposed targets

RC TARGET SUPPLY/DEMAND BALANCE to check availability	Baseline	PO2A	PO2B	PO2C	Preferred individual	Preferred + EPR
Covered by long products only	33%		42%	53%	37%	36%
Covered by long and dismantled flat products	32%		36%	44%	32%	31%
Covered by long, dismantled flat and % of remaining flat steels	22%		20%	22%	15%	17%

For steel, a recycled content target under **PO2B** and **PO2C** provide an additional push to integrate higher quality scrap into new vehicles, with roughly 585 tons of GHG savings in comparison to the baseline for 2035 and 900 ktons towards 2040 for **PO2B** and 1,400 ktons for **PO2C**. In addition, a shift in energy demand is relevant, including 260 GWh extra electricity demand for Electric Arc Furnaces in 2035 by 2035 while reducing the demand for natural gas (15 million m3 less), hydrogen (3,000 ton less) and in particular coal (170 kton less) and iron ore (600 kton less) as displayed in Table 1 for **PO2B** in 2035. These values are obviously increasing for **PO2C** and for later years as the target would be fully implemented between 2035 and 2040 with the 7 years introduction after entry into force.

Table 8.5 Summary environmental impacts for the steel recycled content targets, 2035 and 2040

Environmental impacts (2035, compared to baseline)	Baseline	PO2A	PO2B	PO2C	Preferred (individually)
Vehicles placed on market (million units)	15,025,000				
Recycled content steel	PO2	PO2A	PO2B	PO2C	Preferred (individually)
2035					
Recycled content steel (kton)	1,515		+505	+1,212	
CO2 savings (kton CO2-eq., steel RC)	1,754		+585	+1,404	
Electricity extra use (GWh)	-776		-259	-621	
Natural gas savings (million m3)	45		+15	+36	
Hydrogen savings (ton H2)	9,185		+3,062	+7,348	
Coal savings (kton)	500		+167	+400	
Iron ore savings (kton)	1,808		+603	+1,446	
Energy savings (coal, nat.gas, H2, in GWh)	2,006		+669	+1,605	
2040					
Recycled content steel (kton)	1,515		+841	+2,019	

CO2 savings (kton CO2-eq., steel RC)	1,603	+891	+2,138
Electricity extra use (GWh)	-778	-432	-1,037
Natural gas savings (million m3)	52	+29	+69
Hydrogen savings (ton H2)	11,299	+6,277	+15,065
Coal savings (kton)	434	+241	+579
Iron ore savings (kton)	1,807	+1,004	+2,409
Energy savings (coal, nat.gas, H2, in GWh)	1,988	+1,105	+2,651

7.3.8 8.1.3 Improve treatment quality and quantity

PO3: There is a significant number of measures for improving reuse and recycling (see Annex 7). To avoid double counting of potentially overlapping effects, the impact assessment model¹⁷⁰ is carefully designed to determine both the impacts of the individual measures as well as in combination. The detailed quantification efforts reflecting the depth of the technical analysis provide a high confidence in the results. The analysis of the separation of electronics is conducted for few parts only and therefore partly incomplete. Nevertheless, the analysis sufficiently illustrates the potential from better separation in such cases.

All three suboptions under **PO3** bring significant environmental benefits from higher quantities and qualities of recycling. For **PO3A**, the effect of better implementation of the current Annex I of the ELV Directive has a significant positive effect of about 1 million tons of materials recovered at higher quality, corresponding with 1.5 million tons of CO₂ savings compared to the baseline. In order of magnitude of GHG savings, improved aluminium and steel recycling contributes the most, followed by the environmental benefits of improved plastics recycling¹⁷¹. **PO3B** and **PO3C** bring even higher benefits. The increased separation of (cast) aluminium components provides significant gains for **PO3B** of around 3.7 million tons of CO₂-eq saved, primarily due to reuse and corresponding aluminium production avoided. Initial assessment for the e-drive motors mandatory removal prior to shredding shows that circa 1 million ELV in 2030 and 5 million ELVs in 2040 will be affected by this provision. It should result in an increased quantity of high-quality secondary steel and aluminium by 15% and 20% in 2030 and 18% and 22% in 2040¹⁷², respectively, compared to baseline scenario. Copper recovery would increase by 97% from e-drive motors and would decrease contamination of secondary base metals, hence increasing quality. The mandatory removal and separate recycling of e-drive motors would also thrive the permanent magnet recycling value chain and generate new flows of CRMs for further recycling, along with innovative solutions entering the future markets. Vice versa it might stimulate the development of better non-PM motors. It is estimated circa 4.2 kt of permanent magnets to be available in 2040 for high quality recycling from future EU ELVs. For **PO3C**, the advanced quality targets provide savings equivalent to 2.9 million tons of CO₂-eq. The update of the recycling, reuse and remanufacturing definitions proposed in the revision would exclude some recycling processes that yield very-low quality recyclates. The more consequent definition of recycling in particular provides an incentive for the improved recycling of plastics and glass

¹⁷⁰ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

¹⁷¹ Recycling quality improvements of PO3 are not overlapping with the allocation of plastics recycling benefits of PO2 to avoid double counting.

¹⁷² These values are not included in Table 2 as the JRC CRM study is still work in progress.

contributing to 600 kton and 200 kton of annual GHG savings respectively. The results are excluding the effect of increased collection from PO4 but already includes the PO5 effect of EPR measures in the last column of Table 2. See Annex 8.3 for the methodological approach, the main assumptions and details per material and other years.

Table 8.6 Summary environmental impacts for the recycling and reuse policy options 3 in 2030

Environmental impacts (2030, compared to baseline)	Baseline	PO3A	PO3B	PO3C	Preferred (individually)	Preferred (combined)
ELVs treated EU (units, legal & illegal)	9,283,014					+1,799,859
Recycling stage (values in kton)	(values in addition to baseline)					
Steel (reused)	559	+447	+447	+447	+447	+559
Steel (recycled, pre-shredder)	98	+295	+640	+886	+640	+800
Steel (recycled post shredder)	4,287	-682	-1,023	-1,266	-1,023	-1,279
Aluminium (reused)	105	+53	+84	+84	+84	+105
Aluminium (recycled pre-shredder)	7	+28	+204	+81	+204	+255
Aluminium (recycled post-shredder)	755	-66	-241	-137	-241	-301
Copper (reused)	1	+8	+9	+9	+9	+11
Copper (recycled pre-shredder)	7	+13	+53	+33	+53	+66
Copper (recycled post-shredder)	79	-16	-51	-39	-51	-64
Glass (recycled pre-shredder, high quality)	20	+4	+121	+121	+121	+151
Glass (recycled post-shredder, low quality)	111	-4	-121	-121	-121	-151
Plastics (reused)	66	+0	+66	+66	+66	+83
Plastics (recycled pre-shredder, high quality)	12	+0	+50	+62	+50	+63
Plastics (recycled post-shredder)	98	+0	+71	+86	+71	+89
EEE (inverter only) - recycled pre-shredder (higher quality) mix of materials	0	+0.8	+4.0	+7.2	+4.0	+4.0
CRMs (permanent magnet materials)	0	+0	+0	+0	+00	+0
Recycling stage (CO ₂ savings in kton)	(values in addition to baseline)					
Steel	6,091	+521	+531	+539	+531	+664
Aluminium	12,114	+574	+1,597	+1,072	+1,597	+1,996
Copper	250	+52	+102	+48	+102	+128
Glass	12	+4	+116	+116	+116	+145
Plastics recycling	859	+0	+751	+660	+751	+939
EEE (inverter only)	35	+3.8	+7	+9	+7	+8
CO₂ savings recycling (ktons CO ₂ eq., excl. steel and aluminium)	19,361	+1,155	+3,104	+2,444	+3,104	+3,879
Recycling rate (improved definition)	70.6%	76.1%	78.8%	77.8%	78.8%	78.8%
Recovery rate (improved definition)	80.4%	81.9%	87.2%	86.7%	87.2%	87.2%
Recycling rate (current definition)	89.6%	90.5%	93.2%	92.2%	93.2%	93.2%
Recovery rate (current definition)	95.1%	92.0%	97.3%	96.8%	97.3%	97.3%
Improving reuse (ktons)	731	508	606	606	606	758
Improving recycling quality (ktons)	144	340	1,068	1,183	1,068	1,335
Recycling of lesser quality (ktons)	5,330	-768	-1,365	-1,477	-1,365	-1,706
Total amounts reused or recycled	6,205	80	309	312	309	386

Table 8.7 Summary environmental impacts for the recycling and reuse policy options 3 in 2035

Environmental impacts (2035, compared to baseline)	Baseline	PO3A	PO3B	PO3C	Preferred (individually)	Preferred (combined)

ELVs treated EU (units, legal & illegal)		9,620,640				+2,106,924
Recycling stage (values in kton)		(values in addition to baseline)				
Steel (reused)	611	+489	+489	+489	+489	+601
Steel (recycled, pre-shredder)	108	+323	+699	+968	+699	+860
Steel (recycled post shredder)	4,687	-746	-1,118	-1,385	-1,118	-1,375
Aluminium (reused)	124	+62	+99	+99	+99	+122
Aluminium (recycled pre-shredder)	9	+37	+266	+105	+266	+327
Aluminium (recycled post-shredder)	889	-81	-306	-169	-306	-376
Copper (reused)	2	+10	+12	+12	+12	+15
Copper (recycled pre-shredder)	9	+17	+67	+42	+67	+82
Copper (recycled post-shredder)	99	-21	-65	-40	-65	-80
Glass (recycled pre-shredder, high quality)	22	+4	+131	+131	+131	+161
Glass (recycled post-shredder, low quality)	120	-5	-131	-131	-131	-161
Plastics (reused)	71	+0	+71	+71	+71	+87
Plastics (recycled pre-shredder, high quality)	13	+0	+54	+67	+54	+66
Plastics (recycled post-shredder)	106	+0	+76	+93	+76	+93
EEE (inverter only, recycled pre-shredder)	0	+0.8	+4.0	+7.2	+4.0	+0.0
CRMs (permanent magnet materials)	0	+0.4	+0.4	+0.4	+0.4	+0.4
Recycling stage (CO2 savings in kton)		(values in addition to baseline)				
Steel	6,662	+597	+641	+672	+641	+788
Aluminium	14,270	+693	+1,994	+1,309	+1,994	+2,453
Copper	318	+69	+143	+76	+143	+176
Glass	13	+4	+126	+126	+126	+155
Plastics recycling	929	+0	+758	+661	+758	+932
EEE (inverter only)	139	+15	+26	+36	+26	+31
CO2 savings recycling (ktons CO ₂ eq., excl. steel and aluminium)	22,331	+1,378	+3,688	+2,880	+3,688	+4,536
Recycling rate (improved definition)	70.6%	73.1%	75.9%	74.9%	75.9%	75.9%
Recovery rate (improved definition)	80.0%	79.0%	84.3%	83.8%	84.3%	84.3%
Recycling rate (current definition)	89.6%	90.5%	93.2%	92.2%	93.2%	93.2%
Recovery rate (current definition)	95.1%	92.0%	97.3%	96.8%	97.3%	97.3%
Improving reuse (ktons)	808	+561	+671	+671	+671	+825
Improving recycling quality (ktons)	161	+381	+1,217	+1,313	+1,217	+1,497
Recycling of lesser quality (ktons)	5,901	-853	-1,544	-1,632	-1,544	-1,899
Total amounts reused or recycled	6,870	+89	+344	+352	+344	+423

Table 8.8 Summary environmental impacts for the recycling and reuse policy options 3 in 2040

Environmental impacts (2040, compared to baseline)	Baseline	PO3A	PO3B	PO3C	Preferred (individually)	Preferred (combined)
ELVs treated EU (units, legal & illegal)	10,324,577				+2,313,146	
Recycling stage (values in kton)	(values in addition to baseline)					
Steel (reused)	703	+562	+562	+562	+562	+658
Steel (recycled, pre-shredder)	124	+371	+804	+1,113	+804	+941

Steel (recycled post shredder)	5,388	-857	-1,286	-1,592	-1,286	-1,505
Aluminium (reused)	167	+83	+134	+134	+134	+157
Aluminium (recycled pre-shredder)	15	+60	+437	+173	+437	+511
Aluminium (recycled post-shredder)	1,194	-118	-479	-255	-479	-560
Copper (reused)	3	+17	+20	+20	+20	+23
Copper (recycled pre-shredder)	15	+28	+113	+71	+113	+132
Copper (recycled post-shredder)	167	-35	-109	-80	-109	-128
Glass (recycled pre-shredder, high quality)	25	+5	+153	+153	+153	+179
Glass (recycled post-shredder, low quality)	139	-5	-152	-152	-152	-178
Plastics (reused)	82	+0	+82	+82	+82	+96
Plastics (recycled pre-shredder, high quality)	16	+0	+62	+78	+62	+73
Plastics (recycled post-shredder)	122	+0	+88	+107	+88	+103
EEE (inverter only) - recycled pre-shredder	0	+2	+12	+22	+12	+14
CRMs (permanent magnet materials)	0	+1.5	+1.5	+1.5	+1.5	+1.5
Recycling stage (CO2 savings in kton)		(values in addition to baseline)				
Steel	7,656	+655	+668	+677	+668	+782
Aluminium	19,220	+983	+3,022	+1,900	+3,022	+3,536
Copper	532	+110	+218	+151	+218	+255
Glass	15	+5	+147	+147	+147	+172
Plastics recycling	1,075	+0	+775	+662	+775	+907
EEE (inverter only)	420	+46	+78	+110	+78	+91
CO2 savings recycling (ktons CO2eq., excl. steel and aluminium)	28,918	+1,799	+4,908	+3,647	+4,908	+5,742
Recycling rate (improved definition)	70.6%	76.5%	79.4%	77.8%	79.4%	79.4%
Recovery rate (improved definition)	80.4%	82.5%	88.4%	87.4%	88.4%	88.4%
Recycling rate (current definition)	89.6%	90.5%	93.4%	91.8%	93.4%	93.4%
Recovery rate (current definition)	95.1%	91.5%	97.4%	96.3%	97.4%	97.4%
Improving reuse (ktons)	955	662	798	798	798	934
Improving recycling quality (ktons)	195	464	1,569	1,588	1,569	1,836
Recycling of lesser quality (ktons)	7,010	-1,015	-1,938	-1,972	-1,938	-2,267
Total amounts reused or recycled	8,160	111	429	414	429	502

7.3.9 8.1.4 Improve collection quality and quantity

PO4: For the measures on collection, the confidence is high. The individual categories of vehicles collected (or not) and reported (or not) and the role of informal/ illegal sector activities is tracked by carefully determined split factor changes representing the effect of the individual measures considered.

The shift from illegal (or unreported) treatment within Europe to ATFs has the following main environmental effect: Illegal treatment might not treat all refrigerants from the air conditioning system and all waste oil. If the ELVs are shifted to ATFs less losses of refrigerants from the air conditioning system can occur. Today, standard dismantling and shredding is in most countries completely self-managed by the recycling sector, without contribution / funding of the EPR systems. It is expected that the illegal ELV treatment is sending the same amounts of steel, aluminium and catalytic converter to recycling and applies

the same effort for separation of spare parts. In consequence no change for the case that more ELVs are shifted from illegal (or unreported) treatment within Europe to ATFs.

Additional information on the export of used vehicles

The impact assessment study¹⁷³ considers for the baseline in 2019 and for the scenarios in 2025 – 2040 (legal and illegal) exports in the order of 25% of vehicles leaving the fleet. For the preferred consolidated option (including EPR from PO5B), the share of exports in fleet exit is significantly lower in 2035 with 8.7% of the fleet exit. The table below displays the impacts for the export in total figures, considering the general increase of the fleet and fleet exits. Impacts for 2025 are not included as many of the collection measures will take effect after 2025. For 2025 one can actually expect for preferred Policy Option (+EPR), before the export limitations are fully enforced), one-off “last minutes” exports. It is estimated this could increase the exports to 33% of the vehicles leaving the fleet. Therefore, there is a likelihood that the export of these vehicles may increase for a short term, before the situation stabilises as a result of full enforcement of the requirements.

The illegal exports are much reduced by the combination of the different measures but possibly cannot avoided by 100%. Some of the illegal might be even shifted, by better administrative compliance of the exporters, to the legal sector. The legal export is reduced too, due to the limitation of exports to those vehicles which have are roadworthy. As demonstrated by a Dutch study¹⁷⁴, currently only a minority (possibly 30%) of the vehicles officially exported via the Dutch harbour have a valid roadworthiness certificate (see the figure below). And even much less vehicles would comply with the import requirements e.g. of the ECOWAS Region: *ECOWAS¹⁷⁵ adopted on 5 Sept 2020 a Directive¹⁷⁶, limiting the import of used vehicles to those with a minimum Euro 4/IV emission standard. The age limit for importing vehicles into the ECOWAS region is 5 years for light duty vehicles, two-wheel motor vehicles, tricycles and quadricycles and 10 years for heavy-duty vehicles. A period of 10 years is granted to countries that have not yet adopted these age limits to gradually comply.*

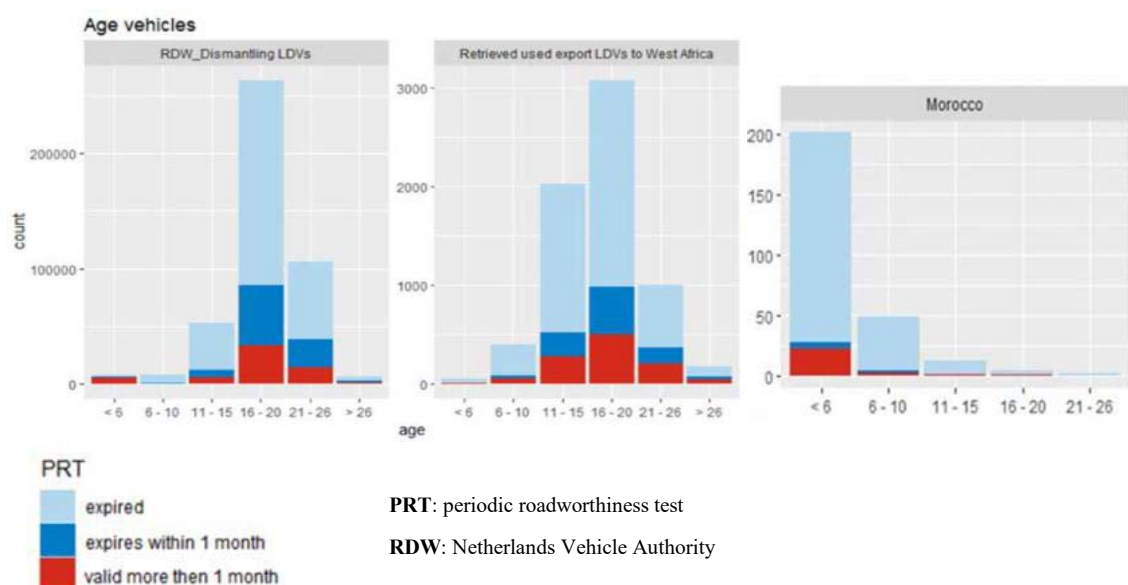
¹⁷³ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

¹⁷⁴ Netherlands Human Environment and Transport Inspectorate, Ministry of Infrastructure and Water Management (2020): Used vehicles exported to Africa: A study on the quality of used export vehicles

¹⁷⁵ Members of ECOWAS: BENIN, BURKINA FASO, CABO VERDE, CÔTE D'IVOIRE, The GAMBIA, GHANA, GUINEA, GUINEA BISSAU, LIBERIA, MALI, NIGER, NIGERIA, SENEGAL, SIERRA LEONE, TOGO

¹⁷⁶ Directive C/Dir.2/09/20 relating to the harmonization of the limits of gas and exhaust particle emission for light and heavy vehicles, two wheel vehicles, tricycles and quadricycles within the ECOWAS region.

Figure 8.2 Age and roadworthiness upon export of vehicles extra-EU



As mentioned by UNEP and UNECE during the stakeholder interviews: It is difficult to the receiving countries to enforce the import limitations as it is (most) likely that each imported vehicle will find its market in the receiving countries. Thus, cooperation and support by the exporting countries is required to support import limits. According to UNEP report¹⁷⁷, Africa and Eastern Europe, the Caucasus, Central Asia, and Middle East are the main destination for the EU 27 Export, representing 91% of the total exported used vehicles.

As demonstrated in the tables below at least 82% of the total exported used vehicles from the EU are exported to 59 countries which have import limitations. This export represents in 2020 2.3 billion € with an average value of each exported used vehicle of 3 279 €.

Table 8.9 Share of used vehicles exported in 2020 from EU-27 to differently regulated countries¹⁷⁸

	Countries mentioned as destination	Share of the total number of EU-27 export
Total export to Africa and Eastern Europe, the Caucasus, Central Asia, and Middle East	82	91%
Ban of import of used vehicles	5	0.4%
Good, very good regulated or the import of used vehicles is banned (UNEP 2020)	29	29%
Good, very good regulated or the import of used vehicles is banned (UNEP 2020) + ECOWAS Countries	43	55%
At least any regulation for the import of used vehicles by age or emission class (including ECOWAS Countries)	59	82%

Table 8.10: Value of used vehicles exported in 2020 from EU-27 to differently regulated countries¹⁷⁹

¹⁷⁷ <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

¹⁷⁸ Source: UNEP 2020; Eurostat: COMEXT (download 27.1.2022)

	Total value of the EU-27 Export (Million €)	Average value of the EU-27 Export (€ per vehicle)
Total export to Africa and Eastern Europe, the Caucasus, and Central Asia and Middle East	2 558	3 226
Ban of import of used vehicles	46	13 684
Good, very good regulated or the import of used vehicles is banned (UNEP 2020)	1 371	5 462
Good, very good regulated or the import of used vehicles is banned (UNEP 2020) + ECOWAS Countries*	1 703	3 553
At least any regulation for the import of used vehicles by age or emission class (including ECOWAS Countries*)	2 340	3 279

* Regulations not enforced yet for all ECOWAS countries for the displayed year 2020.

The shift of extra EU export of ELVs and (old) used vehicles to treatment in the EU creates more resources available for recycling if treated in the EU. The related LCA credits are granted for recycling directed to treatment plants in Europe. In addition, there is less hazardous waste in receiving countries (not assessed quantitatively). The resulting environmental impacts summary provides an increasing level of additional material recovery and corresponding CO₂ savings. **For PO4B** with improved enforcement and **harmonised national registers** significantly reduces the unknown whereabouts, adding to 1.5 million tonnes of CO₂ savings. This is increasing to 3.2 million tonnes of CO_{2eq} for **PO4C** including its more advanced **export restriction** measures.

Air pollution: quantitative assessment of external costs associated with the export of used vehicles from the EU to third countries

The export of non-roadworthy vehicles to third countries has a significant impact on air pollution and human health. This is due to the fact that many of these vehicles are older, less fuel-efficient, and emit higher levels of pollutants. All these factors can be translated into damage costs to environment which are external costs of transport referring to the costs that are not directly borne by the users of the transportation system, but are instead imposed on society as a whole. As explained in the methodology provided in the Handbook on the external costs of transport¹⁸⁰, air pollution can have significant impacts on human health, including respiratory and cardiovascular problems. It can also damage crops, forests, and ecosystems. In the EU, vehicle emissions are regulated by the Euro standards, which set limits on the amount of pollutants that can be emitted by new vehicles. However, non-roadworthy used vehicles that are exported to third countries may not meet these standards and can therefore contribute to higher levels of air pollution accompanied with damage costs. The external costs associated with air pollution must be factored in when considering the true cost of these exports, including the other types of damage, going beyond the air pollution, such as noise pollution, accidents, and congestion.

It is expected that by eliminating the non-roadworthy used vehicles from the exporting market will have a significant impact on improving the air quality in the receiving countries. The

¹⁷⁹ Source: UNEP 2020; Eurostat: COMEXT (download 27.1.2022);

¹⁸⁰ <https://cedelft.eu/publications/handbook-on-the-external-costs-of-transport-version-2019/>

scale of positive impact cannot be quantified as the damage caused by non-roadworthy used vehicles being exported from the EU to third countries would depend on a variety of factors, including the number and type of vehicles exported, the condition of the vehicles, and the air quality in the receiving countries. Nevertheless, by eliminating the export of non-roadworthy used vehicles, the EU will reduce the negative impact of these vehicles on the environment and public health in receiving countries. In return, this can also support the development of a more sustainable and efficient transport system in these countries by encouraging the use of newer, more fuel-efficient, and environmentally friendly vehicles, as demonstrated in cases of those third countries¹⁸¹ which established import restrictions of the used vehicles referring to their age and emission level. Instead, by promoting the export of roadworthy used vehicles that meet the environmental and safety standards, the EU is expected to create a level playing field for the automotive industry in receiving countries and support the transition to cleaner and more sustainable transportation.

Table 8.11 Summary environmental impacts for the collection policy options 4 in 2030

Environmental impacts (2030, compared to baseline)	Baseline	PO4A	PO4B	PO4C	Preferred PO4D	Preferred (combined) + EPR
Collection stage (values in kton)	(values in addition to baseline)					
ELVs treated EU (legal & illegal)	9,283,014	+62,064	+310,320	+806,833	+1,303,346	+1,799,859
to ATFs and CoD reported	7,347,797	+111,715	+484,100	+980,613	+2,221,894	+2,470,151
treated in the EU (non-reported)	1,935,217	-49,651	-173,780	-173,780	-918,548	-670,292
Export of used vehicles	3,129,803	-62,064	-310,320	-806,833	-1,303,346	-1,799,859
Used vehicles export reduction		2.0%	10%	26%	42%	58%
Steel/ cast iron (ktons)	6,893	+46	+230	+599	+968	+1,336
Aluminium (ktons)	987	+7	+33	+86	+139	+191
Copper/Brass (ktons)	123	+1	+4	+11	+17	+24
Average Plastic (ktons)	261	+2	+9	+23	+37	+51
Platinum (tons)	30	+0	+1	+3	+4	+6
Materials recovered (ktons)	8,264	+55	+276	+718	+1,160	+1,602
GHG savings collection (ktons CO ₂ eq.)		+323	+1,400	+3,015	+4,810	+5,886
GHG savings refrigerants (ktons CO ₂ eq.)		+6	+27	+57	+57	+278

Table 8.12 Summary environmental impacts for the collection policy options 4 in 2035

Environmental impacts (2030, compared to baseline)	Baseline	PO4A	PO4B	PO4C	Preferred PO4D	Preferred (combined) + PO5 EPR
Collection stage (values in kton)	(values in addition to baseline)					
ELVs treated EU (legal & illegal)	9,620,640	+115,624	+501,037	+1,079,156	+1,721,511	+2,106,924
to ATFs and CoD reported	7,630,563	+218,401	+796,520	+1,374,639	+2,916,291	+3,237,468
treated in the EU (non-reported)	1,990,077	-102,777	-295,483	-295,483	-1,194,780	-1,130,544
Export of used vehicles	3,226,456	-115,624	-501,037	-1,079,156	-1,721,511	-2,106,924

¹⁸¹ For more information see M21 in the Annex 7.

Used vehicles export reduction		3.6%	16%	33%	53%	65%
Steel/ cast iron (ktons)	7,084	+85	+369	+795	+1,268	+1,552
Aluminium (ktons)	1,074	+13	+56	+121	+192	+235
Copper/Brass (ktons)	142	+2	+7	+16	+25	+31
Average Plastic (ktons)	268	+3	+14	+30	+48	+59
Platinum (tons)	30	+0	+2	+3	+5	+7
Materials recovered (ktons)	8,568	+103	+446	+961	+1,533	+1,876
GHG savings collection (ktons CO ₂ eq.)	27,850	+353	+1,513	+3,222	+5,218	+6,350
GHG savings refrigerants (ktons CO ₂ eq)	969	+30	+113	+207	+408	+464

Table 8.13 Summary environmental impacts for the collection policy options 4 in 2040

Environmental impacts (2030, compared to baseline)	Baseline	PO4A	PO4B	PO4C	Preferred PO4D	Preferred (combined) + PO5 EPR
Collection stage (values in kton)	(values in addition to baseline)					
ELVs treated EU (legal & illegal)	10,324,577	+234,068	+729,742	+1,418,179	+1,968,928	+2,313,146
to ATFs and CoD reported	8,205,505	+454,368	+1,170,342	+1,721,091	+3,511,025	+3,924,087
treated in the EU (non-reported)	2,119,072	-220,300	-440,600	-302,912	-1,542,097	-1,610,941
Export of used vehicles	3,444,148	-234,068	-729,742	-1,418,179	-1,968,928	-2,313,146
Used vehicles export reduction		6.8%	21%	41%	57%	67%
Steel/ cast iron (ktons)	7,387	+167	+522	+1,015	+1,409	+1,655
Aluminium (ktons)	1,304	+30	+92	+179	+249	+292
Copper/Brass (ktons)	196	+4	+14	+27	+37	+44
Average Plastic (ktons)	287	+7	+20	+39	+55	+64
Platinum (tons)	27	+1	+2	+4	+5	+6
Materials recovered (ktons)	9,175	+208	+648	+1,260	+1,750	+2,055
GHG savings collection (ktons CO ₂ eq.)	0	+329	+1,427	+3,072	+4,867	+6,164
GHG savings refrigerants (ktons CO ₂ eq)	0	+6	+27	+57	+57	+278

7.3.10 8.1.5 Improve governance and economic conditions

PO5: The assessment of the EPR and economic incentives related measures is assessed as based on their amplifying effect on the measures under **PO3** for recycling and **PO4** on collection.

Extended Producer Responsibility Schemes are not an objective by itself compared to the reduction of “missing vehicles” or the more advanced “circularity”. Instead, EPR is developed to ensure that producers become both financially and organisationally responsible for the end-of-life management of their products. This affects the compliance level for the end-of-life management. Therefore, the economic, environmental and social impacts are not elaborated in the same methodology as for the other sectors as these impact relay more on the defined level of compliance under “circularity” and “missing vehicles” and less on the structure of the EPR.

Therefore, the effect of EPR on the collection volume is calculated in particular in above Tables 8.11 to 8.13 for 2035 and shows an additional 6% reduction, or 385,000 vehicles

exported less plus an extra 320,000 units brought to ATFs for intra-EU. The combined effect is an additional 340 ktons of materials and 1,2 million tonnes of CO₂ savings.

Table 8.14 Summary amplification of environmental impacts for collection in 2030,2035 and 2040

Environmental impacts (Amplification of EPR compared to baseline)	2030	2035	2040
At the waste stage -collection +EPR	(values in addition to baseline)		
ELVs treated in the EU (legal & illegal)	+496,513	+385,413	344,218
to ATFs and CoD reported	+248,257	+321,177	413,062
treated in the EU (non-reported)	-422,036	-359,719	-234,068
Export of used vehicles	-496,513	-385,413	-344,218
Steel/ cast iron (ktons)	+52	+43	+43
Aluminium (ktons)	+7	+6	+7
Copper/Brass (ktons)	+14	+11	+9
Average Plastic (ktons)	+2	+1	+1
Platinum (tons)	+0.4	+0.3	+0.3
Materials recovered (ktons)	+442	+343	+305
GHG savings collection (ktons CO ₂ eq.)	+1,076	+1,132	+1,297
GHG savings refrigerants (ktons CO ₂ eq.)	+56	+56	+56

7.3.11 8.1.6 Extend the vehicle category scope

PO6: The level of confidence in the assessment of quantitative impacts for the measures related to the scope extension is based on assumptions as lack of comprehensive data for vehicles remained a persistent problem in the impact assessment. However, the setting of basic measures to improve the information availability and to ensure minimum treatment performance enabling a later phased-in approach are well justified.

Table 8.15 Summary environmental impacts for the scope extension, 2030

Environmental impacts (2030, compared to baseline)	Baseline	PO6A	PO6B	PO6C	Preferred (individually)	Preferred (combined)
Scope extension (values in million units)	(values in addition to baseline)					
ELVs (motorcycles, L3e-L7e)	1,557,104					
ELVs (buses, M2,M3)	31,359					
ELVs (lorries and trailers, N2,N3,O)	264,382					
ELVs to ATFs (L3e-L7e)	0		+233,566	+326,992	+233,566	+233,566
ELVs to ATFs (M2,M3)	20,697		+1,008	+1,411	+1,008	+1,008
ELVs to ATFs (N2,N3,O)	68,739		+16,141	+22,597	+16,141	+16,141
ELVs non-reported to ATFs (L3e-L7e)	0		+0	+0	+0	+0
ELV+ used export reduction (M2,M3)	10,662		+0	+0	+0	+0
ELV+ used export reduction (N2,N3,O)	195,643		+0	+0	+0	+0
Materials recovered (ktons of materials)	(values in addition to baseline)					

Additional reuse (L3e-L7e, ktons)	288		+0	+0	+0	+0
Additional reuse (M2,M3, ktons)	89		+13	+19	+13	+13
Additional reuse (N2,N3,O, ktons)	504		+76	+106	+76	+76
Additional recycling (L3e-L7e, ktons)	183		+27	+38	+27	+27
Additional recycling (M2,M3, ktons)	109		+16	+23	+16	+16
Additional recycling (N2,N3,O, ktons)	657		+99	+138	+99	+99
Total materials recovered (ktons)	1,830		+231	+324	+231	+231
GHG savings (ktons of CO2eq.)			(values in addition to baseline)			
GHG savings (L3e-L7e, ktons CO2eq.)	2,529		+61	+85	+61	+61
GHG savings (M2,M3, ktons CO2eq.)	1,060		+65	+80	+65	+65
GHG savings (N2,N3,O, ktons CO2eq.)	1,874		+384	+537	+384	+384
Total GHG savings (ktons of CO2eq.)	5,463		+510	+702	+510	+510

Table 8.16 Summary environmental impacts for the scope extension, 2035

Environmental impacts (2035, compared to baseline)	Baseline	PO6A	PO6B	PO6C	Preferred (individually)	Preferred (combined)
Scope extension (values in million units)			(values in addition to baseline)			
ELVs (motorcycles, L3e-L7e)	1,624,242					
ELVs (buses, M2,M3)	32,972					
ELVs (lorries and trailers, N2,N3,O)	289,992					
ELVs to ATFs (L3e-L7e)	0		+487,273	+633,454	+487,273	+487,273
ELVs to ATFs (M2,M3)	21,762		+2,119	+2,754	+2,119	+2,119
ELVs to ATFs (N2,N3,O)	75,398		+35,408	+46,030	+35,408	+35,408
ELVs non-reported to ATFs (L3e-L7e)	0		+0	+0	+0	+0
ELV+ used export reduction (M2,M3)	11,211		+0	+0	+0	+0
ELV+ used export reduction (N2,N3,O)	214,594		+0	+0	+0	+0
Materials recovered (ktons of materials)			(values in addition to baseline)			
Additional reuse (L3e-L7e, ktons)	301		+0	+0	+0	+0
Additional reuse (M2,M3, ktons)	104		+31	+40	+31	+31
Additional reuse (N2,N3,O, ktons)	553		+166	+216	+166	+166
Additional recycling (L3e-L7e, ktons)	191		+57	+75	+57	+57
Additional recycling (M2,M3, ktons)	127		+38	+49	+38	+38
Additional recycling (N2,N3,O, ktons)	720		+216	+281	+216	+216
Total materials recovered (ktons)	1,995		+508	+661	+508	+508
GHG savings (ktons of CO2eq.)			(values in addition to baseline)			
GHG savings (L3e-L7e, ktons CO2eq.)	2,639		+126	+164	+126	+126
GHG savings (M2,M3, ktons CO2eq.)	1,235		+152	+178	+152	+152
GHG savings (N2,N3,O, ktons CO2eq.)	2,055		+841	+1,094	+841	+841
Total GHG savings (ktons of CO2eq.)	5,929		+1,120	+1,436	+1,120	+1,120

Table 8.17 Summary environmental impacts for the scope extension, 2040

Environmental impacts (2040, compared to baseline)	Baseline	PO6A	PO6B	PO6C	Preferred (individually)	Preferred (combined)
Scope extension (values in million units)			(values in addition to baseline)			
ELVs (motorcycles, L3e-L7e)	1,701,058					
ELVs (buses, M2,M3)	35,057					
ELVs (lorries and trailers, N2,N3,O)	310,292					
ELVs to ATFs (L3e-L7e)	0		+637,897	+663,413	+637,897	+637,897
ELVs to ATFs (M2,M3)	23,138		+2,816	+3,492	+2,816	+2,816
ELVs to ATFs (N2,N3,O)	80,676		+58,724	+58,724	+58,724	+58,724
ELVs non-reported to ATFs (L3e-L7e)	0		+0	+0	+0	+0
ELV+ used export reduction (M2,M3)	11,919		+0	+0	+0	+0
ELV+ used export reduction (N2,N3,O)	229,616		+0	+0	+0	+0
Materials recovered (ktons of materials)			(values in addition to baseline)			
Additional reuse (L3e-L7e, ktons)	315		+0	+0	+0	+0
Additional reuse (M2,M3, ktons)	104		+39	+48	+39	+39
Additional reuse (N2,N3,O, ktons)	591		+222	+275	+222	+222
Additional recycling (L3e-L7e, ktons)	200		+75	+93	+75	+75
Additional recycling (M2,M3, ktons)	127		+48	+59	+48	+48
Additional recycling (N2,N3,O, ktons)	771		+289	+358	+289	+289
Total materials recovered (ktons)	2,108		+672	+834	+672	+672
GHG savings (ktons of CO ₂ eq.)			(values in addition to baseline)			
GHG savings (L3e-L7e, ktons CO ₂ eq.)	2,763		+426	+528	+426	+426
GHG savings (M2,M3, ktons CO ₂ eq.)	1,235		+190	+216	+190	+190
GHG savings (N2,N3,O, ktons CO ₂ eq.)	2,199		+1,125	+1,396	+1,125	+1,125
Total GHG savings (ktons of CO ₂ eq.)	6,197		+1,742	+2,139	+1,742	+1,742

Currently, negative impacts on the environment are associated with some of the identified problems: Because the potential to contribute to the circular economy of a large share of vehicles is not exploited yet, because there is no incentive to design for circularity. Because of the expected increase of the total amount of vehicles, vehicles designed and treated currently may cause environmental harm. Due to the lack of information, the calculated environmental benefits of **PO6C** covering the export and EPR effects but not a full scope extension might thus be even underestimated. The available information suggests also clear environmental benefits for **PO6B** with its mandatory treatment by ATFs as well as export restrictions of HDVs and buses which are not roadworthy..

8.2 Economic impacts

7.3.12 8.2.1 Design Circular: Improve reusability, recyclability and recoverability at design

The estimated operational costs for modernising the 3R type-approval framework of **PO1A**, excluding administrative costs, are rather limited and assessed qualitatively. The revisions to

the 3R-type-approval calculation will make the process somewhat more complex for OEMs and type-approval authorities. Possible sanctions for non-compliance are not included in these estimates. The expected increase in the rate of reuse of certain components means suppliers of new replacement parts see a loss of business, while ATFs and remanufacturers will see an increase. Vehicle owners shall benefit from increased supply of spare parts from improved digital marketplaces and less digital keys hampering repair. With a large number of different parts and values, these revenues are not quantified.

The costs of improving recyclability of difficult-to-recycle materials and R&D related to the circularity strategies in **PO1B** are not assessed in detail, but the envisaged cooperation between recyclers and manufacturers is an important improvement, frequently mentioned by a range of stakeholders.

The introduction of a digital Circularity Vehicle Passport¹⁸² as a single entry for treatment operators **under PO1C** is consistent with the corresponding provisions in the proposal for Battery Regulation, the ESPR proposal and the proposal for the Euro 7 standard (Environmental Vehicle Passport), where the digital implementation of a Circularity Vehicle Passport acts as a data carrier for environmentally relevant information pertaining to the vehicle. As dismantling and recycling information is already being shared between vehicle manufacturers and recyclers via industry-supported databases (like IDIS (dismantling) and GADLS, IMDS (chemical content)). The Circularity Vehicle Passport would act as a ‘data carrier’ that would make access to such information easier. The Circularity Vehicle Passport could fulfil that role by providing a permanent link¹⁸³ to the relevant documents hosted outside of the vehicle (e.g., in a dedicated website). This would make it unnecessary to reserve costly data storage space in the vehicle and enable updates to the documents as necessary. The additional costs per vehicle associated to extending the Circularity Vehicle Passport to end-of-life information would be negligible. It overlaps with existing and new digital platforms that manufacturers are further expanding. Thus, development costs are already assumed for the baseline.

For substances of concern, the suboptions ‘restriction under REACH and other existing legislation’ and the ‘hybrid approach’ will have overall similar impacts, with a slightly higher impact in terms of administrative burden given the need for automotive operators to familiarise with REACH and its restriction procedures. The hybrid approach is assessed to be that resulting in the highest ease of implementation. Detailed administrative costs are presented in Annex 8.3.

More information can be found in Annex 9. Member States will have lower administrative burden by dealing with the technical and socio-economic assessment of the proposals under one single common assessment framework, provided by ECHA according to the methodologies developed for chemical risk management under REACH. This is consistent with the “one-substance, one assessment” approach put forward in the upcoming Chemical Strategy for Sustainability. Industry may benefit from the high standards and procedural guarantees in carrying-out chemical risk assessments as defined under REACH managed by ECHA. The preferred option 5c provides the best balance in terms of ease of implementation, administrative burden, legal coherence and efficiency given it relies on ECHA support for all

¹⁸² containing information provided by the manufacturer on the composition of vehicles and its components, relevant for repair, maintenance, dismantling, re-use, remanufacturing and recycling

¹⁸³ e.g., via a QR code displayable in the infotainment system of the vehicle)

assessment but allows for simple implementation by maintaining existing restrictions and their exemptions under the ELV legislation and clarifies that all new substance restrictions, for reasons concerning primarily of chemical risk, will be carried out under REACH, or as applicable under the new Batteries Regulation (as *lex specialis*) or for Persistent Organic Pollutants, covered under the POPs Regulation.

Table 8.18 Summary qualitative assessment of the economic impacts for policy options 1.

Economic impacts (2035, compared to baseline, excl. admin costs)	PO1A	PO1B	PO1C
Vehicles placed on market (million units)	15,025,000		
Design stage	(values in addition to baseline)		
Operational costs 3R type-approval (qualitative)	(-)	(--)	(--)
Hazardous substance declaration (qualitative)	(o)	(o)	(+)

7.3.13 8.2.2 Increase the use of recycled content - plastics

The costs for the options for plastics recycled content are provided in the Annex 4 of the JRC study¹⁸⁴. The presented economic impact assessment is based on the assumption that the produced recyclates are of high quality and comply with the technical specifications, as required by manufacturers. This would require a range of investments though. The additional costs range approximately from 15 to 49 €/vehicle in 2035 and will be relatively high in the short term as manufacturers and suppliers will adapt manufacturing lines, carry out the necessary R&D, testing and validation of the new blends and secure supplies with recyclers. For the high targets of **PO2B**¹⁸⁵ and the very high targets of **PO2C**¹⁸⁶, in 2035, the measures would cost 740 respectively 1,170 million EUR but generate a net profit for recyclers of 600 resp. 735 million EUR at the same time and thus an important incentive for secondary markets for raw materials. The quantities for 2040 are assumed to be similar to 2035, however, the investment costs are mainly transitional until 2035 to scale-up and are assumed to become negligible and are thus excluded from the costs after 2035.

Table 8.19 Summary economic impacts for the plastic recycled content targets, 2030, 2035 and 2040

Economic impacts (Compared to baseline, excl. admin costs)	PO2	PO2A	PO2B	PO2C	Preferred (individually)
Vehicles placed on market (million units)	Baseline	15,025,000			
Recycled content plastics (JRC study)	PO2	10% in 'fleet' 2035	25% of newly TA from 2030	30% of newly TA from 2030	25% of newly TA from 2030
2030					
Recycled content plastics (kton)	92	+111	+505	+608	+505
Manufacturer and supplier costs	0	-135	-360	-511	-360
Recycler investments	-2	-14	-49	-57	-49

¹⁸⁴ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

¹⁸⁵ Corresponds with scenario 4b in the JRC study.

¹⁸⁶ Corresponds with scenario 4c in the JRC study.

Plastics (processing costs)	-34	-47	-203	-244	-203
Plastics (revenues recyclers)	83	+112	+491	+590	+491
Total costs/ revenues (M EUR)	47	-84	-120	-222	-120
2035					
Recycled content plastics (kton)	123	+240	+713	+873	+713
Manufacturer and supplier costs	0	-204	-389	-735	-389
Recycler investments	-4	-20	-69	-83	-69
Plastics (processing costs)	-53	-101	-284	-349	-284
Plastics (revenues recyclers)	112	+215	+599	+735	+599
Total costs/ revenues (M EUR)	54	-109	-144	-432	-144
2040					
Recycled content plastics (kton)	123	+713	+873	+713	+240
Manufacturer and supplier costs	-204	-389	-735	-389	-204
Recycler investments	+0	+0	+0	+0	+0
Plastics (processing costs)	-101	-284	-349	-284	-101
Plastics (revenues recyclers)	+215	+599	+735	+599	+215
Total costs/ revenues (M EUR)	54	-89	-75	-348	-75

For the recycled content target for steel, the necessary shredder costs for improving ELV steel scrap sampling to ensure quality requirements are estimated at 7 million EUR for **PO2B** and 16 million EUR for **PO2C**. Further costs for improving quality of treatment, including a ban on mixed treatment and the removal obligations of components are allocated to **PO3**. On the revenues side, the revenue potential is estimated at 66 million EUR, assumed to be split equally between the steel industry and automotive manufacturers. These revenues do present an increasing purchasing cost for steel producers, which could be covered by lower ETS¹⁸⁷ costs, estimated conservatively at 132 EUR resp. 156 EUR/ton CO_{2eq} according to the low scenario of the DG MOVE handbook¹⁸⁸. For 2040 the avoided carbon costs would increase towards 132 million EUR for **PO2B** and 316 million EUR for **PO2C**.

Table 8.20 Summary economic impacts for the steel recycled content targets

Economic impacts (2035, compared to baseline, excl. admin costs)	PO2	PO2A	PO2B	PO2C	Preferred (individually)
Vehicles placed on market (million units)	Baseline	15,025,000			
Production - Recycled content steel					
2035					
Recycled content quality steel (kton)	1,515	+0	+505	+1,212	+0
Shredder and sampling costs (HQ steel, excl PO3)		+0	-4	-10	+0
Steel industry (cost HQ scrap)		0	-33	-80	0

¹⁸⁷ https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

¹⁸⁸ European Commission, Directorate-General for Mobility and Transport, Essen, H., Fiorello, D., El Beyrouthy, K., et al., Handbook on the external costs of transport: version 2019 – 1.1, Publications Office, 2020

Manufacturers (premium RC steel)		+0	-33	-80	+0
Shredders (revenues HQ scrap)		+0	+33	+80	+0
Steel industry (reduced processing costs)		+0	+33	+80	+0
2040					
Recycled content quality steel (kton)	1,515	+0	+841	+2,019	+0
Shredder and sampling costs (HQ steel, excl PO3)		+0	-7	-16	+0
Steel industry (cost HQ scrap)		0	-66	-158	0
Manufacturers (premium RC steel)		+0	-66	-158	+0
Shredders (revenues HQ scrap)		+0	+66	+158	+0
Steel industry (reduced processing costs)		+0	+66	+158	+0

7.3.14 8.2.3 Improve treatment quality and quantity

The results of the impact assessment for PO3 are displayed below. The majority of the costs are for the dismantlers and linked to the requirements on removal of parts prior to shredding in **PO3A** and **PO3B** (around 350 million EUR), partially compensated by additional revenues from removed materials. Similarly, the recycling definition improvement and ban on the landfilling of the residues from shredding operations of **PO3A** come with a cost. The cost-effectiveness of dismantling smaller components under **PO3C** is much lower compared to **PO3A** and **PO3B**. The ban on mixed treatment of ELV with other scrap types (**PO3B**) at the same time reduces shredder capacity flexibility leading to extra costs, at the same time, it improves quality of recycling and noticeably the value of ELV steel and aluminium fractions in return. Since this is difficult to quantify and very shredder and Member State specific, the net result is assumed to be cost neutral. It should be noted that the modelling approach focused on manual dismantling¹⁸⁹ **does not allow to quantitatively assess the less costly mechanical recycling** scenario, for the **PO3B** and **PO3C** in those countries that have sufficient PST capacity. The **PO3C** costs in particular are to be regarded ‘worst-case’.

There is a substantial shift in costs and revenues between stakeholders for all three policy options. The value of removed materials minus dismantling costs will not be a direct net profit to the ATFs, as shredder companies will pay less for dismantled hulks where significant material value is already removed and subsequent lower treatment costs due to for instance the prior removal of glass. In Section 8.2 and in Annex 8.3, these ‘propagations’ of reduced costs and revenues are made explicit for each stakeholder, material, component and for other years.

Table 8.21 Summary economic impacts for the recycling and reuse policy options 3 in 2030

Economic impacts (2030, compared to baseline)	PO3	PO3A	PO3B	PO3C	Preferred (individually)	Preferred (combined)
Recycling stage (values in million EUR, + = revenue, - = cost)						
ATFs	Baseline	(values in addition to baseline)				
Steel (dismantling+other costs)	18	+55	+120	+166	+120	+150
Steel (additional revenues)	-21	-7.0	-42.0	-25.0	-42.0	-52.5

¹⁸⁹ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

Aluminium (dismantling+other costs)	8	+33	+237	+94	+237	+296
Aluminium (additional revenues)	-9	0	-94	-88	-94	-118
Copper (dismantling+other costs)	44	+82	+334	+208	+334	+418
Copper (additional revenues)	-14	-1	-21	-21	-21	-26
Glass (dismantling+other costs)	0	+0	+1	+1	+1	+2
Glass (additional revenues)	-1	0.0	-4.0	-5.0	-4.0	-5.0
Plastics (dismantling+other costs)	18	+55	+120	+166	+120	+150
Plastics (additional revenues)		Cannot be quantified				
EEE (inverter only, dismantling+other costs)		-23	-30	-37	-30	-38
EEE (additional revenues)		+23	+23	+23	+23	+29
CRMs (dismantling costs)	0	-26	-26	-26	-26	-26
CRMs (additional revenues)	22	22	22	22	22	22
Total dismantling costs selected	-73	-64	-233	-201	-233	-291
Reduced revenues dismantled hulks	933	-194	-644	-443	-644	-805
Total additional revenues	96	22	72	49	72	89
Shredders/PST (excl plastics RC)						
Steel (change in revenues)	802	-128	-191	-237	-191	-239
Aluminium (change in revenues)	731	-64	-234	-132	-234	-293
Copper (change in revenues)	494	-102	-322	-198	-322	-403
Glass (change in revenue)	1.2	0.3	-0.9	-0.9	-0.9	-1.1
Plastics (additional revenues)	11	0	+8	+9	+8	+10
Total costs	0	-294	-756	-577	-756	-945
Reduced costs for dismantled hulks		177	644	443	644	805
Total additional revenues	2,039	177	644	443	644	805
Recycling/ End-processing		(+)	(+)	(++)		
Steel (change in revenues)	820	-72	-72	-71	-72	-90
Aluminium (change in revenues)	739	-31	+4	-38	+4	+5
Copper (change in revenues)	538	-20	+13	+10	+13	+16
Glass (change in revenues)	0.4	0.1	2.2	2.2	2.2	+3
Plastics (compounding costs)	-33	+0	-3	-11	-3	-4
Plastics (change in revenues)	44	+0	+48	+59	+48	+60
CRMs (additional revenues)	26	+67	+67	+67	+67	+67
Total costs	-33	-123	-75	-120	-75	-94
Total additional revenues	2,151	+19	+87	+91	+87	+103
Total costs (all stakeholders)	-106	-481	-1,064	-899	-1,064	-1,330
Total revenues (all stakeholders)	4,286	235	802	583	802	997

Table 8.22 Summary economic impacts for the recycling and reuse policy options 3 in 2035

Economic impacts (2035, compared to baseline)	PO3	PO3A	PO3B	PO3C	Preferred (individually)	Preferred (combined)
Recycling stage (values in million EUR, + = revenue, - = cost)						
ATFs	Baseline	(values in addition to baseline)				

Steel (dismantling+other costs)	-21	-7.1	-48	-31	-48	-58
Steel (additional revenues)	20	+60	+131	+181	+131	+161
Aluminium (dismantling+other costs)	-21	-7.0	-48	-31	-48	-59
Aluminium (additional revenues)	11	+43	+309	+122	+309	+380
Copper (dismantling+other costs)	-9	0	-104	-98	-104	-128
Copper (additional revenues)	56	+104	+424	+264	+424	+522
Glass (dismantling+other costs)	-15	-1	-23	-23	-23	-28
Glass (additional revenues)	+0	+0	+1	+1	+1	+2
Plastics (dismantling+other costs)	-1	0.0	-4.3	-5.4	-4.3	-5.3
Plastics (additional revenues)		Cannot be quantified				
EEE (inventor only, dismantling+other costs)		-93	-120	-147	-120	-148
EEE (additional revenues)		+38	+38	+38	+38	+47
CRMs (dismantling costs)	0	-65	-65	-65	-65	-65
CRMs (additional revenues)	61	+98	+98	+98	+98	+98
Total dismantling costs selected	-67	-173	-412	-401	-412	-491
Reduced revenues dismantled hulks	840	-309	-902	-634	-902	-1,089
Total additional revenues	113	+34	+100	+70	+100	+121
Shredders/PST (excl plastics rec.)		(values in addition to baseline)				
Steel (change in revenues)	877	-140	-209	-259	-209	-257
Aluminium (change in revenues)	860	-78	-296	-164	-296	-364
Copper (change in revenues)	625	-129	-408	-252	-408	-502
Glass (change in revenue)	1	0	-1	-1	-1	-1
Plastics (additional revenues)	12	+0	-84	-10	-84	-103
Total costs	0	-347	-998	-686	-998	-1,228
Reduced costs for dismantled hulks	-840	309	902	634	902	1,089
Total additional revenues	2,375	309	902	634	902	1,089
Recycling/ End-processing		(values in addition to baseline)				
Steel (change in revenues)	897	-79	-79	-79	-79	-79
Aluminium (change in revenues)	870	-36	+13	-41	+13	+16
Copper (change in revenues)	681	-25	+16	+12	+16	+20
Glass (change in revenues)	0	+0	+2	+2	+2	+3
Plastics (compounding costs)	-36	+0	-3	-12	-3	-4
Plastics (change in revenues)	48	+0	+52	+64	+52	+64
CRMs (additional revenues)	26	68	68	68	68	68
Total costs	-36	-140	-82	-132	-82	-83
Total additional revenues	2,522	68	152	146	152	171
Total costs (all stakeholders)	-103	-660	-1,492	-1,219	-1,492	-1,802
Total revenues (all stakeholders)	5,010	412	1,153	851	1,153	1,380

Table 8.23 Summary economic impacts for the recycling and reuse policy options 3 in 2040

Economic impacts (2040, compared to baseline)	PO3	PO3A	PO3B	PO3C	Preferred (individually)	Preferred (combined)
Recycling stage (values in million EUR, + = revenue, - = cost)						
ATFs	Baseline	(values in addition to baseline)				
Steel (dismantling+other costs)	-21	-7.1	-48	-31	-48	-56
Steel (additional revenues)	20	+60	+131	+181	+131	+153
Aluminium (dismantling+other costs)	-21	-7.0	-48	-31	-48	-56
Aluminium (additional revenues)	11	+43	+309	+122	+309	+362
Copper (dismantling+other costs)	-9	0	-104	-98	-104	-122
Copper (additional revenues)	56	+104	+424	+264	+424	+496
Glass (dismantling+other costs)	-15	-0.76	23	23	23	27
Glass (additional revenues)	0	+0.04	+1.3	+1.3	+1.3	+1.5
Plastics (dismantling+other costs)	-1	0.0	-4.3	-5.4	-4.3	-5.0
Plastics (additional revenues)		Cannot be quantified				
EEE (inventor only, dismantling+other costs)	-78	-279	-362	-444	-362	-423
EEE (additional revenues)	78	+279	+279	+279	+279	+326
CRMs (dismantling costs)	0	-125	-125	-125	-125	-125
CRMs (additional revenues)	136	214	214	214	214	214
Total dismantling costs selected	-145	-294	-542	-587	-542	-634
Reduced revenues dismantled hulks	840	-630	-1,223	-956	-1,223	-1,398
Total additional revenues	113	70	136	106	136	155
Shredders/PST (excl plastics rec.)						
		(values in addition to baseline)				
Steel (change in revenues)	1,008	-160	-241	-298	-241	-282
Aluminium (change in revenues)	1,155	-114	-463	-246	-463	-542
Copper (change in revenues)	1,051	-217	-686	-503	-686	-803
Glass (change in revenue)	1.5	0.3	-1.1	-1.1	-1.1	-1.3
Plastics (additional revenues)	13	0	-97	-12	-97	-113
Total costs	0	-491	-1,488	-1,060	-1,488	-1,741
Reduced costs for dismantled hulks		630	1,223	956	1,223	1,398
Total additional revenues	3,229	631	1,223	956	1,223	1,398
Recycling/ End-processing						
		(values in addition to baseline)				
Steel (change in revenues)	1,031	-91	-90	-90	-90	-105
Aluminium (change in revenues)	1,172	-44	+44	-45	+44	+51
Copper (change in revenues)	1,145	-42	+27	-59	+27	+32
Glass (change in revenues)	0.5	0.1	2.8	2.8	2.8	+3
Plastics (compounding costs)	-41	+0	-4	-14	-4	-5
Plastics (change in revenues)	55	+0	+60	+74	+60	+71
CRMs (additional revenues)	57	+181	+181	+181	+181	+181
Total costs	-41	-177	-94	-208	-94	-110
Total additional revenues	3,461	+181	+315	+258	+315	+338
Total costs (all stakeholders)	-186	-962	-2,124	-1,855	-2,124	-2,485

Total revenues (all stakeholders)	6,802	882	1,674	1,320	1,674	1,892

Above tables should be treated with caution, as the calculation does not include all revenues from components sold for reuse/remanufacturing, since they vary significantly among the components and their age. The introduced calculation is based on the materials recovered and not on the wide range of all possible individual components. Moreover, not all the benefits of higher quality of scrap from PO3C is taken into account as these prices vary significantly over time and depend on the specific qualities and alloy types for aluminium for example.

7.3.15 8.2.4 Improve collection quality and quantity

ATFs will be affected under PO4 by more ELVs directed to ATFs and also by new restrictions regards the export of (old) used vehicles. ATFs and specialised dealers selling/ exporting such (old) used vehicles would incur losses in turnover. At the same time, it is expected that ATFs as a whole would benefit from more ELVs directed to ATFs. In 2035, for **PO4A - enhanced reporting**, ATFs would net benefit for 24 million EUR more profits, increasing to 82 million EUR for **PO4B** – interoperable registers and 125 million EUR when **PO4C - export measures** would be implemented. For **PO4D**, the combination of the before mentioned policy options, the additional profits for ATFs is estimated to 308 million EUR. Shredders will also have additional turnovers and profits if more ELVs are treated in Europe. Shredder plants and recycling industry will experience an increase in turnover, however as the profit per tonne depolluted and dismantled vehicle is limited, the total effects are close to marginal at EU level.

Used car dealer with a focus on extra EU export (and not involved in the ELV management) will experience losses of profits due to the limitations of the exports of between 27 to 414 million Euro per year in 2035 for the **PO4A** to **PO4D**. Most of this loss in revenues will lead to lower compensation for vehicle owners when selling/ turning in their old vehicles.

Table 8.24 Summary economic impacts for the collection policy options 4 in 2030, 2035 and 2040

Economic impacts (2035, compared to baseline)	Baseline	PO4A	PO4B	PO4C	PO4D Preferred (individually)	Preferred (combined)
Collection stage (values in million EUR, + = revenue, - = cost)						
2030	Baseline					
Consumers	0	+0	+0	-134	-134	-134
Car dealers (export requirements)	939	-15	-77	-213	-312	-461
ATF profits	1,783	+12	+49	+87	+236	+236
Shredder profits	130	+1	+4	+11	+18	+25
Total costs	0	-19	-93	-376	-525	-674
Total additional revenues	2,851	+17	+70	+127	+332	+339
Total	2,851	-2	-23	-249	-193	-335
2035	Baseline					
Consumers	0	+0	+0	-134	-142	-151
Car dealers (export requirements)	968	-27	-123	-282	-414	-523
ATF profits	1,849	+24	+82	+125	+308	+328
Shredder profits	135	+2	+7	+15	+24	+29
Total costs		-27	-123	-416	-556	-673

Total additional revenues	2,952	+26	+89	+140	+332	+357
Total	2,952	-1	-34	-276	-223	-316
2040	Baseline					
Consumers	0	+0	+0	-134	-134	-134
Car dealers (export requirements)	1,033	-53	-179	-375	-464	-556
ATF profits	1,986	+51	+121	+152	+379	+415
Shredder profits	145	+3	+10	+20	+28	+32
Total costs	0	-70	-219	-559	-725	-828
Total additional revenues	3,163	+77	+171	+222	+533	+586
Total	3,163	+1	-48	-337	-192	-242

7.3.16 8.2.5 Improve governance and economic conditions

PO5: The assessment of the EPR and economic incentives related measures is assessed as based on their amplifying effect on the measures under **PO1**, **PO3** and **PO4**.

The economic and governance elements of **PO5A – ELV specific EPR** will particularly support more advanced designs for recycling of **PO1** in the long term and reduce costs for obligatory dismantling. The positive impacts are difficult to quantify due to the long time before a new vehicle turns into an ELV.

In the mid- to long-term, the data provided by manufacturers to ATFs could become more fit-for-purpose through its harmonisation and tests. This will reduce costs for obligatory dismantling and in turn lead to a decline in dismantling costs under **PO3**, in particular when harmonised EPR fee modulation under **PO5B – Harmonised EPR** requirements would be implemented.

Depending on the level of EPR requirements ensuring high-quality recycling, but which are not economical for dismantlers and shredders, EPR schemes and producers (and subsequently consumers) will be exposed to higher cost compliance compensation levels to materialise the environmental benefits of **PO3** improving treatment. The reduced export of old vehicles under **PO4** will increase the demand for compliance cost to be compensated by producers. The 385,000 vehicles exported less are leading to an addition 200 million EUR in revenues for ATFs and 14 million EUR for shredders. Vice-versa, the value of vehicles exported less for car dealers is expected to be reduced with 95 million EUR.

The implementation of measures envisaged in this revision, aimed at improving high quality recycling and a higher recovery of CRMs, is likely to increase the operating and investment costs of dismantlers and shredding operators. When these costs offset the revenues for these operators, EPR schemes would require that vehicle manufacturers compensate them via appropriate financial support. These calculations would have to be done at regular intervals to adjust the contributions required by the manufacturers, as is already common practice in sectors already covered by EPR schemes. The costs are estimated at EU level. Setting a fixed amount of EPR fees or a threshold for such fees at EU level is not feasible for the scope of this impact assessment, as the costs of these operations:

- Differ between Member States, notably those which have already advanced EPR schemes (like the Netherlands, where producers paid a fee of 22.5€/vehicle in 2023 and 30€ in

- 2022 to the competent PRO) and those for which have not set up any particular EPR mechanism, and
- Depend on market conditions (notably the prices of secondary materials, the availability post-shredder technology and labour costs) which change over time.

Based on the study accompanying the impact assessment, projections have been made in this impact assessment that the additional costs for manufacturers generated by the “EPR-related” measure. The costs would depend on the evolution of prices of components and spare parts removed by ATFs for re-use or recycling, the evolution of prices of recyclates (notably compared to virgin products), the value of the remaining hulk of ELVs sent by ATFs to shredders, as well as economies of scale realised by ATFs, shredders and recyclers. Based on these projections, the assessment is that the costs linked to EPR for manufacturers would be in a range of 5 to 41€/vehicle (see table below). These costs are additional to the baseline scenario. They are of course accounted for when all costs for operators are calculated with regard to all measures contained in the preferred option.

Table 8.25 Sensitivity analysis compliance cost offsetting levels for policy option 5 in 2035 for the EU

Scenarios compliance cost offsetting for treatment operators	
Highest EPR fee scenario, extra collection value 0% for ATFs, revenues of plastics and steel RC not to treatment operators	-€ 33.36
High EPR fee scenario, extra collection value 0% to ATFs, default allocation of treatment costs	-€ 21.37
Default scenario	-€13.74
Low EPR fee scenario, extra collection value 100% for ATFs, default treatment costs	-€12.23
Lowest case EPR fee scenario, collection value 100% for ATFs, all removal revenues to treatment operators	-€2.71

7.3.17 8.2.6 Extend the vehicle category scope

Lack of comprehensive data for vehicles remained a persistent problem in the impact assessment. As a result, the economic impacts of the measures can only be qualified as illustrated below for **PO6A – Information requirements** and **PO6B – Mandatory treatment**. For **PO6C – Full scope extension**, a qualitative assessment is incomplete, but expected to be significantly more costly compared to PO6B. For **PO6A – Information requirements** it is assumed that the required provision of dismantling information will not change the current market structure of ATFs and recyclers; it might result in a minor reduction of dismantling times due to better information, however, this is not calculated separately.

Table 8.26 Summary economic impacts for the scope extension PO 6 in 2030

Economic impacts (2030, compared to baseline)	Baseline	PO6A	PO6B	PO6C	Preferred (individually)	Preferred (combined)
Scope extension (million units)					(qualitative assessment only)	
ELVs (motorcycles, L3e-L7e)	1,557,104					
ELVs (buses, M2,M3)	31,359					

ELVs (lorries and trailers, N2,N3,O)	264,382					
ELVs non-reported to ATFs (L3e-L7e)	0		15%	15%	15%	15%
ELV+ used export reduction (M2,M3)	10,662	not assessed	9%	9%	9%	9%
ELV+ used export reduction (N2,N3,O)	195,643		8%	8%	8%	8%
Lost revenues exporters (M EUR)			(values in addition to baseline)			
Costs (lost revenue L3e-L7e; M EUR)						
Costs (lost revenue M2,M3; M EUR)			-2.5	-4.4	-2.5	-3
Costs (lost revenue N2,N3,O; M EUR)			-48	-84	-48.3	-48
Total costs			-51	-88	-51	-51
ATFs (M EUR)			(values in addition to baseline)			
Costs (L3e-L7e; M EUR)			-8	-11	-8	-8
Costs (M2,M3; M EUR)			-1	-2	-1	-1
Costs (N2,N3,O; M EUR)			-9	-13	-9	-9
Revenues (L3e-L7e; M EUR)		not assessed	+0	+0	+0	+0
Revenues (M2,M3; M EUR)			+2	+3	+2	+2
Revenues (N2,N3,O; M EUR)			+17	+24	+17	+17
Costs ATFs			-18	-27	-18	-18
Revenues ATFs			+19	+27	+19	+19
Recyclers (M EUR)			(values in addition to baseline)			
Costs (L3e-L7e; M EUR)						
Costs (M2,M3; M EUR)						
Costs (N2,N3,O; M EUR)						
Revenues (L3e-L7e; M EUR)		not assessed				
Revenues (M2,M3; M EUR)			+2	+3	+2	+2
Revenues (N2,N3,O; M EUR)			+15	+22	+15	+15
Revenues recyclers			+18	+25	+18	+18
Total costs (scope extension, M EUR)			-69	-115	-69	-69
Total revenues (scope extension, M EUR)			+37	+51	+37	+37
Cost - revenues scope extension			-32	-63	-32	-32
Monetised GHG savings (M EUR)			(values in addition to baseline)			
Monetised GHG savings (L3e-L7e)	467	not assessed	+11	+11	+11	+11
Monetised GHG savings (M2,M3)	196		+12	+12	+12	+12
Monetised GHG savings (N2,N3,O)	346		+71	+71	+71	+71
Monetised GHG savings (M EUR)	+1,008		+94	+94	+94	+94

Table 8.27 Summary economic impacts for the scope extension PO 6 in 2035

Economic impacts (2035, compared to baseline)	Baseline	PO6A	PO6B	PO6C	Preferred (individually)	Preferred (combined)
Scope extension (million units)		(qualitative assessment only)				
ELVs (motorcycles, L3e-L7e)	1,624,242					
ELVs (buses, M2,M3)	32,972					
ELVs (lorries and trailers, N2,N3,O)	289,992					

ELVs non-reported to ATFs (L3e-L7e)	0		30%	39%	30%	30%
ELV+ used export reduction (M2,M3)	11,211	not assessed	19%	25%	19%	19%
ELV+ used export reduction (N2,N3,O)	214,594		17%	21%	17%	17%
Lost revenues exporters (M EUR)			(values in addition to baseline)			
Costs (lost revenue L3e-L7e; M EUR)						
Costs (lost revenue M2,M3; M EUR)			-2.5	-4.4	-2.5	-3
Costs (lost revenue N2,N3,O; M EUR)			-48	-84	-48.3	-48
Total costs			-51	-88	-51	-51
ATFs (M EUR)			(values in addition to baseline)			
Costs (L3e-L7e; M EUR)			-17	-22	-17	-17
Costs (M2,M3; M EUR)			-2	-4	-2	-2
Costs (N2,N3,O; M EUR)			-20	-27	-20	-20
Revenues (L3e-L7e; M EUR)		not assessed	+0	+0	+0	+0
Revenues (M2,M3; M EUR)			+5	+6	+5	+5
Revenues (N2,N3,O; M EUR)			+38	+49	+38	+38
Costs ATFs			-39	-53	-39	-39
Revenues ATFs			+42	+55	+42	+42
Recyclers (M EUR)			(values in addition to baseline)			
Costs (L3e-L7e; M EUR)						
Costs (M2,M3; M EUR)						
Costs (N2,N3,O; M EUR)						
Revenues (L3e-L7e; M EUR)		not assessed	+5	+7	+5	+5
Revenues (M2,M3; M EUR)			+34	+44	+34	+34
Revenues (N2,N3,O; M EUR)			+39	+50	+39	+39
Revenues recyclers			+39	+50	+39	+39
Total costs (scope extension, M EUR)			-90	-141	-90	-90
Total revenues (scope extension, M EUR)			+81	+105	+81	+81
Cost - revenues scope extension			-9	-36	-9	-9
Monetised GHG savings (M EUR)			(values in addition to baseline)			
Monetised GHG savings (L3e-L7e)	598	not assessed	+17	+37	+29	+29
Monetised GHG savings (M2,M3)	280		+35	+40	+35	+35
Monetised GHG savings (N2,N3,O)	466		+191	+248	+191	+191
Monetised GHG savings (M EUR)	+1,344		+242	+326	+254	+254

Table 8.28 Summary economic impacts for the scope extension PO 6 in 2040

Economic impacts (2040, compared to baseline)	Baseline	PO6A	PO6B	PO6C	Preferred (individually)	Preferred (combined)
Scope extension (million units)	(qualitative assessment only)					
ELVs (motorcycles, L3e-L7e)	1,701,058					
ELVs (buses, M2,M3)	35,057					
ELVs (lorries and trailers, N2,N3,O)	310,292					
ELVs non-reported to ATFs (L3e-	0	not	38%	39%	38%	38%

L7e)		assessed				
ELV+ used export reduction (M2,M3)	11,211		24%	24%	24%	24%
ELV+ used export reduction (N2,N3,O)	214,594		26%	26%	26%	26%
Lost revenues exporters (M EUR)			(values in addition to baseline)			
Costs (lost revenue L3e-L7e; M EUR)						
Costs (lost revenue M2,M3; M EUR)			-2.5	-4.4	-2.5	-3
Costs (lost revenue N2,N3,O; M EUR)			-48	-84	-48.3	-48
Total costs			-51	-88	-51	-51
ATFs (M EUR)			(values in addition to baseline)			
Costs (L3e-L7e; M EUR)			-17	-22	-17	-17
Costs (M2,M3; M EUR)			-2	-4	-2	-2
Costs (N2,N3,O; M EUR)			-20	-27	-20	-20
Revenues (L3e-L7e; M EUR)			+0	+0	+0	+0
Revenues (M2,M3; M EUR)			+5	+6	+5	+5
Revenues (N2,N3,O; M EUR)			+38	+49	+38	+38
Costs ATFs			-39	-53	-39	-39
Revenues ATFs			+42	+55	+42	+42
Recyclers (M EUR)			(values in addition to baseline)			
Costs (L3e-L7e; M EUR)						
Costs (M2,M3; M EUR)						
Costs (N2,N3,O; M EUR)						
Revenues (L3e-L7e; M EUR)			+5	+7	+5	+5
Revenues (M2,M3; M EUR)			+34	+44	+34	+34
Revenues (N2,N3,O; M EUR)			+39	+50	+39	+39
Revenues recyclers			+39	+50	+39	+39
Total costs (scope extension, M EUR)			-90	-141	-90	-90
Total revenues (scope extension, M EUR)			+81	+105	+81	+81
Cost - revenues scope extension			-9	-36	-9	-9
Monetised GHG savings (M EUR)			(values in addition to baseline)			
Monetised GHG savings (L3e-L7e)	743		+115	+142	+115	+115
Monetised GHG savings (M2,M3)	332		+51	+58	+51	+51
Monetised GHG savings (N2,N3,O)	592		+303	+375	+303	+303
Monetised GHG savings (M EUR)	+1,667		+468	+575	+468	+468

In **PO6B – Mandatory treatment**, the additional numbers of HDVs and buses to be treated in ATFs due to the proposed requirement on export restriction of unroadworthy vehicles will cause lost revenues for exporters and additional dismantling costs at ATFs. However, it is expected that there will also be additional revenues for ATFs from removed materials which will compensate their costs. For the situation of shredders, no information was available to calculate their additional costs or revenues.

For the recyclers, no information was available on the costs of the measures, however, due to the additional material of the new vehicle types of the extended scope, the revenues of the recyclers will increase accordingly.

For **PO6C – Full scope extension**, the quantitative assessment is not complete with the impacts of Measure 33 omitting. Nevertheless, the export reduction impacts are presented. As a result, the entirety of the PO6C impacts are underestimated and expected to be significantly more costly compared to **PO6B** when the costs for a full regulatory scope would be determined.

8.3 Administrative burden

Data for the administrative costs are derived from the Oeko-Institut support study¹⁹⁰, the JRC study on plastics recycled content¹⁹¹ and preliminary measures for CRMs¹⁹². The data is fully aligned with the EU Standard Cost Model¹⁹³ and presented in detail in the following Tables 8.29 – 8.33. The administrative burden for the policy options 1 and 2 relate to vehicles placed-on-the-market as new ones. The costs for the policy options 3-6 are related to ELVs (with varying collection numbers). In below summary statements in Table 8.34 and further, for comparison the costs per vehicles, the latter absolute costs for collection and treatment are divided by the total number of vehicles placed on the market which is lower than the collection volumes.

¹⁹⁰ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

¹⁹¹ Based on the JRC study, see Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

¹⁹² N. Tazi, M. Orefice, C. Marmy, Y. Baron, M Ljunggren, P Wäger, F. Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821.

¹⁹³ See Tool#58 of the Better Regulation Guidance – November 2021.

Table 8.29 Detailed recurrent administrative costs, businesses (PO1-PO3) under the OIOO approach

		New administrative obligations					Price (€/per action)	Freq (per year)	Override cost per entity used	Number of entities	Override costs where P*Q not used	Equipment costs (€/per entity)	Total Administrative Costs	Business As Usual Costs	Total Administrative Burdens
Measure	PO	No.	Type of obligation (see below for typology)	Description of required action(s)	Target group	SM Es affected (Y/N)									
Businesses															
M8	PO1C	2	Submission of (recurring) reports	Producing new data	Manufacturers	N	0	1	175,000	10	1,750,000		1,750,000	0%	1,750,000
M23	PO1BC	3	Non labelling information for third parties	Other	Manufacturers	N	0	1	6,000,000	1	6,000,000		6,000,000	50%	3,000,000
M9	PO2ABC	4	Submission of (recurring) reports	Producing new data	Manufacturers	N	0	0	120,000	1	120,000		120,000	0%	120,000
M10	PO2ABC	5	Submission of (recurring) reports	Producing new data	Manufacturers	N	0	0	120,000	1	120,000		120,000	0%	120,000
M12	PO3ABC	7	Submission of (recurring) reports	Filing forms and tables	ATFs	Y	206	1	0	12,000	0		2,467,200	95%	123,360
M14a	PO3ABC	8	Submission of (recurring) reports	Filing forms and tables	ATFs	Y	411	1	0	12,000	0		4,934,400	60%	1,973,760
M14b	PO3BC	9	Submission of (recurring) reports	Submitting the information (sending it to the designated recipient)	Dismantlers	Y	77	52	0	270,000	0		1,082,484,000	100%	-
M13a	PO3ABC	10	Submission of (recurring) reports	Submitting the information (sending it to the designated recipient)	ATFs	Y	411	1	0	12,000	0		4,934,400	70%	1,480,320
M16a	PO3ABC	11	Submission of (recurring) reports	Submitting the information (sending it to the designated recipient)	Shredders/ PST operators	Y	411	1	0	140	0		57,568	0%	57,568
M16a	PO3ABC	13	Submission of (recurring) reports	Submitting the information (sending it to the designated recipient)	Shredders/ PST operators	Y	411	1	0	140	0		57,568	0%	57,568
M12	PO3ABC	14	Submission of (recurring) reports	Submitting the information (sending it to the designated recipient)	Shredders/ PST operators	Y	1,028	1	0	200	0		205,600	10%	185,040
M12,M13	PO3ABC	15	Submission of (recurring) reports	Submitting the information (sending it to the designated recipient)	ATFs	Y	0	1	2.50	6,310,435	15,776,087		15,776,087	20%	12,620,869
M12,M13	PO3ABC	16	Submission of (recurring) reports	Submitting the information (sending it to the designated recipient)	Shredders	Y	0	1	2.50	6,310,435	15,776,087		15,776,087	20%	12,620,869
M12,M13	PO3ABC	17	Submission of (recurring) reports	Submitting the information (sending it to the designated recipient)	Recyclers	Y	0	1	1.00	15,776,087	3,155,217		3,155,217	20%	2,524,174

No.	Comments
2	Once the format for the digital Circularity Vehicle Passport (digital CVP) is established, the OEMs have to fill and maintain the database with existing information to support the CVP. Total effort requires 1 person-year (equivalent to 125,000 €) per OEM plus 50,000 € in overhead costs.
3	Under the current EPR obligations OEMs must inter alia provide easy access to harmonised information. The current cost (e.g. for IDIS) are estimated by ACEA at 3 M€/yr. The effort for additional support in monitoring and reporting on compliance (currently a shared responsibility of ATFs and public authorities) and the task to provide easier accessible information in a harmonised manner (e.g. via photo of VIN number, directly digitally accessible) and more information (not obligatory dismantling only, but on valuable components for reuse, remanufacturing, recycling as well) will possibly double the effort might double. Similar tasks are provided by ARN in the NL and cost can be derived from this example too.
4	Source: JRC plastics recycling report, certification costs, Figure 42, sum for all manufacturers.
5	Assumed to be similar to plastics recycling costs, JRC study page 42, sum for all manufacturers.
7	ATFs need to spend more effort to assess the effective recycling rate “at the point of calculation” when the recycling definition is aligned with the WFD. As ATFs have a reporting obligation under the current legislation too. The effort shall not change significantly, but more documentation will need to be provide evidence.
8	ATFs shall monitor and report on reuse in more details as currently.
9	Not to be included: Considered to be part of the baseline as operational costs as the revenues that are not precisely quantified certainly will outweigh the reporting costs. Support reuse market, Repair shops. We know that in some cases repair shops already apply reused parts, anyway the obligation could lead to an increase in such activities.
10	Obligatory dismantling, ATF Reporting to MS authority on mandatory dismantled parts/components either for reuse/remanufacturing or for recycling, ATFs already today report but will have additional effort to provide data on weight and kind of dismantled components for reuse/remanufacturing and recycling. It is assumed that ATFs will dismantle more, thus higher effort.
11	We assume that the OEMs will report on post shredder treatment (PST) capacities via (collective / multiple competitive / individual) PROs.
13	Disposal ban (PST plastic), Reporting obligation on the quality of residues (POP content), We assume that the OEMs will report on post shredder treatment (PST) activities via (collective / multiple competitive / individual) PROs. The aspect is currently not reported
14	Mutual RRR targets, Waste operators/PROs to report on treated ELVs to MS authorities considering the "calculation point", The effort of waste operators will depend on how the reporting is determined. The calculation assumes involvement of all parties in the value chain (conservative). The assessment also covers any burden for reporting related to material specific targets
15	Monitoring of material flows and compliance with RRR targets. Based on indication from Belgium (Febelauto), Netherlands (ARN) and Ireland (ELVES) we conclude that the effort for this task is between less than 1 € and in maximum 5 € per new and used car first registered; here considered the share of the ATFs
16	Monitoring of material flows and compliance with RRR targets. Based on indication from Belgium (Febelauto), Netherlands (ARN) and Ireland (ELVES) we conclude that the effort for this task is between less than 1 € and in maximum 5 € per new and used car first registered; here considered the share for the shredders
17	Monitoring of material flows and compliance with 3R targets, based on indication from Belgium (Febelauto), Netherlands (ARN), Ireland (ELVES): the effort for this task is between < 1 € and maximum 5 € per new or used car first registered; reflects share of recyclers/ end-processors.

Table 8.30 Detailed recurrent administrative costs, businesses, continued and citizens (PO4-PO6) under the OIOO approach

		New administrative obligations					Price (€per action)	Freq (per year)	Override cost per entity used	Number of entities	Override costs where P*Q not used	Equipment costs (€per entity)	Total Administrative Costs	Business As Usual Costs	Total Administrative Burdens
Measure	PO	No.	Type of obligation (see below for typology)	Description of required action(s)	Target group	SM Es affected (Y/N)									
Businesses															
M17	PO4ABC	18	Submission of (recurring) reports	Submitting the information (sending it to the designated recipient)	OEMs, car producers, PRO	N	9	1	0	1,000	0		8,912	0%	8,912
M22	PO4ABC	19	Other	Other	OEMs, car producers, PRO	N	0	1	1.50	15,024,844	22,537,267		22,537,267	80%	4,507,453
M22	PO4ABC	20	Non labelling information for third parties	Filing the information	OEMs, car producers, PRO	N	0	1	0.80	15,776,087	12,620,869		12,620,869	10%	11,358,782
M22	PO4ABC	21	Non labelling information for third parties	Other	OEMs, car producers, PRO	N	0	0	1	15,024,844	15,024,844		15,024,844	0%	15,024,844
M24	PO4BC	22	Other	Other	OEMs, car producers, PRO	N	43,002	0	0		0		1,161,063	0%	1,161,063
M28	PO6ABC	23	Submission of (recurring) reports	Filling forms and tables	HDV manufacturers and their suppliers	N	206	0	0	14	0		0	100%	-
M28	PO6ABC	24	Submission of (recurring) reports	Filling forms and tables	L-cat manufacturers	N	206	3	0	16	0		9,869	0%	9,869
M31a	PO6ABC	25	Submission of (recurring) reports	Filling forms and tables	ATFs / dismantlers	Y	206	1	0	4,500	0		925,200	0%	925,200
M28	PO6ABC	26	Notification of (specific) activities or events	Retrieving relevant information from existing data	HDV manufacturers and their suppliers	N	206	1	0	14	0		2,878	0%	2,878
M28	PO6ABC	27	Notification of (specific) activities or events	Retrieving relevant information from existing data	L-cat manufacturers	N	206	1	0	16	0		3,290	0%	3,290
M30a	PO6BC	28	Certification of products or processes	Filling forms and tables	ATFs	Y	822	1	0	4,500	0		3,700,800	0%	3,700,800
M30a	PO6BC	29	Notification of (specific) activities or events	Submitting the information (sending it to the designated recipient)	Business owners	Y	2	1	0	400,000	0		856,667	33%	573,967
M30a	PO6BC	30	Notification of (specific) activities or events	Submitting the information (sending it to the designated recipient)	ATFs	Y	4	1	0	2,024,242	0		8,670,504	33%	5,809,237
Citizens															
M30a	PO6BC	31	Notification of (specific) activities or events	Submitting the information (sending it to the designated recipient)	Citizen owners	N	2	1	0	1,624,242	0		3,478,585	33%	2,330,652

No.	Comments
18	Monitoring and reporting on illegal activities in the sector: As the PRO / producer must activate notifications, forwarding the information to the responsible authorities only, the effort to establish and maintain this functionality is marginal.
19	Obligation for all MS to establish national EPR schemes: Administrative effort of OEMs to demonstrate a “zero cost network” is (as demonstrated for existing PROs) about 1 to 3 € per new vehicle placed on the market (see section 6.7.2 in Annex I in the support study). Calculation with the number of new registrations for passenger cars in 2019 (Eurostat). While not all countries require a formal implementation of EPR schemes and PRO(s), almost all MS consider the current obligation to demonstrate the take back at zero cost with a sufficient take back network as an EPR obligation and OEMs spent already today effort to demonstrate this towards the authorities.
20	Awareness raising of last holder to deliver ELVs to ATFs, In Ireland the PRO conducted comprehensive effort for awareness raising. Annual report 2021 ELVES: total expenditures 1.9 M€; 11% on advertising, marketing, PR = 0.2 M€, Considering 250,000 new and used cars registered for the first time in Ireland around 0.8 € per new and used car first registered; Calculation with new registrations for passenger cars in 2019 (Eurostat) + 5% import of used vehicles.
21	Training for staff of ATFs (and shredders) in particular for the for the handling of (traction) batteries: Considering that each of the 12,000 ATFs will sooner or later need training in handling of high-voltage batteries, such training, including missed work time, easily costs ATFs more than €5,000, which would add up to € 60 million for the entire EU. Considering that such training needs to be completed in a period of 5 years and taking into account 63 million new passenger cars registered in the previous 5-year period (2017 – 2021) this would account for around 1 € per each new vehicle in that period. Other trainings to be added.
22	EPR Fee modulation: The effort for the stakeholders (producers, dismantlers, shredders) associated with the fee adjustment is the negotiation process to adjust the modulation (including studies to prove one's own position) and the effort for the (public) clearinghouse to moderate this process. The fee modulation will not change the total fee.
24	Information to waste operators, 16 L3e-L7e manufacturers according to ACEM interview.
25	Reporting on treated ELVs to MS authority: Taking into account that 15% (per unit) of vehicles are not in scope today and assuming the identical additional share for ATFs might be required for the dismantling of PTW, lorries, buses and (semi-)trailers, this results in a number 4.500 ATFs being required for vehicles other than M1 and N1 (~ 30,000)
26	Contribution to the development of vehicle specific Annex II of ELVD
27	Contribution to the development of vehicle specific Annex II of ELVD
28	Authorisation process; for nr of ATFs, see no. 25
29	Vehicle owners to receive and store CoD documents, 0,4 Mio = sum of expected waste lorries, buses and trailers; Business owners assuming that in 1/3 of the EU MS CoD requirements exist in the national legislation
30	ATFs to print and provide CoD to vehicle owners & notify vehicle registers; for nr of ATFs, see no. 25
	Costs for citizens
31	Vehicle owners to receive and store CoD documents, 1.62 Mio = sum of expected waste L-cat; Citizen ownerships assuming in 1/3 of the EU MS CoD requirements exist in national legislation

Table 8.31 Detailed recurrent administrative costs, authorities (PO1-PO4, top), (PO5-PO6, middle) and non-preferred options (bottom)

		New administrative obligations						Price (€per action)	Freq (per year)	Override cost per entity used	Number of entities	Override costs where P*Q not used	Equipment costs (€per entity)	Total Administrative Costs	Business As Usual Costs	Total Administrati ve Burdens
Measure	PO	No.	Type of obligation (see below for typology)	Description of required action(s)	Target group	SMEs affected (Y/N)										
Businesses																
Public authorities																
M1	PO1ABC	32	Inspection on behalf of public authorities	Inspecting and checking (including assistance to inspection by public authorities)	MS Type approval authorities	N	1,028	1	0	14	0			13,878	0%	13,878
M1	PO1ABC	33	Inspection on behalf of public authorities	Inspecting and checking (including assistance to inspection by public authorities)	MS market surveillance authorities	N	617	1	0	5	0	30,000		165,331	0%	165,331
M1	PO1ABC	34	Inspection on behalf of public authorities	Inspecting and checking (including assistance to inspection by public authorities)	MS market surveillance authorities	N	206	1	0	22	0	1,000		26,041	0%	26,041
M1	PO1ABC	35	Inspection on behalf of public authorities	Inspecting and checking (including assistance to inspection by public authorities)	EEA/ National registration auth.	N	2,056	5	0	1	0	150,000		160,280	0%	160,280
M12	PO3ABC	36	Submission of (recurring) reports	Filing forms and tables	MS competent authorities waste	N	206	1	0	27	0			5,551	100%	0
M14a	PO3ABC	37	Submission of (recurring) reports	Filing forms and tables	MS competent authorities waste	N	206	1	0	27	0			5,551	60%	2,220
M14b	PO3BC	38	Submission of (recurring) reports	Filing forms and tables	MS competent authorities waste	N	308	3	0	27	0			24,980	0%	24,980
M13a	PO3ABC	39	Submission of (recurring) reports	Filing forms and tables	MS competent authorities waste	N	206	1	0	27	0			5,551	70%	1,665
M16b	PO3BC	40	Submission of (recurring) reports	Filing forms and tables	MS competent authorities waste	N	411	1	0	27	0			11,102	0%	11,102
M12	PO3ABC	43	Submission of (recurring) reports	Filing forms and tables	MS competent authorities waste	N	129	1	0	27	0			3,470	10%	3,123
M17	PO4ABC	44	Inspection on behalf of public authorities	Inspecting and checking (including assistance to inspection by public authorities)	Authorities for waste/ inspections	N	695	1	0	3,600	0			2,500,294	0%	2,500,294
M20	PO4BC	45	Other	MS registration systems interoperable with the systems of other MS	National registration authorities	N	0	7,512,422	0	1	0			1,608,910	0%	1,608,910
M22	PO4ABC	46	Notification of (specific) activities or events	Filing forms and tables	Ministry	N	1,911	1	0		0			51,603	0%	51,603
M22	PO4ABC	47	Other	Other	Ministry or specialised EPR agency	N	43,002	0	0		0			1,161,063	0%	1,161,063
M20/M25	PO4BC	48	Registration	Other	Registration authority	N	0	1	1	15,024,844	15,024,844			15,024,844	0%	15,024,844
M24	PO4BC	49	Other	Other	Ministry or specialised EPR agency	N	43,002	0	0		0			1,161,063	0%	1,161,063
M20/M25	PO4BC	50	Other	Other	EC	N	0	1	350,000	1	350,000			350,000	0%	350,000

continued, PO5-PO6, non-preferred options and costs not falling under the OIOO approach

New administrative obligations							Price (€ per action)	Freq (per year)	Override cost per entity used	Number of entities	Override costs where P*Q not used	Equipment costs (€ per entity)	Total Administrative Costs	Business As Usual Costs	Total Administrative Burdens
Measure	PO	No.	Type of obligation (see below for typology)	Description of required action(s)	Target group	SMEs affected (Y/N)									
Public authorities															
M31a	PO6ABC	53	Submission of (recurring) reports	Filing forms and tables	Member States- waste authorities	N	411	1	0	27	0		11,102	75%	2,776
M30a	PO6BC	54	Inspection on behalf of public authorities	Inspecting and checking (including assistance to inspection by public authorities)	Member States- waste authorities	N	617	0.1	0	4,500	0		277,560	0%	277,560

New administrative obligations							Price (€ per action)	Freq (per year)	Override cost per entity used	Number of entities	Override costs where P*Q not used	Equipment costs (€ per entity)	Total Administrative Costs	Business As Usual Costs	Total Administrative Burdens
Measure	PO	No.	Type of obligation (see below for typology)	Description of required action(s)	Target group	SMEs affected (Y/N)									
Businesses															
M1	PO1ABC	1	Submission of (recurring) reports	Inspecting and checking (including assistance to inspection by public authorities)	Manufacturers	N	3,084	5	0	10	0	30,000	454,200	0%	454,200
M11	PO2C	6	Submission of (recurring) reports	Inspecting and checking (including assistance to inspection by public authorities)	Manufacturers	N	0	0	90,000	1	90,000		90,000	0%	90,000
M16c	PO3C	12	Submission of (recurring) reports	Submitting the information (sending it to the designated recipient)	Steel recyclers	Y	206	12	0	200	0		493,440	75%	123,360
Public authorities															
M16c	PO3C	41	Submission of (recurring) reports	Filing forms and tables	MS competent authorities waste	N	411	1	0	27	0		11,102	0%	11,102
M16c	PO3C	42	Submission of (recurring) reports	Filing forms and tables	MS competent authorities waste	N	308	1	0	27	0		8,327	0%	8,327
M26	PO4C	51	Other	Other	EC	N	0	1	250,000	1	250,000		250,000	0%	250,000
M27	PO4C	52	Other	Other	EC	N	0	1	250,000	1	250,000		250,000	0%	250,000

No.	Comments
	Costs for authorities, not in OIOO scope
32	3R Type approval submissions: Assumed to only affect some MS
33	3R Type approval market surveillance: Represents market surveillance costs for MS performing surveillance at vehicle level
34	3R Type approval market surveillance: Represents market surveillance costs for MS performing surveillance at component level
35	3R dismantling tests: Represents dismantling costs for 5 vehicles
36	Aligning recycling definition with WFD, MS Reporting on treated ELVs to Eurostat, MS already report on M1 and N1 ELVs, the format will not change from the baseline but only what values are reported under which part, all costs occur in the baseline.
37	Monitoring reuse, MS Reporting on treated ELVs to Eurostat, MS already report on M1 and N1 ELVs, the format will change from the baseline but still MS just need to compile the data they get from ATFs and validate it.
38	Support reuse market, MS Reporting on treated ELVs to Eurostat. To implement enforcement against illegal sales of reused components, MS would need to inspect online sale platforms to ensure no illegal activities.
39	Obligatory dismantling, MS Reporting on treated ELVs to Eurostat, MSs already report and will use same format, however those not yet reporting. It is assumed that ATFs will dismantle more, thus higher effort.
40	PST - general, MS Reporting on treated ELVs to Eurostat. There is currently no reporting on PST capacities
43	Mutual RRR targets, MS Reporting on treated ELVS to Eurostat ("calculation point"), MS will have higher costs as the reporting format will need to be updated based on the calculation point principal and is expected to be slightly more specific.
44	Considering 12,000 ATFs in the EU and taking into account that not only ATFs shall be included in the inspection we consider a total of 36,000 installations / sites targeted for inspections, thereof 10% shall be physically assessed each year. We assume an average effort of 24 hours for each visit / report per site.
45	As a first indication the envisaged budget on interconnection with the EU central information system (e.g. Move-Hub) for national vehicle registration and roadworthiness authorities for the year 2022 might serve as a first proxy which is around 1.6 million € for all the different services provided to its members. The cost is charged separately for different services to the individual vehicle registration authorities. Considering these cost and the cost at national level and considering full digitalisation we take 0.5 minutes into consideration and that around 50% of the used vehicles cross borders during their life. in result the admin burden is around 0.1 Euro per new vehicle. The detailed impact would be assessed as part of the impact assessment for the "roadworthiness package" which is under preparation by the European Commission , as one aim of this package is to move to a full digitalisation of the registration documents and improve the exchange of information between Member States on their registers.
46	Obligation for all MS to establish national EPR schemes. While currently not all MS require a formal implementation of EPR schemes and PRO(s), all MS task OEMs to demonstrate the take back at zero cost with a sufficient take back network and must establish some evaluation means effort. Insofar 100% is covered with BAU.
47	MS to establish an independent competent authority (clearing house) Advanced MS and also smaller MS establish "cover authorities" for more than on EPR only. Under such roof the effort should be limited to 1/2 FTE per MS. Additional one-off cost occur during negotiation of compliance cost compensation or fee modulation.
48	Establishment of a notification system for ELV, CoD and final cancellation. Registration authorities must establish adjusted procedures. Based on indication from Belgium

No.	Comments
	Costs for authorities, not in OIOO scope
	(Febelauto), Netherlands (ARN) and Ireland (ELVES) the effort for this task is less than 1 € per new and used car first registered.
49	EPR Fee modulation. The effort for the stakeholders (producers, dismantlers, shredders) associated with the fee adjustment is the negotiation process to adjust the modulation (including studies to prove one's own position) and the effort for the (public) clearinghouse to moderate this process. The fee modulation will not change the total fee.
50	EPR schemes for intra EU trade (delegated / implementing act). So far cost for EC occur for staff and support study for (if any) delegated / implementing act (~ € 350,000) in total.
53	Reporting on treated ELVS to Eurostat, MS already report on M1 and N1 ELVs, the format can be the same for other vehicles, thus, 75% of the costs occur in the baseline
54	Authorisation of dismantling facilities, assuming 10% of the ATFs being checked per year for number of ATFs, see above.
	Costs for businesses, preferred option, not in OIOO scope
1	The cost for the OEMs are to carry out 3R dismantling tests. Estimation represents costs for the OEM when the tests are carried out by third companies. Testing costs not in OIOO scope.
	Costs for businesses, non-preferred options
6	These costs are about declaration costs for other materials, sum for all manufacturers
12	Recyclers to monitor and report on PST - copper level. Recyclers reporting on quality of smelted steel batches. Assumingly recyclers will report over time about the changing level of copper in steel smelted batches. Cost reflect the need to compile and submit the data.
	Costs for authorities, non-preferred options
41	PST - copper level and quality of steel fractions, MS Reporting quality of steel recyclates to MS. Newly introduced reporting based on recycler submitted data
42	Disposal ban (PST plastic). MS Reporting on treated ELVs to Eurostat. There is currently no reporting on the quality of PST residues
51	European EPR for the EU market/ cross border EPR implementation (support study). Cost for EC for staff and support study to prepare the feasibility study (~€ 250,000) in total.
52	Green Public Procurement. Estimated cost for EC occur for staff and study occur to prepare the feasibility study (~ 250,000) in total.

Table 8.32 Detailed one-off administrative costs for businesses (PO1-PO6)

New administrative obligations creating one-off administrative costs							Total initial cost (€)	Assumed lifetime over	Discount rate (%)	Total annualised one-off
Measure	PO	No.	Type of obligation (see below for typology)	Description of required action(s)	Target group	SMEs affected (Y/N)				
Businesses										
M8	PO1C	55	Certification of products or processes	Inspecting and checking (including assistance to inspection by public authorities)	Manufacturers	N	370,000	10	3.0	43,375.29
M8	PO1C	56	Certification of products or processes	Submitting the information (sending it to the designated recipient)	Manufacturers	N	2,000,000	10	3.0	234,461.01
M28	PO6ABC	57	Submission of (recurring) reports	Buying (IT) equipment & supplies	L-cat manufacturers	N	25,940	10	3.0	3,040.98
M28	PO6ABC	58	Application for general authorisation or exemption	Retrieving relevant information from existing data	HDV manufacturers and their suppliers	N	25,940	10	3.0	3,040.98
M28	PO6ABC	59	Application for general authorisation or exemption	Retrieving relevant information from existing data	L-cat manufacturers	N	29,646	10	3.0	3,475.41

No.	Comments
55	3 person years for developing the structure and requirements of the digital product passport / Circularity Vehicle Passport (DPP/CVP), total for all OEMS for preparation and discussion
56	Adaptation of existing industry databases to digital product passport / Circularity Vehicle Passport (DPP/CVP) requirements
57	Maintenance of online platform for information sharing, one-off development costs; assumption that no additional costs will arise for HDV manufacturers as the documents will probably be provided on their current websites
58	Provision of substances information, one-off costs; 3x 1440 mins, frequency =3, a reporting format for lorries, trailers, one for buses; 8 lorry manufacturers + 6 "others" (assumed for trailers and buses)
59	Provision of substances information, one-off costs; 3x 1440 mins, frequency = 3; a reporting format for L-cat vehicles; 16 L-cat manufacturers

Table 8.33 Detailed one-off administrative costs for authorities (PO1-PO6), not in OIOO scope

		New administrative obligations creating one-off administrative costs					Total initial cost (€)	Assumed lifetime over	Discount rate (%)	Total annualised one-off
Measure	PO	No.	Type of obligation (see below for typology)	Description of required action(s)	Target group	SMEs affected (Y/N)				
Public authorities										
M8	PO1C	60	Certification of products or processes	Other	EC/ ECHA	N	200,000.00	10	3.0	23,446
M22	PO4ABC	61	Certification of products or processes	Other	Competent authorities for waste	N	540,000	10	3.0	63,304
M17	PO4ABC	62	Certification of products or processes	Filing forms and tables	Competent authorities for waste	N	810,000	10	3.0	94,957

No.	Comments
60	European Commission: management of the discussion to establish the requirements (content) and the format for the digital product passport / Circularity Vehicle Passport (DPP/CVP). Support study: 100,000 €; plus one person year (+100,000 EUR)
61	Obligation for all MS to establish national EPR schemes, changes for national legislation
62	MS to report on implementation and enforcement regards EPR: Two reports in year + 3 and +5 required. Limited one-off effort demonstrating implementation. No explicit data collection but focussing on legal implementation.

Administrative burden per policy option is included in Section 7.1 in the comparison of options in Tables 9 to 13. An overview of the administrative burden for 2035 per economic operator are provided in Annex 3 per stakeholder affected and here in much more detail for each operator per policy option. For **PO1A**, the 3R calculation and required declaration generally follows existing procedures, with some one-off transition costs. For plastics recycled content, the certification costs are estimated to be limited to 0.35 million EUR in 2035 for **PO2C** and relatively marginal compared to processing costs. A similar value is expected for the steel recycled content target, following the same approach. The highest costs related to for **PO3B** and **PO3C** where ATFs are required to improve reporting over depollution and mandatory removal (roughly 3 EUR/vehicle). The costs related to EPR in setting up PROs PO5 are around 32 million EUR and 56 million EUR in total for PO4 and PO5 combined (6 EUR/ vehicle); the costs for competent authorities for waste and for adapting the vehicle registration systems are 22 million EUR (less than 2 EUR/vehicle). In total, including some administrative costs for the scope extension of PO6, the total administrative costs range between 7 and 11 EUR per vehicle. Below Tables 8.34 and 8.35 provide an overview of the administrative burden for all policy options for 2035.

Table 8.34 Administrative burden per economic operator in detail, in 2035

Administrative burden (2035, compared to baseline)	PO1A- PO6A	PO1B- PO6B	PO1C- PO6C	Preferred (individually)	Preferred (combined)
At the production stage (3R type-approval), in Million EUR (+ = revenue, - = cost) (PO1)					
Manufacturers M1,N1 (to service provider)	-0.454	-3.454	-5.204	-5.204	-5.204
Type approval authorities	-0.014	-0.014	-0.014	-0.014	-0.014
Market surveillance authorities	-0.191	-0.191	-0.191	-0.191	-0.191
SMEs: ATFs	-0.160	-0.160	-0.160	-0.160	-0.160
EC/ ECHA - (one off)	0.000	0.000	-0.200	-0.200	-0.200
Manufacturers M1,N1 (one-off)	0.000	0.000	-2.370	-2.370	-2.370
Subtotal (recurring)	-0.82	-3.82	-5.57	-5.57	-5.57
Subtotal (one-off)	0.00	0.00	-2.57	-2.57	-2.57
Total (annualised)	-0.82	-3.82	-5.87	-5.87	-5.87
At the production stage (steel+plastics RC), in Million EUR (+ = revenue, - = cost) (PO2)					
Manufacturers (certification costs)	-0.240	-0.240	-0.330	-0.240	-0.240
Type approval authorities	0.000	0.000	0.000	0.000	0.000
Market surveillance authorities	0.000	0.000	0.000	0.000	0.000
Subtotal (recurring)	-0.24	-0.24	-0.33	-0.24	-0.24
At the production stage (hazardous substances), in Million EUR (+ = revenue, - = cost) (PO1)					
Manufacturers (hazardous substances)	(o)	(o)	(+)	(+)	(+)
EC/ECHA/MS (hazardous substances)	(-)	(-)	(++)	(++)	(++)
Recycling, in Million EUR (+ = revenue, - = cost) (PO3)					
SME - ATFs	-16.198	-16.198	-16.198	-16.198	-16.198
SME - Shredders/PST operators	-12.921	-12.921	-12.921	-12.921	-12.921
Recyclers	-2.524	-2.524	-2.648	-2.524	-2.524
MS competent authorities waste	-0.007	-0.043	-0.063	-0.043	-0.043
Subtotal (recurring)	-31.65	-31.69	-31.83	-31.69	-31.69

Collection + EPR, in Million EUR (+ = revenue, - = cost) (PO4+PO5)					
ATFs and shredders	0.000	0.000	0.000	0.000	0.000
MS competent authorities waste	-3.713	-4.874	-4.874	-4.874	-4.874
MS national vehicle registration	0.000	-16.634	-16.634	-16.634	-16.634
Manufacturer/ PRO	-30.900	-32.061	-32.061	-32.061	-32.061
European Commission/ ECHA	0.000	-0.350	-0.850	-0.850	-0.850
MS authorities waste (one-off)	-1.35	-1.35	-1.35	-1.35	-1.35
Subtotal (recurring)	-34.61	-53.92	-54.42	-54.42	-54.42
Subtotal (one-off)	-1.35	-1.35	-1.35	-1.35	-1.35
Total (annualised)	-34.77	-54.08	-54.58	-54.58	-54.58
Scope extension, in Million EUR (+ = revenue, - = cost) (PO6)					
Manufacturers (L-cat, recurrent)	-0.013	-0.013	-0.013	-0.013	-0.013
Manufacturers (HDV, recurrent)	-0.003	-0.003	-0.029	-0.003	-0.003
ATFs	-4.626	-10.435	-10.435	-10.435	-10.435
MS waste authorities	-0.003	-0.280	-0.280	-0.280	-0.280
Professional vehicle owners	0.000	-0.574	-0.574	-0.574	-0.574
Private vehicle owners	0.000	-2.331	-2.331	-2.331	-2.331
Manufacturers (L-cat, one-off)	-0.056	-0.056	-0.056	-0.056	-0.056
Manufacturers (HDV, one-off)	-0.026	-0.026	-0.026	-0.026	-0.026
Subtotal (recurrent)	-4.64	-13.64	-13.66	-13.64	-13.64
Subtotal (one-off)	-0.08	-0.08	-0.08	-0.08	-0.08
Total (annualised)	-4.65	-13.65	-13.67	-13.65	-13.65
Total (PO1-PO6, recurrent)	-71.97	-103.30	-105.81	-105.55	-105.55
Total (PO1-PO6, one-off - annualised)	-0.17	-0.17	-0.47	-0.47	-0.47
Total (PO1-PO6, recurrent+annualised)	-72.14	-103.47	-106.28	-106.02	-106.02

Table 8.35 Administrative burden summarised per economic operator and policy option, in 2035

Administrative burden (2035, compared to baseline)	PO1A- PO6A	PO1B- PO6B	PO1C- PO6C	Preferred (individually)	Preferred (combined)	Preferred (N1,M1 only)
Summary of administrative burden per economic operator, in Million EUR (+ = revenue, - = cost)						
Consumers/ vehicle owners	+0.000	-2.905	-2.905	-2.905	-2.905	-2.331
Manufacturers/ PROs	-31.610	-35.771	-37.637	-37.521	-37.521	-37.424
ATFs	-20.985	-26.794	-26.794	-26.794	-26.794	-16.359
Shredder/PST operators	-12.921	-12.921	-12.921	-12.921	-12.921	-12.921
Recyclers	-2.524	-2.524	-2.648	-2.524	-2.524	-2.524
MS type approval authorities	-0.014	-0.014	-0.014	-0.014	-0.014	-0.014
MS market surveillance	-0.191	-0.191	-0.191	-0.191	-0.191	-0.191
MS competent authorities waste	-3.723	-5.197	-5.217	-5.197	-5.197	-4.917
MS national vehicle registration	+0.000	-16.634	-16.634	-16.634	-16.634	-16.634
European Commission/ ECHA	+0.000	-0.350	-0.850	-0.850	-0.850	-0.850
Subtotal (recurrent)	-71.97	-103.30	-105.81	-105.55	-105.55	-91.92
Summary of administrative burden per policy option, in Million EUR (+ = revenue, - = cost)						

3R type-approval (PO1)	-0.820	-3.820	-5.570	-5.570	-5.570	-5.570
Recycled content (PO2)	-0.240	-0.240	-0.330	-0.240	-0.240	-0.240
Reuse and recycling (PO3)	-31.651	-31.687	-31.829	-31.687	-31.687	-31.687
Collection and EPR (PO4+PO5)	-34.613	-53.919	-54.419	-54.419	-54.419	-54.419
Scope extension (PO6)	-4.645	-13.636	-13.662	-13.636	-13.636	+0.000
Subtotal (recurring)	-71.97	-103.30	-105.81	-105.55	-105.55	-91.92
plus one-off costs:						
EC/ ECHA - (one off)	0.000	0.000	-0.200	-0.200	-0.200	-0.200
Manufacturers M1,N1 (one-off)	0.000	0.000	-2.370	-2.370	-2.370	-2.370
MS authorities waste (one-off)	-1.350	-1.350	-1.350	-1.350	-1.350	-1.350
Manufacturers (L-cat, one-off)	-0.056	-0.056	-0.056	-0.056	-0.056	
Manufacturers (HDV, one-off)	-0.026	-0.026	-0.026	-0.026	-0.026	
Subtotal (one-off)	-1.432	-1.432	-4.002	-4.002	-4.002	-3.920
Subtotal (one-off annualised)	-0.168	-0.168	-0.469	-0.469	-0.469	-0.460
Total (PO1-PO6, recurrent+annualised)	-72.14	-103.47	-106.28	-106.02	-106.02	-92.37

8.4 Social impacts (job creation)

An overview of the social impacts is provided in Table 8.36. The highest contribution to the creation of total jobs relates to the plastics recycled content option with respectively 1,600, 3,200 and 6,500 jobs for the options PO2A-PO2C for both manufacturers and shredder/PST operators. Second in contribution are the additional jobs related to mandatory removal of components, ranging for 930 jobs for PO3A to over 6,500 jobs for PO3C due to high dismantling times of smaller components.

Table 8.36 Social impacts – job creation per economic operator and policy option, in 2035

Social impacts (2035, compared to baseline)	PO1A- PO6A	PO1B- PO6B	PO1C- PO6C	Preferred (individually)	Preferred (combined)
Social impacts, job creation (in FTE) (Values in addition to baseline)					
Manufacturers 3R type-approval (PO1)	+5	+5	+5	+5	+5
Manufacturers (Plastics RC, PO2)	+1,642	+3,264	+6,529	+6,529	+6,529
Manufacturers (PO1,2)	+1,647	+3,269	+6,534	+6,534	+6,534
SMEs: ATFs, shredders (PO2)	+598	+1,196	+1,794	+1,794	+1,794
ATFs (PO3)	+934	+6,224	+6,504	+6,224	+7,593
Steel	+86	+582	+383	+582	+716
Copper	+0	+1,196	+1,196	+1,196	+1,471
Aluminium	+86	+582	+383	+582	+716
Glass	+19	+644	+644	+644	+792
Plastics (dismantling/recycling)	+0	+1,795	+1,795	+1,795	+2,208
Plastics (recycled content)	+7	+18	+29	+18	+22
EEC - inventor	+466	+1,134	+1,801	+1,134	+1,394
Hazardous substances	+0	+3	+3	+3	+4
CRMs	+270	+270	+270	+270	+270
SMEs: ATFs, shredders, (PO4)	+328	+1,195	+2,062	+4,374	+4,856

Manufacturers/ PROs (PO5)	+512	+512	+512	+512	+630
Scope extension (PO6)	+0	+701	+829	+701	+701
Total job creation (in FTE), of which:	+4,019	+13,097	+18,235	+20,139	+22,108
Manufacturers	+2,159	+3,781	+7,046	+7,046	+7,164
SME's: ATFs and shredders	+1,860	+8,615	+10,360	+12,392	+14,243

8.5 How do the options compare?

8.5.1 8.5.1 Summary of impacts and costs/ benefits

Below tables provide an overview of the main costs and benefits, with the CO₂ savings monetised as displayed in Table 8.37 based on the DG MOVE handbook monetising these external costs. For the avoided ETS compliance costs for the recycled content targets for steel which will fully reside under ETS by 2035, the 'Low Scenario' is used as a conservative estimate of the 'revenue' potential of higher quality scrap. Note that the current ETS price is 94 EUR/ton of CO₂ (per 31.01.2023). Other environmental impacts as fossil fuel savings, reduced disease incidences and other emissions are not monetised.

Table 8.37 External costs of CO₂ emissions used for the cost-benefit analysis

	2025	2030	2035	2040
Low	84	108	132	156
Medium (default for cost/ benefit analysis)	142	185	227*	269
High	266	344	421	498
Source:	European Commission, Directorate-General for Mobility and Transport, H. Essen, D., Fiorello, K. El Beyrouty, et al., Handbook on the external costs of transport: version 2019 – 1.1, Publications Office, 2020, https://data.europa.eu/doi/10.2832/51388			

Table 8.38 Comparison of options, environmental impacts per PO, 2030

PO	Environmental impacts (2030, compared to baseline)	PO1A- PO6A	PO1B- PO6B	PO1C- PO6C	Preferred (individually)	Preferred (combined + EPR PO5)
All life-cycle stages (in kton of materials)		(values in addition to baseline)				
2	Steel recycled content	+0	+0	+0	+0	+0
2	Plastics recycled content	+111	+505	+505	+505	+505
3	Materials at higher quality (recycling)	+848	+1,674	+1,789	+1,674	+2,093
4	Materials recovered (collection + export)	+55	+276	+718	+1,160	+1,602
6	Materials arriving at EoL (scope extension)	n.a	+231	n.a	+231	+231
PO1-6	Total materials recycled at HQ (kton)	+1,014	+2,686	+3,012	+3,570	+4,431
1-6 GHG savings (kttons of CO ₂ -eq)		(values in addition to baseline)				
2	GHG savings steel recycled content	+0	+0	+0	+0	+0
2	GHG savings plastics recycled content	+48	+250	+295	+250	+250
3	GHG savings recycling	+1,155	+3,104	+2,444	+3,104	+3,879
4	GHG savings collection + export	+329	+1,427	+3,072	+4,867	+6,164
6	GHG savings scope extension	n.a	+510	n.a	+510	+510

PO1-6 Total GHG savings (kton CO2 eq)	+1,531	+5,290	+5,811	+8,730	+10,803

Table 8.39 Comparison of options, economic impacts per PO, 2030

PO	Economic impacts (2030, compared to baseline, excl. admin)	PO1A- PO6A	PO1B- PO6B	PO1C- PO6C	Preferred (individually)	Preferred (combined + EPR PO5)
All life-cycle stages (M EUR, + = revenue, - = cost)		(values in addition to baseline)				
2	Costs steel recycled content	+0	+0	+0	+0	+0
2	Costs plastics recycled content	-197	-614	-815	-614	-614
3	Costs recycling	-481	-1,064	-899	-1,064	-1,330
4	Costs collection + export	-19	-93	-376	-525	-674
6	Costs scope extension	+0	-69	-115	-69	-69
PO1-6	Total costs (M EUR)	-696	-1,840	-2,204	-2,272	-2,687
PO1-6	Total administrative burden	-72	-103	-106	-106	-106
PO1-6	Total costs + admin burden	-768	-1,943	-2,311	-2,378	-2,793
2	Revenues steel recycled content	n.a	+0	n.a	+0	+0
2	Revenues plastics recycled content	+113	+494	+593	+494	+494
3	Revenues higher quality (recycling)	+235	+802	+583	+802	+997
4	Revenues collected + export	+17	+70	+127	+332	+339
6	Revenues scope extension	n.a	+37	n.a	+37	+37
PO1-6	Total revenues (million EUR)	+365	+1,403	+1,303	+1,665	+1,867
PO1-6	Total costs - revenues (excl admin)	-332	-437	-902	-607	-819
PO1-6	Total costs - revenues (incl. admin)	-404	-541	-1,008	-713	-925
2	CO2 credits steel recycled content	+0	+0	+0	+0	+0
2	CO2 credits plastics recycled content	+9	+46	+54	+46	+46
3	CO2 credits at higher quality recycling	+213	+573	+451	+573	+716
4	CO2 credits collected + export	+61	+263	+567	+898	+1,137
6	CO2 credits scope extension	n.a	+94	n.a	+94	+94
PO1-6	Total CO2 credits (M EUR)	+283	+976	+1,072	+1,611	+1,993
PO1-6	Total costs - revenues (+CO2 credits)	-121	+435	+64	+898	+1,068

Table 8.40 Comparison of options, environmental impacts per PO, 2035

PO	Environmental impacts (2035, compared to baseline)	PO1A- PO6A	PO1B- PO6B	PO1C- PO6C	Preferred (individually)	Preferred (combined + ERP PO5)
All life-cycle stages (in kton of materials)		(values in addition to baseline)				
2	Steel recycled content	+0	+505	+1,212	+0	+0
2	Plastics recycled content	+240	+713	+873	+713	+713
3	Materials at higher quality (recycling)	+942	+1,888	+1,984	+1,888	+2,322
4	Materials recovered (collection + export)	+103	+446	+961	+1,533	+1,876
6	Materials arriving at EoL (scope extension)	n.a	+508	n.a	+508	+508

PO1-6 Total materials recycled at HQ (kton)		+1,285	+4,060	+5,030	+4,642	+5,420
1-6 GHG savings (ktons of CO2-eq)		(values in addition to baseline)				
2	GHG savings steel recycled content	+0	+585	+1,404	+0	+0
2	GHG savings plastics recycled content	+90	+314	+376	+314	+314
3	GHG savings recycling	+1,378	+3,688	+2,880	+3,688	+4,536
4	GHG savings collection + export	+353	+1,513	+3,222	+5,218	+6,350
6	GHG savings scope extension	n.a	+1,120	n.a	+1,120	+1,120
PO1-6 Total GHG savings (kton CO2 eq)		+1,821	+7,220	+7,881	+10,340	+12,320

Table 8.41 Comparison of options, economic impacts per PO, 2035

PO	Economic impacts (2035, compared to baseline, excl. admin)	PO1A- PO6A	PO1B- PO6B	PO1C- PO6C	Preferred (individually)	Preferred (combined +EPR PO5)
All life-cycle stages (M EUR, += revenue, - = cost)		(values in addition to baseline)				
2	Costs steel recycled content	+0	-71	-170	+0	+0
2	Costs plastics recycled content	-326	-745	-1,171	-745	-745
3	Costs recycling	-660	-1,492	-1,219	-1,492	-1,802
4	Costs collection + export	-27	-123	-416	-556	-673
6	Costs scope extension	n.a	-90	n.a	-90	-90
PO1-6 Total costs (M EUR, +=revenue, -=cost)		-1,012	-2,521	-2,975	-2,883	-3,311
PO1-6 Total administrative burden		-72	-103	-106	-106	-106
PO1-6 Total costs + admin burden		-1,084	-2,625	-3,082	-2,989	-3,417
2	Revenues steel recycled content	+0	+67	+160	+0	+0
2	Revenues plastics recycled content	+216	+602	+739	+602	+602
3	Revenues higher quality recycling	+412	+1,153	+851	+1,153	+1,380
4	Revenues collected + export	+26	+89	+140	+332	+357
6	Revenues scope extension	n.a	+81	n.a	+81	+81
PO1-6 Total revenues (million EUR)		+654	+1,991	+1,890	+2,168	+2,420
PO1-6 Total costs - revenues (excl admin)		-358	-530	-1,085	-715	-891
PO1-6 Total costs - revenues (incl. admin)		-430	-633	-1,191	-821	-997
2	CO2 credits steel recycled content	+0	+133	+318	+0	+0
2	CO2 credits plastics recycled content	+20	+71	+85	+71	+71
3	CO2 credits at higher quality recycling	+312	+836	+653	+836	+1,028
4	CO2 credits collected + export	+80	+343	+731	+1,183	+1,440
6	CO2 credits scope extension	n.a	+254	n.a	+254	+254
PO1-6 Total CO2 credits (M EUR)		+413	+1,637	+1,787	+2,345	+2,793
PO1-6 Total costs - revenues (+CO2 credits)		-18	+1,004	+596	+1,524	+1,796

Table 8.42 Comparison of options, environmental impacts per PO, 2040

PO	Environmental impacts (2040, compared to baseline)	PO1A- PO6A	PO1B- PO6B	PO1C- PO6C	Preferred (individually)	Preferred (combined + ERP PO5)
All life-cycle stages (in kton of materials)		(values in addition to baseline)				
2	Steel recycled content	+0	+841	+2,019	+0	+0
2	Plastics recycled content	+240	+713	+873	+713	+713
3	Materials at higher quality (recycling)	+1,126	+2,367	+2,386	+2,367	+2,769
4	Materials recovered (collection + export)	+208	+648	+1,260	+1,750	+2,055
6	Materials arriving at EoL (scope extension)	n.a	+672	n.a	+672	+672
PO1-6 Total materials recycled at HQ (kton)		+1,574	+5,241	+6,539	+5,502	+6,209
1-6 GHG savings (ktons of CO2-eq)		(values in addition to baseline)				
2	GHG savings steel recycled content	+0	+891	+2,138	+0	+0
2	GHG savings plastics recycled content	+90	+314	+376	+314	+314
3	GHG savings recycling	+1,799	+4,908	+3,647	+4,908	+5,742
4	GHG savings collection + export	+329	+1,427	+3,072	+4,867	+6,164
6	GHG savings scope extension	n.a	+1,742	n.a	+1,742	+1,742
PO1-6 Total GHG savings (kton CO2 eq)		+2,218	+9,281	+9,233	+11,831	+13,962

Table 8.43 Comparison of options, economic impacts per PO, 2040

PO	Economic impacts (2040, compared to baseline, excl. admin)	PO1A- PO6A	PO1B- PO6B	PO1C- PO6C	Preferred (individually)	Preferred (combined +EPR PO5)
All life-cycle stages (M EUR, += revenue, -= cost)		(values in addition to baseline)				
2	Costs steel recycled content	+0	-138	-331	+0	+0
2	Costs plastics recycled content	-306	-676	-1,087	-676	-676
3	Costs recycling	-962	-2,124	-1,855	-2,124	-2,485
4	Costs collection + export	-70	-219	-559	-725	-828
6	Costs scope extension	n.a	-90	n.a	-90	-90
PO1-6 Total costs (M EUR, +=revenue, -=cost)		-1,338	-3,248	-3,833	-3,615	-4,080
PO1-6 Total administrative burden		-72	-103	-106	-106	-106
PO1-6 Total costs + admin burden		-1,410	-3,351	-3,939	-3,721	-4,186
2	Revenues steel recycled content	+0	+131	+315	+0	+0
2	Revenues plastics recycled content	+216	+602	+739	+602	+602
3	Revenues higher quality recycling	+882	+1,674	+1,320	+1,674	+1,892
4	Revenues collected + export	+71	+171	+222	+53	+533
6	Revenues scope extension	n.a	+81	n.a	+81	+81
PO1-6 Total revenues (million EUR)		+1,169	+2,659	+2,596	+2,410	+3,107
PO1-6 Total costs - revenues (excl admin)		-169	-588	-1,236	-1,205	-973
PO1-6 Total costs - revenues (incl. admin)		-241	-692	-1,343	-1,311	-1,079
2	CO2 credits steel recycled content	+0	+240	+575	+0	+0
2	CO2 credits plastics recycled content	+24	+84	+101	+84	+84

3	CO2 credits at higher quality recycling	+484	+1,320	+981	+1,320	+1,545
4	CO2 credits collected + export	+89	+384	+826	+1,309	+1,658
6	CO2 credits scope extension	n.a	+468	n.a	+468	+468
PO1-6 Total CO2 credits (M EUR)		+597	+2,497	+2,484	+3,183	+3,756
PO1-6 Total costs - revenues (+CO2 credits)		+356	+1,805	+1,141	+1,871	+2,677

8.5.2 8.5.2 Comparison of options

Benefit - cost ratios

To compare the various costs and benefits, the benefit costs ratios (BCR) are presented in Table 8.44, based on the previous Tables 8.38 – 8.43. A BCR ratio above 1 indicates that the (monetised) benefits basically outweigh the costs. The higher the ratio, the higher the ‘return on investment’. All individual costs for each of the economic operators as well as the revenues from more collection, higher recycling quality are included as well as the monetised GHG savings as displayed in the bottom parts of above tables. Neither other environmental and health benefits as well as reduced raw material dependencies beyond its intrinsic value are included, but the recurring administrative costs are. A quantified and comparable analysis of the benefit/ cost ratios are not provided for **PO1** for the 3RTA elements as well as for **PO6A** and **PO6C** due to the qualitative nature of the assessment in these cases.

Assumptions:

In the case of steel and plastics, the policy options 2 and 3 are obviously closely related as recycling effort is needed to enable the uptake of recycled content. Here, specific allocations are applied for a fair and comparable benchmark of the combined effect for these material specific options. So far, in all of the assessments, the costs and revenues related to obtaining (improved quality) dismantling and shredder fractions are included under PO3, whereas the costs for further upgrading and incorporating plastic and steel fractions into new production are included under PO2. In the case of steel, this leads to a kind of an inflated BCR as the majority of combined costs are made under PO3 and all of the GHG savings are allocated to PO2. Therefore, the removal costs of steel parts that directly contribute to higher quality fractions are allotted to PO2 (48 million EUR for *1 in below table for PO2B for 2035). Costs for additional copper removal could be considered likewise as this is contributing to improved treatment quality as well. In this case however, since it is a different target material and would complicate the revenues allocation to each of the individual materials, this is not applied. In the case of plastics recycling, since the supporting JRC study follows the PEF rules¹⁹⁴ (see Section 2.1 of the JRC plastics recycled content study), the monetised value of avoided GHG emissions from plastics incineration is not included in PO2 but taken into account in the Oeko-Institut IA support study for the entirety of the impacts for plastics sent less to landfill and energy recovery. This makes the plastics recycled content BCR difficult to compare with the steel one. Therefore, the actual revenues of plastics recycling realised under PO2 are complemented with the monetised CO₂ credits of avoiding incineration for that volume of plastics from PO3 to PO2. The affected volume for 2035 is 240, 713 and 873 ktons of plastics

¹⁹⁴ European Commission. (2012). Product Environmental Footprint (PEF) Guide.

corresponding with 336, 999 and 1,224 kttons of CO₂ and 76, 226 and 277 million EUR of credits respectively for PO2A, PO2B and PO2C. This is based on the assumption of 1.73 ton of CO₂ per ton of plastics diverted with 81% as the share of incineration with energy recovery for the ELV plastic types involved¹⁹⁵.

With these allocations, all costs and benefits to **directly** enable the establishment of the recycled content targets are more fairly allocated at the production stage of (PO2) and deducted from the treatment stage (PO3) to make the BCRs for plastics and steel comparable. Note that this does not affect the overall BCR of the package as the sum of costs and revenues are zero.

Table 8.44 Benefit – costs ratios (BCR) per policy option, 2035

Benefit / Cost ratios (2035, compared to baseline, including recurrent administrative burden)	Policy options			Preferred (individually)	Preferred (combined + EPR)
Benefit/ Costs ratio including CO ₂ credits	(values in addition to baseline)				
PO1 3RTA	PO1A	PO1B	PO1C		
B/C ratio 3RTA	Not assessed quantitatively				
PO2 Steel recycled content	PO2A	PO2B	PO2C		
B/C ratio, steel RC *1	N.A.	1.69	2.38	N.A.	N.A.
PO2 Plastics recycled content	PO2A	PO2B	PO2C		
B/C ratio plastics RC *2	0.96	1.21	0.94	1.21	1.21
PO3 Recycling	PO3A	PO3B	PO3C		
B/C ratio recycling *3	0.99	1.22	1.03	1.22	1.24
PO4 Collection	PO4A	PO4B	PO4C	PO4D	
B/C ratio collection (incl. export)	3.97	3.51	2.09	2.73	2.67
PO6 Scope extension	PO6A	PO6B	PO6C		
B/C ratio scope extension	n.a.	3.72	n.a.	3.72	3.72
Benefit / costs ratio				1.57	1.57

*1 This includes the costs for removal of steel parts at ATFs originally allocated to PO3

*2 This includes the avoided emissions now from plastics incineration originally allocated to PO3

*3 This excludes the costs and avoided emissions allocated to PO2

For **PO2B** and **PO2B** for the steel recycled content, the BCR lies significantly above 1 indicating relevant monetised CO₂ savings in comparison to the related expenses for dismantling, sampling and sorting. For plastics, the BCR is lower, with relatively speaking higher investments to realise the monetised CO₂ credits in this case. Only **PO2B** has an acceptable BCR of 1.21. In the case of **PO2A**, the BCR slightly below 1 is due to relatively high investment costs for a smaller volume of plastics. The opposite counts for the **PO2C**, where the more constrained supply-demand balances and higher quality constraints to meet the closed loop share, results in higher estimated costs of recyclates compared to the more optimal balance for **PO2B**.

¹⁹⁵ Tenhunen – Lunkka et al, Greenhouse Gas Emission Reduction Potential of European Union's Circularity Related Targets for Plastics, Circular Economy and Sustainability, Jan. 2022, <https://doi.org/10.1007/s43615-022-00192-8>

For the recycling policy options, **PO3B** shows the most attractive benefit/ costs ratio where the material revenues from improved separation (1.1 billion EUR) plus monetised CO₂ savings (0.8 billion EUR) together outweigh the significant costs (1.5 billion EUR) to achieve the improved treatment quality. Both **PO3A** as **PO3C** show a BCR value close or below 1 due to lower monetised CO₂ savings (**PO3A**) and relatively higher dismantling costs for relatively lower material recovery amounts (**PO3C**).

All three collection options have a high BCR ranging from above 7 for **PO4A** to above 2 for **PO4C**. Here, it should be noted that in absolute terms, **PO4D** is the most effective option with a net monetised result of +1,120 million EUR over +80 million EUR for **PO4A**.

PO6B has a comparable BCR to the PO4 options of 3.7, reflecting the relatively high environmental benefits and increased revenues vs limited costs, linked to the additional treatment of lorries, buses and L3e-L7e category vehicles.

Cost – efficiency: cost per ton of CO₂ avoided

To further compare the costs of the reduced GHG savings as the most common benefit of the policy options, in Table 8.45, the costs per ton of CO₂eq avoided are presented for the policy options as well as the combined effect for the preferred options. While PO4A has the lowest cost per ton of CO₂ avoided, it does not realise the full potential in terms of absolute amounts of CO₂ avoided (PO4A: 353 kt CO₂ savings; PO4D: 5,218 kt CO₂ savings, see Table 8.40 before). PO4D, with a cost of €43 per ton of CO₂ avoided, still has a low cost for CO₂ savings and at the same time makes the best use of the absolute potential. This is followed by the **PO2B** recycled steel. Here the assessment is based on the combination of impacts including the costs for the **PO3B** recycling improvement options. The results for steel are thus indicative as the costs of creating higher purity scrap allocated to **PO3B** are related to both the removal of steel parts as well as copper parts. To provide an indication of the overall costs/benefits ratio, the costs for removing steel parts are included in the cost comparison for the steel recycled content, but excluding the related costs for removing copper being a different target material. For the steel recycled content, the costs of **PO2B** and **PO2C** are respectively 88 EUR and 29 EUR per ton. It has to be noted that there is uncertainty about the future availability of post-consumer steel scrap and the closed-loop percentage for the latter.

Similarly for plastics, the assessment of the policy options for recycled content are production related as again the preceding recycling efforts are quantified under policy options 3. For a fair comparison of the recycled content targets: all material specific costs and benefits to establish the targets are allocated at production stage of (PO2) and deducted from the treatment stage (PO3). Specifically: For plastic recycled content there **additional GHG savings from avoiding incineration of non-recycled plastics at the end-of-life stage that are to be accounted for** as the combined effort of the production and recycling stage. Without this, the costs per ton of CO₂ avoided would be ‘artificially’ made more attractive for the policy option 3 compared to the policy options 2. When applying this, **PO2B** for plastics, with a costs of 109 EUR per ton of CO₂ avoided, is more efficient compared **PO2A** with relatively high investment costs for a relatively low amount of plastics, resulting in over 200 EUR per ton of CO₂eq. For the higher volumes of **PO2C**, the opposite effect is observed with a cost of 270 EUR per ton of CO₂eq: Due to more constrained supply-demand balances and higher quality constraints to meet the closed loop share, the costs of recyclates are much higher compared to **PO2B**. It should be noted that there are additional environmental benefits

like the fossil-fuel savings of 4.5 billion Barrels of Oil equivalent, reduced plastic waste volume and health benefits.

Table 8.45 Cost per ton of GHG reduction for the various policy options, 2035

Costs per ton of CO₂ avoided (2035, compared to baseline, including recurring administrative burden)	Policy options			Preferred (individually)	Preferred (combined + EPR)
EUR per ton of CO ₂ reduction	(values in addition to baseline)				
PO1 3RTA	PO1A	PO1B	PO1C		
Production (3RTA)	Not assessed quantitatively				
PO2 Steel recycled content	PO2A	PO2B	PO2C		
Production + recycling (steel RC) *1	N.A.	€ 88	€ 29	N.A.	N.A.
PO2 Plastics recycled content	PO2A	PO2B	PO2C		
Production + recycling (plastics RC) *2	€ 257	€ 109	€ 270	€ 109	€ 109
PO3 Recycling	PO3A	PO3B	PO3C		
Recycling (excl. costs plastics/steel) *3	€ 231	€ 108	€ 203	€ 108	€ 103
PO4 Collection	PO4A	PO4B	PO4C	PO4D	
Collection + export	< 0	€ 23	€ 86	€ 43	€ 50
PO6 Scope extension	PO6A	PO6B	PO6C		
Scope extension (L+HDV)	n.a.	€ 8	n.a.	€ 8	€ 8
				€ 69	€ 72

*1 This includes the costs for removal of steel parts at ATFs originally allocated to PO3

*2 This includes the avoided emissions now from plastics incineration originally allocated to PO3

*3 This excludes the costs and avoided emissions now allocated to PO2

Effectiveness, efficiency, coherence and proportionality

Below Table 8.46 provides a summary of the comparison of the options based on the two key elements of the general objectives: First on the functioning of the internal market for both the automotive and recycling sectors (first row per policy option) and second, the sustainability impacts (second row per policy option). In addition, the qualitative comparison for the criteria effectiveness, efficiency, coherence and proportionality are provided.

Table 8.46 Overview of the results from the impact assessment study.

PO1. Design Circular	PO1A	PO1B	PO1C
Effectiveness	(++)	(++)	(+++)
Efficiency	(++)	(++)	(+++)
Coherence	(+)	(++)	(+++)
Proportionality	(++)	(+++)	(+++)
PO2. Steel Recycled Content	PO2A	PO2B	PO2C
Effectiveness	(o)	(+)	(++)
- incl. GHG savings (kton CO _{2eq})	0	+585	+1,404
Efficiency	(o)	(++)	(++)
- Benefit Cost Ratio (BCR)	N.A.	1.7*	2.4*
Coherence	(o)	(+++)	(++)
Proportionality	(o)	n.a.	n.a.

PO2. Plastics Recycled Content	PO2A	PO2B	PO2C	
Effectiveness	(+)	(++)	(++)	
- incl. GHG savings (kton CO _{2eq})	+426*	+1,313*	+1,599*	
Efficiency	(-)	(+)	(-)	
- Benefit Cost Ratio (BCR)	0.96*	1.2*	0.94*	
Coherence	(+)	(+++)	(++)	
Proportionality	(o)	(+)	(--)	
PO3. Treat Better	PO3A	PO3B	PO3C	
Effectiveness	(++)	(+++)	(++)	
- incl. GHG savings (kton CO _{2eq})	+1,042*	+2,689*	+1,656*	
Efficiency	(-)	(+)	(o)	
- Benefit Cost Ratio (BCR)	0.99*	1.22*	1.03*	
Coherence	(++)	(+++)	(+)	
Proportionality	(+)	(+++)	(-)	
PO4. Collect More	PO4A	PO4B	PO4C	PO4D
Effectiveness	(+)	(++)	(+++)	(+++)
- incl. GHG savings (kton CO _{2eq})	+353	+1,513	+3,222	+5,218
Efficiency	(+++)	(+++)	(++)	(++)
- Benefit Cost Ratio (BCR)	4.0	3.5	2.1	2.7
Coherence	(+)	(+)	(++)	(++)
Proportionality	(++)	(++)	(+)	(++)
PO5. EPR	PO5A	PO5B	PO5C	
Effectiveness	(++)	(+++)	(+)	
Efficiency	(+)	(++)	(+)	
Coherence	(++)	(+++)	(++)	
Proportionality	(+)	(+++)	(++)	
PO6. Cover more vehicles	PO6A	PO6B	PO6C	
Effectiveness	(-)	(++)	(++)	
- incl. GHG savings (kton CO _{2eq})	n.a.	+1,120	n.a.	
Efficiency	(+)	(+++)	(-)	
- Benefit Cost Ratio (BCR)	n.a.	3.7	n.a.	
Coherence	(+)	(++)	(+++)	
Proportionality	(+)	(++)	(--)	

(+++)	(+++) highly positive
(++)	(++) moderately positive
(+)	(+) slightly positive
(o)	(o) neutral/ baseline
(-)	(-) slightly negative
(--)	(--) moderately negative
(---)	(---) highly negative
n.a.	not assessed

The analysis reveals a range of consistent performances for almost all criteria for **PO1C** including the modernisation of the 3R type-approval methodology, the circularity strategy and Circularity Vehicle Passport policy options¹⁹⁶. It complies with the proportionality principle in ensuring that vehicles placed on the market achieve 3R targets and that data is sufficiently available to ATFs. The requirement to adopt a vehicle circularity strategy further complements to the circularity ambition in a proportionate manner proving the coherence with the CEAP and provides the highest potential to encourage high-quality recycling, including

¹⁹⁶ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023: See chapter 6.4.1, Table 6-20 "Initial assessment of measures to identify discarded and short-listed measures; and chapter 7.4 Evaluation results of the effectiveness of the 3R Directive and its relation to the ELVD

the non-recyclable materials. As regards the effectiveness, costs are expected to increase proportionally to the benefits, as **PO1C** contains a mix of short-term obligations.

For the recycled content targets for plastics¹⁹⁷ and steel¹⁹⁸, some contradicting scores are identified: **PO2C** for recycled content of plastics creates a lower score for proportionality due to lower availability of automotive plastics of sufficient quality related to the closed loop requirement and thus higher costs for recyclates, whereas for **PO2A** the investment cost in mechanical recycling of plastics are relatively for the volume of plastics at stake. **PO2C targets** of 30% in 2035 correspond to a demand of recyclates of 872 ktons in 2035¹⁹⁹. The target would represent an effective recycling rate of available ELV plastics of 64% which poses a supply – demand imbalance risk. For **PO2C** for steel, the 15% closed loop element to the target may constrain flexibility in sourcing of higher value scrap and the target level of 30% might be too high in case the demand for long products reduces over time due to electrification of the vehicles. Therefore, **PO2B** level 25 % recycled content for plastic with the same percentage share of closed-loop and the 20% open -loop recycled content target for steel provide the best-cost-benefit balance, avoids excessive costs and risks of supply shortage, and offers most certainty for manufacturing planning. For these aspects it is considered to be most effective and efficient, without creating an unproportionate burden or competition between the relevant sectors.

For quality of treatment²⁰⁰, the effectiveness of **PO3A** is regarded insufficient, whereas the proportionality of **PO3C** is a concern due to very high removal costs for the more advanced list of components targeted for Annex I of the ELV Directive. While in terms of cost effectiveness, **PO3C** requires higher costs than **PO3A** or **PO3B**, but it also results in the best outcomes in providing high quality secondary materials (steel, aluminium, copper, plastic etc.) subject to the mandatory removal obligations prior-shredding. In return, this option provides the optimum level of potential for the circular use of materials in the automotive sector, including the closed-loop potential. Therefore, it is seen to have the high positive impacts on the EU internal market, competitiveness as well as generating environmental impacts through integrating sustainability aspects. Measures dedicated to support the reuse of spare parts also contribute to higher availability of these parts on the market, benefiting ATFs and indirectly repair shops and consumers. The obligatory dismantling of components will support ELV treatment options higher up waste hierarchy, in particular, effectively contributing to the reuse. As a result, that will have a positive effect on the circular business models, where consumers would benefit from reduced costs for repairs of their vehicles. Measures under the **PO3C** build a strong coherence with CEAP and the EU climate policy, as the advanced quality targets for **PO3C** provide savings equivalent to 2.9 million tons of CO₂.

eq.

¹⁹⁷ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008

¹⁹⁸ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023: See chapter 3.1.5.5 “Comparison of scenarios for steel”

¹⁹⁹ Corresponds to the scenario JRC4c in the Annex of the study (JRC129008).

²⁰⁰ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023: See chapter 3.1.10.1.4 “Comparison of scenarios for EEC”

PO4D combining the elements of **PO4A** to **PO4C** and thus including the roadworthiness requirement upon export is the most effective option, but has a significant impact on specialised car dealers exporting (low quality) used vehicles. Analysing the differences between **PO4A**, **PO4B** and **PO4C** the measures under these policy options are designed to be coherent. A closer look shows that the measures under **PO4A**, **PO4B** and **PO4C** are not sufficient to solve the problem of export of (very) old used vehicles²⁰¹ and the problem of "missing vehicles" (a mixture of unregistered extra-EU export and illegal treatment within the EU). **PO4D**, on the other hand, achieves that, compared to the baseline, more than 2.9 million ELVs are sent to ATFs, which is more than twice as much as the next best **PO4C** (see Table 8.12, referring to the support study accordingly²⁰²). Therefore, the option **PO4D** is considered the most effective as it also has the highest positive impact in terms of streamlining vehicle traceability at the EU internal market, while at the same time efficiently contributing to the fight against illegal treatment and illegal export of ELVs and reducing the EU external pollution footprint.

For EPR, it is important to note that, if ATFs were subject to additional burdens related to circular economy (PO3) without adequate compensation, this would clearly challenge the legal sector. In consequence the illegal sector (which avoids circular economy obligations, unprofitable to the dismantlers) would be expected to increase. Such a combination (higher burden on ATFs / no compensation for compliance costs) would clearly jeopardize the goal of reducing the number of missing vehicles and worsen the current situation²⁰³. In this context **PO5B** is regarded the most effective, coherent and proportional choice in comparison, whereas some elements of **PO5C** are left as voluntary elements for the Member States, as it gives the discretion for the Member States to establish "deposit return schemes" based on the common EU wide criteria, whereby a lump sum of money is given to the last owner of an ELV upon its delivery to an ATFs. Although **PO5A** is considered effective, efficient, proportionate and coherent, its impacts are not reaching enough to substantially contribute to achieving the specific objectives, as it is essentially limited to the basic requirement for Member States to establish specific Extended Producer Responsibility (EPR) schemes for vehicles, aligned with the minimum requirements applicable to other sectoral waste streams, as specified in the Waste Framework Directive therefore. **PO5B** already steps further and introduces additional elements such as modulation of fees and cross-border functionality of EPR, which significantly contributes to better streamlining of the producer responsibility across the EU. Such regulatory option positively affects coherence and the efficiency of measures through ensuring a fair allocation of costs and creating a level playing field between ELV operators across in a proportionate manner.

²⁰¹ Export of low quality used vehicles to third non-EU countries often lack necessary ELV treatment infrastructure in place and environmental and safety risks in the receiving countries. (see Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023: See chapter 6.5.1 Facts on extra EU Export

²⁰² Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023: See chapter "6.6.2.4 Results of the scenario calculations regards the shift of number of whereabouts between categories", Table "Change in categories of whereabouts for the different scenarios"

²⁰³ Dito: chapter: 3.2.9.3 Interrelations with preferred option regards the circularity

PO6A is assessed as ineffective²⁰⁴, whereas there is insufficient information available to substantiate the full-scope extension of **PO6C**. Therefore, the **PO6B** is considered as a preferred option which best presents the balance between overall benefits and costs in a most proportionate and coherent manner. Direct positive impacts mostly relate to increased environmental performance at the end-of-life stage, as the additional categories of vehicles will have to be treated in authorized treatment facilities, so minimizing environmental and health related risks, e.g. exhaust gas emissions or leakage of hazardous liquids into environment. These measures will have an additional medium economic burden, i.e., costs for management and authorization of dismantling facilities. This option also includes the information requirements for which economic burden in the form of administrative costs can be expected. However, these aspects are not inflicting the efficiency, effectiveness or proportionality. On the opposite, it is expected to have a positive impact for introducing common minimum requirements for these vehicles and therefore harmonizing different Member States approaches which currently pose a risk to fragmentation of the EU internal market. but benefits are expected from heavy metal restrictions and formalized treatment. Even if the measures considered for “design for circularity” are not implemented for new vehicles in scope in the mid- to long-term, it could be expected that the circularity of “new vehicles in scope” shall increase, as some manufacturers of M1 and N1 vehicles also manufacture other categories of vehicles. These would be expected at least in some cases to apply similar practices to the design of “new vehicles in scope”. In terms of the coherence of the options with overarching objectives of EU policies, **PO6A** and **PO6B** contribute to the goals set out in the CEAP, however, **PO6B** has a more influential effect due to minimum mandatory requirements for the ELV treatment as well as export related measures. **PO6C** is regarded as disproportionate, it was identified, that measures cause high costs, which are not quantifiable, and bringing unclear benefits which cannot be assessed due to the lack of substantiated data.

8.5.3 8.5.3 Preferred options

Design circular:

PO1C is the preferred option. It anchors the circularity requirements as an important element of the type-approval of new vehicle types. It contains a mix of short term obligations (requirement for vehicle manufacturers to make available detailed and user-friendly dismantling and recycling information, including the use and location of CRMs in vehicles and on the share of recycled content used in new vehicles; follow-up on manufacturers’ obligation to ensure recyclability and re-usability of type-approved vehicles) and actions on a medium term (revision of the methodology to calculate recyclability and re-usability of new vehicles at type-approval stage and the development of an Circularity Vehicle Passport. This provides an ambitious, cost-effective and proportionate package to improve the circularity in the design of vehicles. For the substances in vehicles, the preferred option is to address all new restrictions of substances in vehicles under REACH, the Union’s core chemicals legislation, with the exception of substances in batteries, which would be addressed under the new Batteries Regulation. Existing restrictions on four heavy metals would remain restricted

²⁰⁴ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023: See chapter 3.4.4.6

under the Regulation and the remaining active exemptions, currently in Annex II of the ELV Directive, would be reviewed with the support of the European Chemicals Agency (ECHA) under an enhanced assessment regime.

Use recycled content:

PO2B is the preferred option for plastics with recycled content targets of 25% applicable to newly type approved vehicles by 2030, of which 25% closed-loop. It provides a significant increase to the recycling of plastics from ELVs and lower the carbon footprint linked to the use of plastics in new vehicles. The PO2B level provides the best-cost-benefit balance, avoids excessive costs and risks of supply shortage, and offers most certainty for manufacturing planning.

For steel recycled content, all options can provide significant GHG savings and an important ‘pull effect’ to better utilise ELV steel scraps in the future, but to a different degree and in different stages. They complement the ‘push effect’ for increased quality of steel scrap defined under **PO3B** and enhance cooperation between manufacturers, steel industry and recyclers. The ambition level of **PO2A** (M10a) takes best into account the need to further address the uncertainty related to the ability of the automotive producers to increase the incorporation of steel scrap, in particular post-consumer scrap, in new electric vehicles²⁰⁵. The advantages of **PO2B** would be that creating a pull to increase scrap utilisation in steel production can achieve faster decarbonisation of production compared to other, more long-term technology conversions and it reduces the need for natural gas, coal and iron-ore in steel production more short-term, provided high quality scraps are made available. **However, the uncertainty in setting an appropriate target level directly in the future legislation is too high.** This is due to uncertainties about (i) the future share of long products (more likely to be able to include recycled steel) in EVs; (ii) current uptake levels of post-consumer scrap in flat production; (iii) the share of pre-consumer versus post-consumer in current scrap utilisation rates and finally about (iv) the impact of such target on the availability and prices of scrap for other steel-demanding sectors. In that regard, the establishment of a steel recycled content target under **PO2B**, M10b, presents the risk to define the target level too low with the consequence that it would not form an actual incentive to higher post-consumer scrap uptake levels. **PO2C**, M10c with the higher target and closed loop percentage may reduce flexibility in the sourcing of post-consumer scrap and is therefore not selected. **PO2A**, M10a is **the preferred option** in the case of steel.

Other recycled content targets for materials like aluminium and other CRMs like magnesium and REE permanent magnet materials cannot yet be substantiated as automotive designs are changing fast and recycling markets are very dynamic with significant progress in sorting technologies. The case of aluminium is inherently more complex with a range of alloy types involved and more complicated economies of scale thresholds when alloy sorting would be implemented. For these materials, the combination of the mandatory recycled content declaration under **PO1C** and the treatment requirements of **PO3B** are regarded adequate for the short term, but an empowerment for the Commission to come forward with recycled content targets for additional materials (such as CRMs, and aluminium) is foreseen within

²⁰⁵ Notably linked to the future share of steel long products in electric vehicles, which are the best candidates for such incorporation

five years after the entry into force of the new legislation, if this proves necessary in the future (**PO2C**, M11).

Treat better: PO3B is the preferred option, as it most effectively addresses the complexity of improving recycling quantity and quality for a wide variety of different materials present in ELVs. The GHG savings are higher and the costs are lower for **PO3B** in comparison to **PO3C**. The stricter definition of “recycling” and restrictions on landfilling will ensure that residues from shredding are effectively recycled or recovered, rather than backfilled or landfilled. This option also contains specific and cost-effective measures for each of the materials and different types. The removal obligations prior to shredding of **PO3B** allow for substantial progress to recover and recycle batteries and electric drive motors from EVs and other parts/components containing plastics, precious metals and CRMs, which are associated with the electrification of the fleet and the wide use of electronics in new vehicles (M13a, M13b). To remain technology-neutral, a derogation from this obligation would apply when recyclers provide verifiable evidence that separation leads to recyclates of at least similar high quality as via manual dismantling. The **PO3B** ban on mixed treatment and mandatory removal and separate recycling of e-drive motors would thrive the permanent magnet recycling value chain and generate new flows of CRMs for further recycling. It is estimated respectively circa 2.4 kton and 4.2 kton of permanent magnet flows to be available in 2035 and 2040 for high quality recycling from future EU ELVs. The separate sorting and recycling of e-drive motors will have a positive impact on innovation and R&D in the EU. The available e-drive motors thanks to this option would thrive research, innovation and the development of new recycling technologies to increase the recovery of SRM, especially CRMs. It would further decrease copper contamination in steel and aluminium scraps from ELVs.

Collect more: The additive combination of **PO4A**, **PO4B** and **PO4C** in the form of **PO4D** is most effective as it increases collection of ELVs most efficiently. It sets out a range of complementary measures, which is indispensable to address the problem of “missing vehicles”. The traceability of used vehicles and ELVs would be improved through (i) a clearer allocation of responsibility for the issuing and reporting of the certificate of destruction (CoD) among economic operators and competent authorities and (ii) the integration of additional information in national vehicle registration systems and their interoperability between Member States. To address the illegal export of ELVs and reduce export of non-roadworthy vehicles, binding criteria for the distinction between used vehicles and ELVs would be established as well as (M19b) a requirement that the export of used vehicles is only authorised upon verification of the roadworthiness status of the vehicle concerned. (M21). New provisions on enforcement would also help addressing illegal treatment and export of ELVs. The impact of these measures should be significant in terms of bringing additional ELVs for treatment to legal ATFs in the EU.

Ensure compliance: PO5B is the preferred option, providing substantial incentives for a better functioning recycling market via the establishment of an obligation for producers to increase collection of ELVs and cover costs of dismantling efforts that cannot be offset by the trade in used parts. This will also help reducing illegal practices²⁰⁶. To ensure harmonisation

²⁰⁶ Umweltbundesamt,(2022), Illegal treatment of end of-life vehicles - Assessment of the environmental, micro- and macroeconomic effects, texte 130/20 22

on how fees are calculated across the EU and further create design incentives leading to lower future recycling costs, this option sets out criteria on how EPR fees are to be modulated, such as the weight of the vehicle, the time to dismantle components such as the battery and amount of recycled content. In addition, it sets out a mechanism to ensure that fees by vehicle manufacturers are paid to recyclers, in the case where the vehicle is treated as an ELV in an EU Member State different than the one where it was placed on the market (“cross-border” EPR mechanism).

Cover all vehicles: PO6B is selected as the preferred option for the scope extension to L-category vehicles, lorries, buses and trailers, via basic requirements and provision of information on composition of these vehicles as well as a declaration on the presence of substances of concern. The preferred option is a set of basic measures that enable a more ambitious ‘phased-in approach’ in the long term. At the same time, basic environmental protection and minimum recycling quality is ensured via the requirement that lorries and buses (but excluding motorbikes) reaching end-of-life shall only be treated in authorised treatment facilities (ATFs).

8.5.4 8.5.4 Combined impacts

The most attractive cost-benefit ratios (Table 8.39) and the highest environmental and economic gains are realised by increasing collection under **PO4C**. The collection effects are further amplified by the incentives of **PO5B**. The ‘EPR amplification’ effect are shown separately in Sections 6.2.4 and 6.3.4. The combined effects are calculated and provided in detail in Annex 8.1.4, 8.2.4 and summarised in Annex 8.5.1 in the Tables 8.33 – 8.38. The results show an additional volume of materials collected of 1.9 million tonnes equalling 6.4 million tonnes of CO_{2eq} in GHG savings against ‘only’ 300 million EUR of net costs. Since the highest ambition level for collection is both attractive, as well as an important basis for the realisation of the other policy options, there is not much choice for alternative combinations other than **PO4C** and **PO5B** forming the heart of the preferred option package.

The synergies between other options are carefully assessed because they are mutually supportive. This is particularly the case for the recycled content options (**PO2A** for steel and **PO2B** for plastics) which target the economic deficiencies in the markets for secondary raw materials and strongly complement the mere technical side to realise higher waste treatment quality (**PO3B**). An alternative choice for the more ambitious **PO3C** would not significantly improve the required treatment quality of steel fractions (**PO2A**) nor improve the quantity of plastics recycling (**PO2B**) and would have a benefit – ratio close to 1 when monetising the environmental gains as demonstrated in Table 14 in the main Staff Working Document. The effects of the highest ambition level of **PO1C** residing under type-approval are expected to facilitate the long-term achievement by design improvements in all other options and are relatively inexpensive.

The elements contained in section 7 of the SWD on the comparison of options provide an assessment of each option and allow to perform calculations for a large number of combinations of options, which could be alternative to the preferred package. This impact assessment report does not provide for the assessment of the impacts of such alternative combinations of options, as it demonstrates that the preferred package is the best able to meet the objectives of this initiative; such additional calculations would not be proportionate and are not required under the Commission better regulation guidelines. However, the information

provided in section 7 is sufficiently comprehensive and transparent to allow stakeholders and policy-makers to perform such assessment, for example if they consider that one objective should be given higher importance compared to another one. As explained in the present report, the preferred package of options takes into consideration the interlinkages between problems and options and is based on a careful balance in that respect, so that, from the Commission's perspective, privileging one objective against another one would jeopardise the overall architecture of the initiative.

The combined impacts of the preferred policy package are presented in Table 8.47 – 8.49. They are respectively calculated for 2030, 2035 and 2040 and compared to the baseline scenario. Compared to the impacts presented per policy option in Section 6, there are significant synergies when applied in combination.

The total cost for the preferred option ranges from 2.7 billion EUR (2030) to 3.4 billion EUR (2035) to 4.01 billion EUR (2040) against respectively 1.8, 2.3 and 3.0 billion EUR in revenues for 2030, 2035 and 2040. The overall environmental benefits are assessed as an **annual reduction of 10.8 (2030), 12.8 (2035) and 14.0 (2040) million tons of CO₂-eq**, key for the decarbonisation of the automotive industry. The GHG savings represent an **additional 2.0, 2.9 and 3.7 billion EUR when monetised for 2030, 2035 and 2040.** This is linked notably to a **better valorisation of resp. 4.4, 5.4 and 6.2 million tons of materials** (plastics, steel, aluminium, copper, CRMs) which would be either recycled at higher quality or re-used, as well as to the fact that **3.8 million additional ELVs** (3.2 million for M1,N1) **would be collected and treated** extra in the EU. **350 tons of rare earth** permanent magnet materials would be separately collected for reuse and recycling in 2035 (and 1,500 tons in 2040), which would **contribute greatly to the EU efforts for strategic autonomy for CRMs.** **The cost of the preferred option is estimated to reach 66 EUR per vehicle put on the market in 2035.**

The estimated potential levels of compliance cost offsetting to be covered by manufacturers are ranging between 3 and 33 EUR per ELV. While there will be short to medium-term costs for the EU automotive industry, the improved resource efficiency of the preferred option reduces EU energy and raw material dependencies for materials sourced in third countries. It strengthens resilience of automotive supply chains. It will also be ready to successfully embrace the transition to electrification on the basis of a robust and sustainable business model.

Table 8.47 Total environmental and economic impacts, preferred options, 2030

Environmental impacts (2030, compared to baseline)		Preferred option	Economic impacts (2035, vs. baseline, incl. admin burden)		Preferred option
PO	All life-cycle stages (in kton of materials)		Design, production (M EUR, - = cost, + = revenue)		
2	Steel recycled content	+0	Manufacturers (incl. admin burden)	-€	400
2	Plastics recycled content	+505	Admin burden authorities	-€	23
3	Materials at higher quality (recycling)	+2,093	Collection, recycling (M EUR, - = cost, + = revenue)		
4	Materials recovered (collection + export)	+1,602	Consumers, vehicle owners	-€	137
6	Materials recovered (scope extension)	+231	Car dealers (export requirements)	-€	512
Total materials recycled at HQ (kton)		+4,431	ATFs	€	34
ELVs collected, treated +reported (M units)		7.6	Shredders/PST operators	-€	115
4,5,6	Extra ELVs to ATFs and CoD reported	+2.7	Recyclers (incl. plastics, steel RC)	€	270

4,5,6	Non-reported treatment	-0.3	Admin burden treatment	-€ 42
4,5,6	Export of ELVs/used vehicles	-1.8	Collection,recycling (M EUR, - =cost, + =revenue)	
GHG savings (ktons of CO2-eq)			Total costs (all)	-€ 2,714
1,2	GHG savings production (steel RC)	+0	Total revenues (all)	€ 1,789
2	GHG savings production (plastics RC)	+250	Total (M EUR, excl CO2 credits)	-€ 925
3	GHG savings recycling (N1,M1)	+3,879	Total (M EUR, incl CO2 credits)	€ 1,068
4	GHG savings collection + export (N1,M1)	+6,164	Total (EUR/ vehicle, excl. CO2 credits)*	-€ 61.57
6	GHG savings scope extension (L+HDV)	+510	Total (EUR/ vehicle, incl. CO2 credits)*	€ 71.09
GHG savings (ktons of CO2-eq)		+10,803	Average cost GHG savings (EUR/ton)	-€ 85.63

* Represents all costs and benefits allocated to all new vehicles, including the scope extension and recurring administrative burden; The net costs per new N1,M1 vehicle, e.g. excluding the scope extension, is 58.69 EUR,

Table 8.48 Total environmental and economic impacts, preferred options, 2035

Environmental impacts (2035, compared to baseline)		Preferred option	Economic impacts (2035, vs. baseline, incl. admin burden)		Preferred option
PO All life-cycle stages (in kton of materials)			Design, production (M EUR, - = cost, + =revenue)		
2	Steel recycled content	+0	Manufacturers (incl. admin burden)		-430
2	Plastics recycled content	+713	Admin burden authorities		-23
3	Materials at higher quality (recycling)	+2,322	Collection,recycling (M EUR, - = cost, + =revenue)		
4	Materials recovered (collection + export)	+1,876	Consumers, vehicle owners		-153
6	Materials recovered (scope extension)	+508	Car dealers (export requirements)		-574
Total materials recycled at HQ (kton)		+5,420	ATFs		-40
ELVs collected, treated +reported (M units)		8.2	Shredders/PST operators		-110
4,5,6	Extra ELVs to ATFs and CoD reported	+3.8	Recyclers (incl. plastics, steel RC)		+375
4,5,6	Non-reported treatment	-1.7	Admin burden treatment		-42
4,5,6	Export of ELVs/used vehicles	-2.1	Collection,recycling (M EUR, - =cost, + =revenue)		
GHG savings (ktons of CO2-eq)			Total costs (all)		-€ 3,417
1,2	GHG savings production (steel RC)	+0	Total revenues (all)		€ 2,420
2	GHG savings production (plastics RC)	+314	Total (M EUR, excl CO2 credits)		-€ 997
3	GHG savings recycling (N1,M1)	+4,536	Total (M EUR, incl CO2 credits)		€ 1,797
4	GHG savings collection + export (N1,M1)	+6,350	Total (EUR/ vehicle, excl. CO2 credits)*		-€ 66.34
6	GHG savings scope extension (L+HDV)	+1,120	Total (EUR/ vehicle, incl. CO2 credits)*		€ 119.58
GHG savings (ktons of CO2-eq)		+12,320	Average cost GHG savings (EUR/ton)		-€ 80.91

* Represents all costs and benefits allocated to all new vehicles, including the scope extension and recurring administrative burden; The net costs per new N1,M1 vehicle, e.g. excluding the scope extension, is 65.01 EUR,

Table 8.49 Total environmental and economic impacts, preferred options, 2040

Environmental impacts (2040, compared to baseline)		Preferred option	Economic impacts (2040, vs. baseline, incl. admin burden)		Preferred option
PO All life-cycle stages (in kton of materials)			Design,production (M EUR, - = cost, + =revenue)		
2	Steel recycled content	+0	Manufacturers (incl. admin burden)		-€ 430
2	Plastics recycled content	+713	Admin burden authorities		-€ 23
3	Materials at higher quality (recycling)	+2,769	Collection,recycling (M EUR, - = cost, + =revenue)		
4	Materials recovered (collection + export)	+2,055	Consumers, vehicle owners		-€ 137

6	Materials recovered (scope extension)	+672	Car dealers (export requirements)	-€ 606
Total materials recycled at HQ (kton)		+6,209	ATFs	-€ 61
ELVs collected, treated +reported (M units)		8.9	Shredders/PST operators	-€ 311
4,5,6	Extra ELVs to ATFs and CoD reported	+4.6	Recyclers (incl. plastics, steel RC)	€ 585
4,5,6	Non-reported treatment	-0.7	Admin burden treatment	-€ 42
4,5,6	Export of ELVs/used vehicles	-2.3	Collection, recycling (M EUR, - =cost, + =revenue)	
GHG savings (ktons of CO2-eq)			Total costs (all)	-€ 4,047
1,2	GHG savings production (steel RC)	+0	Total revenues (all)	€ 3,022
2	GHG savings production (plastics RC)	+314	Total (M EUR, excl CO2 credits)	-€ 1,025
3	GHG savings recycling (N1,M1)	+5,742	Total (M EUR, incl CO2 credits)	€ 2,731
4	GHG savings collection + export (N1,M1)	+6,164	Total (EUR/ vehicle, excl. CO2 credits)*	-€ 68.23
6	GHG savings scope extension (L+HDV)	+1,742	Total (EUR/ vehicle, incl. CO2 credits)*	€ 181.74
GHG savings (ktons of CO2-eq)		+13,962	Average cost GHG savings (EUR/ton)	-€ 73.43

* Represents all costs and benefits allocated to all new vehicles, including the scope extension and recurring administrative burden; The net costs per new N1,M1 vehicle, e.g. excluding the scope extension, is 66.90 EUR

Table 8.50 Detailed cost per vehicle (all categories), per new vehicle and per ELV (for M1,N1 only in last column), 2030

Economic impacts (2030, compared to baseline, incl. admin burden)	Policy Options A	Policy Options B	Policy Options C	Preferred (individually)	Preferred (combined + EPR)	Preferred (N1,M1*)
Design + production (EUR/new vehicle, - =cost, + =revenue)	(values in addition to baseline)					Per new vehicle (N1,M1)
N1,M1 vehicles POM (M units)					15.02	15.02
L3e-L7e vehicles POM (M units)					1.82	
N2,N3,M2,M3,O POM (M units)					0.37	
Manufacturers (plastics RC)	-€7.87	-€21.05	-€29.86	-€21.05	-€21.05	-€24.12
Manufacturers (steel RC)						
Manufacturers (admin. burden)	-€1.84	-€2.08	-€2.18	-€2.18	-€2.18	-€2.49
Admin burden authorities	-€0.23	-€1.30	-€1.33	-€1.33	-€1.33	-€1.50
Collection + recycling (EUR/ELV, - =cost, + =revenue)	(values in addition to baseline)					Per ELV (N1,M1)
ELVs treated (N1,M1; M units)	9.35	9.59	10.09	10.59	11.08	11.08
ELVs treated (L3e-L7e; M units)	0.00	0.26	0.26	0.26	0.26	
ELVs treated (HDV, in M units)	0.09	0.11	0.11	0.11	0.11	
Consumers	€-	-€0.29	-€13.08	-€12.49	-€11.95	-€12.35
Exporters	-€1.55	-€12.79	-€28.78	-€33.16	-€44.72	-€41.64
ATFs - costs	-€6.80	-€25.22	-€21.74	-€22.94	-€27.03	-€26.28
ATFs - revenues recycling	€3.56	€14.05	€15.54	€29.77	€30.04	€29.32
Shredders/PST operators - costs	-€31.16	-€75.84	-€55.15	-€68.97	-€82.47	-€85.23
Shredders/PST operators - revenues	€20.66	€65.03	€43.40	€60.41	€72.45	€74.87
Recyclers - costs (incl plastics RC)	-€19.63	-€33.07	-€40.69	-€29.05	-€21.96	-€16.74
Recyclers - revenues (incl plastics RC)	€14.01	€58.60	€65.65	€51.31	€43.12	€32.87

Admin burden treatment	-€3.86	-€4.24	-€4.05	-€3.85	-€3.69	-€2.87
All life-cycle stages (EUR/new vehicle, - =cost, + =revenue) (values in addition to baseline)						
Total costs (all)	-€72.94	-€175.89	-€196.86	-€195.03	-€216.39	-€213.23
Total revenues (all)	€38.23	€137.69	€124.58	€141.49	€145.61	€137.06
Total per vehicle POM (excl CO2 credits)	-€26.87	-€35.99	-€63.63	-€47.44	-€61.57	-€58.69
Total per vehicle POM (incl. CO2 credits)	-€8.07	€28.97	€7.73	€59.77	€71.09	€73.97

* excludes all scope extension related costs

Table 8.51 Detailed cost per vehicle (all categories), per new vehicle and per ELV (for M1,N1 only in last column), 2035

Economic impacts (2030, compared to baseline, incl. admin burden)	Policy Options A	Policy Options B	Policy Options C	Preferred (individually)	Preferred (combined + EPR)	Preferred (M1,N1*)
Design + production (EUR/new vehicle, - =cost, + =revenue) (values in addition to baseline)						Per new vehicle (N1,M1)
N1,M1 vehicles POM (M units)					15.02	15.02
L3e-L7e vehicles POM (M units)					1.91	
N2,N3,M2,M3,O POM (M units)					0.37	
Manufacturers (plastics RC)	-€11.86	-€22.67	-€42.67	-€22.67	-€22.67	-€26.11
Manufacturers (steel RC)		-€1.92	-€4.62			
Manufacturers (admin. burden)	-€1.83	-€2.07	-€2.17	-€2.17	-€2.17	-€2.49
Admin burden authorities	-€0.23	-€1.29	-€1.32	-€1.32	-€1.32	-€1.50
Collection + recycling (EUR/ELV, - =cost, + =revenue) (values in addition to baseline)						Per ELV (M1,N1)
ELVs treated (N1,M1; M units)	9.74	10.12	10.70	11.34	11.73	11.73
ELVs treated (L3e-L7e; M units)	0.00	0.29	0.29	0.29	0.29	
ELVs treated (HDV, in M units)	0.10	0.13	0.15	0.13	0.13	
Consumers	€-	-€0.28	-€12.29	-€12.32	-€12.63	-€13.09
Exporters	-€2.71	-€16.48	-€33.23	-€39.47	-€47.21	-€44.59
ATFs - costs	-€17.57	-€42.76	-€40.72	-€38.32	-€43.67	-€41.91
ATFs - revenues recycling	€5.94	€21.26	€22.51	€38.30	€40.38	€38.25
Shredders/PST operators - costs	-€35.29	-€95.01	-€62.49	-€84.81	-€101.01	-€104.67
Shredders/PST operators - revenues	€31.63	€89.31	€65.49	€78.66	€92.00	€95.33
Recyclers - costs (incl plastics RC)	-€26.65	-€44.78	-€58.35	-€37.27	-€29.05	-€23.50
Recyclers - revenues (incl plastics RC)	€29.00	€75.18	€87.23	€64.49	€49.51	€40.05
Admin burden treatment	-€3.70	-€4.01	-€3.80	-€3.59	-€3.48	-€2.71
All life-cycle stages (EUR/new vehicle, - =cost, + =revenue) (values in addition to baseline)						
Total costs (all)	-€99.83	-€231.26	-€261.68	-€241.95	-€263.21	-€260.57
Total revenues (all)	€66.57	€185.74	€175.23	€181.45	€181.89	€173.62
Total per vehicle POM (excl CO2 credits)	-€28.64	-€42.14	-€81.62	-€54.61	-€66.34	-€65.01

Total per vehicle POM (incl. CO2 credits)	-€1.16	€66.82	€37.32	€101.43	€119.58	€120.91

* excludes all scope extension related costs

Table 8.52 Detailed cost per vehicle (all categories), per new vehicle and per ELV (for M1,N1 only in last column), 2040

Economic impacts (2040, compared to baseline, incl. admin burden)	Policy Options A	Policy Options B	Policy Options C	Preferred (individually)	Preferred (combined + EPR)	Preferred (M1,N1*)
Design + production (EUR/new vehicle, - =cost, + =revenue)	(values in addition to baseline)					Per new vehicle (M1,N1)
N1,M1 vehicles POM (M units)					15.02	15.02
L3e-L7e vehicles POM (M units)					2.01	
N2,N3,M2,M3,O POM (M units)					0.38	
Manufacturers (plastics RC)	-€11.79	-€22.54	-€42.43	-€22.54	-€22.54	-€26.11
Manufacturers (steel RC)		-€3.77	-€9.05			
Manufacturers (admin. burden)	-€1.82	-€2.05	-€2.16	-€2.16	-€2.16	-€2.49
Admin burden authorities	-€0.23	-€1.29	-€1.32	-€1.31	-€1.31	-€1.50
Collection + recycling (EUR/ELV, - =cost, + =revenue)	(values in addition to baseline)					Per ELV (N1,M1)
ELVs treated (N1,M1; M units)	10.56	11.05	11.74	12.29	12.64	12.64
ELVs treated (L3e-L7e; M units)	0.00	0.31	0.31	0.31	0.31	
ELVs treated (HDV, in M units)	0.10	0.17	0.17	0.17	0.17	
Consumers	€-	-€0.25	-€11.20	-€10.72	-€10.44	-€10.83
Exporters	-€5.00	-€19.90	-€37.88	-€40.34	-€46.24	-€43.96
ATFs - costs	-€27.56	-€50.44	-€52.34	-€45.54	-€51.38	-€50.21
ATFs - revenues recycling	€11.32	€25.92	€25.61	€43.62	€46.71	€45.14
Shredders/PST operators - costs	-€46.05	-€129.65	-€88.06	-€116.54	-€132.77	-€137.77
Shredders/PST operators - revenues	€59.46	€112.64	€92.72	€97.93	€109.08	€113.18
Recyclers - costs (incl plastics RC)	-€26.21	-€38.81	-€59.16	-€29.87	-€21.65	-€18.89
Recyclers - revenues (incl plastics RC)	€37.47	€86.41	€95.36	€71.54	€45.88	€40.05
Admin burden treatment	-€3.42	-€3.66	-€3.47	-€3.31	-€3.22	-€2.52
All life-cycle stages (EUR/new vehicle, - =cost, + =revenue)	(values in addition to baseline)					
Total costs (all)	-€122.07	-€272.36	-€307.08	-€272.34	-€291.71	-€294.29
Total revenues (all)	€108.25	€224.97	€213.69	€213.09	€201.67	€198.37
Total per vehicle POM (excl CO2 credits)	-€16.01	-€46.02	-€91.70	-€55.31	-€68.23	-€66.90
Total per vehicle POM (incl. CO2 credits)	€23.70	€120.15	€73.59	€156.50	€181.74	€183.07

* excludes all scope extension related costs

8.6. Feasibility and implementation

The choice for a Regulation is the most efficient choice in delivering economic, environmental and social improvements and allow for a coherent approach targeting both the design and end-of-life stages allows the transition to a low-carbon society and the retention of component and material value for a more circular economy. It supports improved harmonisation for both automotive manufacturers as well as recyclers operating in the single market. Key elements to ensure technical, economic and legislative feasibility are listed as follows:

- 3R type-approval: The modernised requirements related to the 3R type approval procedures follow similar procedures as currently in place. It may require a change in international agreements being the ISO 22628: 2002 standard and UN ECE Regulation No. 133. Both would have to be updated by for instance removing the battery from the recyclability assessment to avoid overlapping measures and double counting of recyclability achievements of embedded EV batteries. For the digital Circularity Vehicle Passport, the Commission would be tasked to develop the technical criteria for minimum information to be provided to end-users, treatment operators and competent authorities to ensure consistency with other similar initiatives like the ESPR framework and the Euro 7 Regulation.
- Recycled plastics content: The chosen target levels are technically feasible but do require immediate investments to timely ramp up production. Key to successful implementation will be appropriate monitoring and verification of the plastic volumes involved and the shares of post- and pre-consumer plus the closed loop contribution. For plastics and steel, it is recommended to include a review clause in order to adapt the recycled content target levels around 2030 given uncertainty in market dynamics related to varying automotive steel grades and the timing of ongoing capital-intensive conversions to e.g. EAF-DRI technologies on the supply side.
- For recycling, the preferred option requires investment in treatment capacity and quality to reduce backfilling of ASR fractions and contribute to higher quality of treatment across the EU. The ban on mixed treatment is technically feasible. Despite reduced flexibility in matching available ELV volumes to treatment capacity, in the long term the improved quality will become more economically attractive. The Commission should be entitled to update the list of parts/components concerned via secondary legislation. A review clause for these targets 8 years after entry into force of the new rules would also be introduced.
- For collection, the implementation largely depends on the revision of the roadworthiness package and related registration document specifications with few additional fields to be added. DG MOVE considers this measure as part of the impact assessment for the legislative proposal on a new roadworthiness package. To support enforcement, information on the roadworthiness status of a vehicle is to be made available to customs authorities through the single window system and close cooperation with DG TAXUD on the matter. In support, reporting obligations by Member States are extended to the number vehicles registered, de-registered, treated as ELVs and shipped outside the Member State of registration (complementing Commission Decision 2005/293/EC).

- To ensure unambiguous financial allocations and proper governance levels, the harmonisation of the ELV requirements across Member States is indispensable. To allow for different approaches at the same time dependent on the Member State market conditions and size, this obligation can be met by car manufacturers individually (Individual Producer Responsibility) or collectively (through Producers Responsibility Organisations). A particular point of attention is to implement the “Polluter pays principle” in such a manner that there is sufficient coverage of costs of compliance for the existing and new requirements for legal operators to avoid giving a further advantage to informal or illegal practices (see Annex 8.1.5 and 8.2.5).
- Scope: Due to a **general lack of information** on the collection and treatment for the extended scope, a **phased-in approach** is deemed inevitable whereby the Commission provides an assessment of the possibility to fully include L-category vehicles, lorries and buses in the scope of the new legislation, if necessary, accompanied by a legislative proposal, 8 years after entry into force of the new legislation.

An overview of implementation timelines is presented in below Table 8.53.

Table 8.53 Implementation timelines of key requirements

EIF Option	EIF/+1 yr	+3 yrs	+ 5yrs	+7 yrs or later
PO1 – Design Circular	Alignment with type-approval framework (M1); restrictions of substances alignment with the Battery Regulation M5).	Calculation methodology for type-approval (M2), Provision of dismantling information (M3); Haz. substance declaration (M4a); Vehicle circularity strategy (M6);	Recycled content declaration under 3R type-approval (M4b,c); design for dismantling (M7).	Digital Vehicle Passport (M8); Hybrid restriction approach > 7 yrs (M5c)
PO2 Use recycled content	Definitions of recycled content (M9b)	Adoption of calculation and verification rules for recycled content, review of target levels for plastics (M9b), feasibility studies for steel RC targets (M10a) and for aluminium/ CRMs (M11)	Target applicable to plastics (M9b). Adoption of calculation and verification rules for recycled content for steel (M10a) and possibly aluminium and CRMs (M11)	Recycled content target applicable to steel (M10a) Recycled content applicable to aluminium and CRMs (M11)
PO3 Treat Better		Alignment of definitions with sectoral legislation (M12) Mandatory removal list (M13ab); Market support for the use of spare parts (M14b); Treatment targets for CRMs (M15b); Landfill ban ASR + ban mixed treatment (M16ab);	30% recycling target for plastic (M15b);	Review of target levels for recycling and removal lists (M13b,M15b)
PO4 Collect More	Definition of minimum requirements for sector inspections (M19a); Clearer definition of ELVs (M19b);	Reporting of established sanctions (M17b); Obligations for dismantlers /recyclers to report CoDs (M18); VIN be made available to customs authorities (M19c);	Interoperability between vehicle registries (M20); Export requirement based on roadworthiness status(M21).	
PO5 EPR		EPR schemes established at national level (M22); Reporting on the PRO tasks achieved (M23); Cross-border EPR mechanism (M25);	Harmonised EPR fee modulation (M24)	
PO6 Cover more vehicles			Information to dismantlers and recyclers (M28); Mandatory ATF treatment Reporting obligation, CoD, VIN (M30), minimum EPR requirements for additional vehicles (M31); Study on regulatory extension of scope (M32)	Review on the regulatory extension of scope to new vehicles (M32)

ANNEX 9: CHEMICALS IN VEHICLES

9.1 Introduction and baseline

A large variety of chemicals, some of them classified as hazardous, are used in vehicles to provide different functionalities to coatings, alloys, electrical and electronic components, lubricants, hydraulic fluids and rubber, plastic, composite and textile elements used in their different parts. Depending on their nature, use and location in the vehicle such hazardous substances can potentially pose a risk during vehicle manufacture and its subsequent service life and will remain once the vehicle reaches its end-of-life.

The presence of such substances in materials that result from the disassembly, shredding and subsequent processing of the different vehicle fractions can pose a risk to the operators involved in the recycling operations and, if they remain embedded in the recovered materials (e.g. recovered alloys, plastic, etc) may make them unsuitable for their use as secondary raw materials. This is due to risks in their subsequent processing and use and as a consequence of commercial and reputational risks that may make them unattractive to the market due to quality and legal constraints brought about by the presence of these substances.

The presence of hazardous substances, especially of substances of concern²⁰⁷, in vehicles and in the materials subsequently recovered from them, can hinder the circularity of materials in vehicles, reducing their uptake into the economy and can potentially be a risk to human health and the environment during their whole life-cycle. In turn this can have clear consequences in terms of adverse human and environmental health effects (due to exposure / releases of substances) and reduce the amounts of materials recovered from vehicles, thereby putting greater stress on primary resources, requiring additional waste disposal capacities and increasing the overall amount of greenhouse gas emissions typically associated to the use of primary materials which have to be used if recycled materials cannot.

Examples of the presence of hazardous substances in vehicles and vehicle components, especially of substances of concern, have been documented, including:

- phthalate plasticisers and antimony trioxide²⁰⁸ as a flame retardant in PVC synthetic leather, used massively in the interiors of cars (seats, door and instrument panels, sun visors, etc).
- platinum compounds in catalytic converters²⁰⁹.
- Polybrominated diphenylethers (PBDEs)²¹⁰ ²¹¹ ²¹² listed as persistent organic pollutants under the Stockholm Convention in plastics and foams found in ELVs.

²⁰⁷ As defined in Article 2(28) of the Commission proposal on a Regulation establishing a framework for setting ecodesign requirements for sustainable products. COM(2022) 142 final.

²⁰⁸ Zattini, G. et al., (2019) Safer Plasticized Polyvinyl Chloride Synthetic Leathers for the Automotive Industry: Evaluation of Alternatives to Antimony Compounds as Flame Retardants.

<https://4spepublications.onlinelibrary.wiley.com/doi/abs/10.1002/pen.25121>

²⁰⁹ Mergfét, R., et al (2001).Evaluation of the health risk of platinum group metals emitted from automotive catalytic converters. <https://pubmed.ncbi.nlm.nih.gov/11327390/>

²¹⁰ Leslie. H.A., et al. (2016). Propelling plastics into the circular economy — weeding out the toxics first. <https://www.sciencedirect.com/science/article/pii/S0160412016301854>

- Metallic and other inorganic substances that can be released in the form of fine particles as wear debris from brake linings²¹³.
- Heavy metals²¹⁴ such as copper, zinc, lead, cadmium and nickel in automotive shredder residue²¹⁵ (ASR).
- Volatile Organic Compounds (VOCs) in interior materials of vehicles^{216 217}. VOCs such as decane, xylene, toluene, styrene and others have been detected in the indoor air of new vehicles as a result of their presence in hard plastics, elastomers, rubber, natural or synthetic leather, fabrics and fibres vehicles.

It is therefore necessary to have a better understanding about the presence of hazardous substances in vehicles and in components of vehicles and to better address the risks they may pose to human health and to the environment. In order to achieve this, and to further develop and provide legal clarity to the general minimisation provisions in Article 4(1)(a) of the current Directive, changes to the Directive would be required to:

- Update the definition of the term “hazardous substance” in Article 2(11) so as align it to that in Regulation (EC) No 1272/2008 (the CLP Regulation);
- Introduce a reference to the term “substance of concern” as defined in Article 2(28) of the Commission proposal for the Ecodesign for Sustainable Products Regulation (ESPR) as these hazardous substances are given particular priority under the chemicals strategy for sustainability and the ESPR;
- Expand the scope of the Directive to cover the impacts of substances in vehicles also to adverse effects on human health (and not only on the environment) and to ensure their full life cycle is considered, not focusing primary only on end-of-life and waste management stages
- Define and provide the means to restrict the presence of substances in vehicles, beyond the four substances²¹⁸ already regulated, including, if appropriate, substances which, for reasons other than their chemical risks, negatively affect the re-use and recycling of materials in the product in which they are present. At the same time, for legal certainty and continuity reasons, the existing four restrictions should remain and the existing exemptions to these be maintained and reviewed, as appropriate.

²¹¹ Leslie et al (2013): POP-BDE waste streams in the Netherlands: analysis and inventory, available at <https://www.informea.org/en/pop-stream-pop-bde-waste-streams-netherlands-analysis-and-inventory>

²¹² Oeko Institute (2018): Effects on ELV waste management as a consequence of the decisions from the Stockholm Convention on decaBDE, available at <https://www.oeko.de/fileadmin/oekodoc/ACEA-DecaBDE-final-report.pdf>

²¹³ Kukutschová, J., et al. (2009). Wear mechanism in automotive brake materials, wear debris and its potential environmental impact. <https://www.sciencedirect.com/science/article/pii/S004316480900163X>

²¹⁴ As defined in the Annex of Decision 2000/532/EC.

²¹⁵ González-Fernández, O., et al (2008). Heavy metals’ content of automotive shredder residues (ASR): Evaluation of environmental Risk. <https://pubmed.ncbi.nlm.nih.gov/17881104/>

²¹⁶ Faber, J., et al. (2014). Comparison of Air Pollution by VOCs Inside the Cabins of New Vehicles. https://www.researchgate.net/publication/274579827_Comparison_of_Air_Pollution_by_VOCs_Inside_the_Cabins_of_New_Vehicles

²¹⁷ Brodzik, K., et al. (2014). In-vehicle VOCs composition of unconditioned, newly produced cars. <https://www.sciencedirect.com/science/article/pii/S1001074213604593>

²¹⁸ Lead, cadmium, mercury and hexavalent chromium

9.1.1 9.1.1 Purpose of the measure

This measure complements the generic minimisation provision in Article 4(1) of the current Directive, which states that *“In order to promote the prevention of waste Member States shall encourage, in particular: (a) vehicle manufacturers, in liaison with material and equipment manufacturers, to limit the use of hazardous substances in vehicles and to reduce them as far as possible from the conception of the vehicle onwards, so as in particular to prevent their release into the environment, make recycling easier, and avoid the need to dispose of hazardous waste”*.

Following further analysis and prioritisation of information about such substances present in vehicles, this measure provides a specific mechanism to impose restrictions on the placing on the market and use of specific hazardous substances, in particular substances of concern, in vehicles and parts of vehicles. These restrictions should address risks to human health and to the environment resulting from the presence of specific substances in vehicles and their parts. They could be envisaged to range from complete bans to specific limitations (e.g. of use in certain parts or materials in vehicles) or to define risk management measures (addressing containment of substances, limiting emissions, setting maximum concentration limit values, etc).

Baseline

The current baseline is defined, on one hand by the existing restriction on certain substances under the ELV Directive and on the other, by restrictions imposed on the use of substances under other legal instruments. More specifically:

9.1.2 9.1.2 Under ELV: Restrictions of substances under the ELV Regulation

- Article 4(b) of the ELV Directive requires Member States to ensure that four substances (lead, cadmium, mercury and hexavalent chromium) are not present in materials and components of vehicles placed on the market after 1 July 2003 other than in cases listed in Annex II under the conditions specified therein.
- Exemptions can be added to Annex II in cases where the use of one of these substances is not avoidable (and can be removed when it becomes avoidable (Article 4(2)(b)(ii – iii)). Annex II of the Directive currently contains **42 exemptions** to the prohibition on the four substances. Of these, **four exemptions for lead are still “active”**, with set review dates in 2024 and 2025 [2(c)(ii), 3, 8(e) and 8(g)(ii)]. In addition, there are **three specific exemptions relevant to batteries** in vehicles [5(a), 5(b) (lead) and 16 cadmium]. Exception 5(b) which refers to lead in batteries used in 12 V applications and in 24 V applications in special purpose vehicles has to be reviewed in 2025.
- All other exceptions in Annex II are “inactive” in the sense that they do not have a review date. They deal with exceptions which allow the use of the substance in spare parts for vehicles and in vehicles that were type-approved before a certain date (already elapsed).

- In addition, the current chapeau of Annex II provides an additional general exemption²¹⁹ for the four substances in vehicles which reads: “*a maximum concentration value up to 0,1 % by weight in homogeneous material for lead, hexavalent chromium and mercury and up to 0,01 % by weight in homogeneous material for cadmium shall be tolerated*”.
- It should be noted that the prohibition on the four substances and their exemptions in Annex II apply to vehicles in scope of the ELV Directive, that is, any vehicle designated as category M1 or N1 defined in Annex IIA to Directive 70/156/EEC, and three-wheel motor vehicles as defined in Directive 92/61/EEC, but excluding motor tricycles. Other vehicles such as **lorries and motorcycles are not in the scope of the current Directive**.

9.1.3 9.1.3 Under REACH (or as applicable under the POPs Regulation²²⁰)

Title VIII of REACH contains the restriction provisions defined under the Union’s umbrella chemicals legislation. Restrictions provide a legal instrument to prohibit or limit the manufacture, placing on the market or use of substances on their own, in mixtures or in articles (including vehicles and their parts). Restrictions adopted under REACH are listed in Annex XVII to the Regulation, which lists specific substances or groups of substances and where the text of each entry defines the specific scope and conditions of the restriction and any applicable exemptions.

Article 68(1) of REACH envisages the amendment of Annex XVII of REACH when there is an unacceptable risk to human health or the environment, arising from the manufacture, use or placing on the market of a substance, which needs to be addressed on a Union-wide basis. Articles 69 – 73 of REACH define a procedure according to which, starting from a restriction dossier prepared by a Member State, or by the European Chemicals Agency (ECHA) at the request of the Commission, the Agency assesses and issues an opinion to the Commission on the content and merits of the restriction proposed. If the requirements for a restriction are fulfilled, Article 73 requires the Commission to prepare an amendment of Annex XVII, which is decided upon via the regulatory procedure with scrutiny (*comitology*).

REACH establishes no limitation on the possibility to restrict substances in vehicles. Vehicles or the use of substances in vehicles or components of vehicles is not listed among the exclusions from the scope of REACH defined in its article 2(1). Similarly, Article 67(2) of REACH only exempts from the scope of the restriction title the use of substances in cosmetic products, as far as it concerns risks to human health. Annex XVII to REACH already contains some restrictions on substances of relevance to vehicles:

- Polycyclic-aromatic hydrocarbons (PAH) in tyres (entry 50)

²¹⁹ The origin to this note can be found in recital 7 of Decision 2002/525/EC which stated: “Since it is evident that a total avoidance of heavy metals is in some instances impossible to achieve, certain concentration values of lead, mercury, cadmium or hexavalent chromium in specific materials and components should be tolerated, provided that these hazardous substances are not intentionally introduced”.

²²⁰ Regulation (EU) 2019/1021 implements the Union’s international commitments under the Stockholm Convention and is applicable for substances identified as POPs under the Convention. This includes limitations on the manufacture, placing on the market and use of POP substances, including, as applicable, to substances in vehicles.

- Phthalates (DEHP, DBP, BBP, DIBP) in a concentration equal to or greater than 0,1 % by weight of plasticised material in articles (entry 51). There is an exception for motor vehicles within the scope of Directive 2007/46/EC, placed on the market before 7 January 2024, or articles, whenever placed on the market, for use exclusively in the maintenance or repair of those vehicles, where the vehicles cannot function as intended without those articles.
- Decabromodiphenyl ether (decaBDE) (entry 67, now repealed) which banned the use and placing on the market of this substance on its own, in mixtures or in articles at a concentration above 0.1%. The restriction contained an exception that allowed the use of DecaBDE for the production of spare parts for motor vehicles as well as for agricultural and forestry vehicles. Following the listing under the Stockholm Convention of decaBDE this restriction was subsequently removed from REACH and introduced in Annex I to Regulation (EU) 2019/1021 (the POPs Regulation), specifying a limit of 500 mg/kg for the sum of listed PBDEs in articles with an exception to allow its use in the manufacture of spare parts for motor vehicles within the scope of Directive 2007/46/EC produced before 15 July 2019, either until 2036 or the end of service life of those motor vehicles, whichever date comes earlier.
- Formaldehyde: a proposal for a restriction on formaldehyde and formaldehyde-releasing substances has been developed under REACH to limit these substances in certain articles, covering road vehicles if the concentration of formaldehyde in the interior of those vehicles exceeds a certain limit value in air. It is envisaged that the restriction will be adopted in the first half of 2023.
- Additionally, Article 68(2) of REACH provides for a simplified restriction procedure for substances on their own, in a mixture or in an article which meet the criteria for classification in certain hazard classes (carcinogenicity, germ cell mutagenicity or reproductive toxicity, category 1A or 1B), if they could be used by consumers. In such cases a restriction to consumer use can be proposed by the Commission and Annex XVII can be amended by comitology, without the need to follow the process defined in Articles 69 to 73 (i.e. without the intervention of ECHA). Such a procedure has to date been used, for example, to restrict the presence of a large group of substances in clothing and related accessories, other textiles and footwear²²¹.
- Title VII of REACH provides another instrument to address the risks posed by chemicals by imposing specific authorisation requirements. More specifically, to ensure that risks from substances of very high concern (SVHCs) are properly controlled and that these substances are progressively replaced by suitable alternative substances or technologies where economically and technically viable. Under this instrument, all manufacturers, importers and downstream users applying for authorisations must analyse the availability of alternatives and consider their risks as well as the technical and economic feasibility of substitution.

²²¹ Commission Regulation (EU) 2018/1513. https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ:L:2018:256:TOC&uri=uriserv:OJ.L_.2018.256.01.0001.01.ENG

- A manufacturer, importer or downstream user cannot place a substance on the market for a use, or use it himself, if that substance is included in Annex XIV, unless the use(s) of that substance on its own or in a mixture or the incorporation of the substance into an article, for which the substance is placed on the market or for which he uses the substance himself, has been authorised. A number of substances relevant to vehicles, in particular specific chromium VI compounds such as chromium trioxide, are listed in Annex XIV and have resulted in applications for authorisation, for instance, for uses in chromium plating of vehicle components or for use of chromium VI in the cooling circuits of portable refrigerators for use in vehicles.
- It should be noted that the REACH Regulation is currently under revision and that it is envisaged that specific aspects of the functioning of the restriction and the authorisation processes may be subject to some changes.

9.1.4 9.1.4 Under the Batteries Regulation

(as per political agreement on the Commission's proposal achieved on 9 December 2022).

- On 10 December 2020 the Commission adopted a proposal on a Regulation on Batteries and Waste Batteries and repealing the previous Directive 2006/66/EC on batteries. A political agreement was reached on the proposal on 9 December 2022. It is envisaged that the new Regulation on Batteries will be adopted in the first half of 2023.
- Under the new Regulation, specifically its Articles 6 and 71, a procedure is introduced to restrict substances in batteries when there is an unacceptable risk to human health or the environment, arising from the use of a substance in the manufacture of batteries, or from the presence of a substance in the batteries when they are placed on the market, or during their subsequent life cycle stages, including during repurposing or during the treatment of waste batteries, that is not adequately controlled and needs to be addressed on a Union-wide basis.
- Under this upcoming regulation, which is *lex specialis* for substances in batteries, these can be restricted following a process which mimics that defined under REACH, with the support of the European Chemicals Agency (ECHA) and subsequently enacted via delegated acts under the Batteries Regulation. This is relevant to the current restrictions on lead and cadmium under the ELV Directive and particularly to its exceptions for use of lead and cadmium in batteries in vehicles.
- The current provisionally agreed text of the draft Regulation on Batteries states, in its recital 15 that “*Batteries used in vehicles which benefit from an exemption under Annex II to Directive 2000/53/EC of the European Parliament and of the Council should be excluded from the prohibition to contain cadmium*”. In addition, Annex I of the draft regulation specifies that “*Portable batteries, whether or not incorporated into appliances, light means of transport or vehicles, shall not contain more than 0,002% of cadmium (expressed as cadmium metal) by weight*”.

9.1.5 9.1.5 Objectives

The three measures analysed below intend to address the problems caused by the presence of hazardous substances, especially those that qualify as substances of concern, in vehicles and their component parts. The **objectives** are to:

- Eliminate or minimise the risks to human health and the environment, throughout the whole life cycle of vehicles and components of vehicles, brought about by hazardous substances, especially substances of concern, and;
- Ensure that recycled materials obtained from treatment of end-of-life vehicles are to the greatest extent possible free of toxic substances, safe and fit-for-purpose, thereby increasing the trust of producers and of consumers in secondary materials obtained from them, reducing the use of primary materials, and;
- Define an efficient, cost effective, evidence-based and reliable mechanism to assess the merits of introducing restrictions on the use or the presence of substances in vehicles or components of vehicles and to make such restrictions become law. In addition, the mechanism defined should allow amending existing restrictions on four substances and their exceptions, as appropriate, as well as any restrictions of new substances and their possible exemption.

9.2 Assessment of measure 5a – Restrictions of substances under the ELV Regulation

9.2.1 9.2.1 Description of the measure

This measure provides a mechanism for restricting substances used in vehicles and components of vehicles, relying on an assessment by the relevant committees²²² of the European Chemicals Agency (ECHA) of restriction dossiers prepared by ECHA at the request of the Commission, or by Member States on their own initiative. The process would be run under enhanced provisions in the ELV Regulation and any restrictions on new substances would be enacted via delegated acts under this regulation, based on opinions submitted by ECHA to the Commission. The main features of the measure are:

- Limitations on all vehicle-relevant chemicals remain in ELV²²³.
- A mechanism is defined under ELV to introduce new restrictions for substances, via delegated acts, which would be listed in a new Annex to the Regulation, with the support of ECHA and subject to dedicated resource allocation (i.e. similar approach to that in the Batteries Regulation).
- The objectives and scope in Articles 1 and 4 are changed to cover impacts on human health and the environment across the full life cycle of vehicles (and not only focus on waste management).
- Existing restrictions on four substances and their exemptions are maintained under ELV and reviewed as appropriate, via delegated acts, with the support of ECHA (rather than using contractors to the Commission, as currently). Relevant active exemptions having a review date [Annex II points 2(c)(ii), 3, 8(e) and 8(g)(ii)] are maintained and reviewed under ELV, with the support of ECHA and subject to specific resource allocation for this task. Other exemptions that do not require a review are also maintained in ELV.

²²² Committee for Risk Assessment (RAC) and Committee for Socio-economic Analysis (SEAC) defined under article 76 of the REACH Regulation.

²²³ It should be noted that the requirements under the Authorisation title of REACH for those substances of very high concern (SVHCs) listed in Annex XIV to REACH (such as certain chromium VI salts) apply, regardless of whether restriction provisions for substances in vehicles remain in ELV or are taken-up by REACH or sector / product-specific legislation.

- The scope of the assessment of exemptions is widened beyond the current description in Article 4(2) of the ELV Directive, which only takes into account whether “*the use of the substances is unavoidable*”. A broader approach, similar to that used in assessing applications for authorisation under REACH, including an analysis of alternatives, a socio-economic analysis and a comparative analysis of the health and environmental impacts of alternatives (at least at the level of comparing the hazards of the different alternative substances) should be included.
- Exemptions from the use of lead and cadmium under the ELV Directive which are specific to batteries [Annex II points 5(a) and 5(b) (lead) and 16 (cadmium)] are, following a transition process, taken up by the Batteries Regulation (*lex specialis*) and removed from the scope of Annex II of the Regulation replacing ELV Directive, via delegated acts.
- The possibility to limit substances of concern in vehicles, for sustainability reasons that do not relate primarily to chemical risks, could be introduced, if required, in the Regulation replacing ELV Directive (similarly to what has been proposed in the Ecodesign Regulation and in the proposal of Regulation on Packaging and Packaging Waste (PPWR)).
- For any expansion in scope of new Regulation replacing ELV Directive to L-category vehicles, lorries and buses, a new dedicated restriction process would be run under the new Regulation, via delegated acts, with the support of ECHA and/or consultants.
- The definition of “hazardous” substance in the new Regulation is updated to be consistent with CLP Regulation. Similarly to the approach in the PPWR, reference to the definition of “substance of concern” is also to be included²²⁴.

The current text of the Directive would also have to be modified in the new Regulation in order to clearly assign to ECHA this task together with having the required budgetary allocation, indicated in its financial fiche.

²²⁴ The PPWR refers to Article 2(28) of proposal for a Regulation on Eco-design for Sustainable Products, according to which substances of concern means a substance that:

- (a) meets the criteria laid down in Article 57 and is identified in accordance with Article 59(1) of Regulation (EC) No 1907/2006; or
- (b) is classified in Part 3 of Annex VI to Regulation (EC) No 1272/2008 in one of the following hazard classes or hazard categories:
 - carcinogenicity categories 1 and 2,
 - germ cell mutagenicity categories 1 and 2,
 - reproductive toxicity categories 1 and 2, [to be added in the course of the legislative procedure once Regulation (EC) No 1272/2008 contains these hazard classes: Persistent, Bioaccumulative, Toxic (PBTs), very Persistent very Bioaccumulative (vPvBs); Persistent, Mobile and Toxic (PMT), very Persistent very Mobile (vPvM); Endocrine disruption],
 - respiratory sensitisation category 1,
 - skin sensitisation category 1,
 - chronic hazard to the aquatic environment categories 1 to 4,
 - hazardous to the ozone layer,
 - specific target organ toxicity
 - repeated exposure categories 1 and 2,
 - specific target organ toxicity
 - single exposure categories 1 and 2; or
- (c) negatively affects the re-use and recycling of materials in the product in which it is present

Consequently, under this measure, the restriction procedure for substances in vehicles would be contained, as a self-standing process, under the new Regulation and would have to be specified via articles to be introduced in the amended legal proposal. This approach would mimic that followed in the Commission proposal for a Regulation concerning batteries and waste batteries²²⁵ and, more specifically that contained in its Articles 6 and 71. As a modification to this approach, this measure would also grant Member States the right of initiative to propose restrictions. This change takes into account the provisional political agreement achieved between the European Parliament and the Council in the trilogue held on 9 December 2022.

9.2.2 9.2.2 Effectiveness / efficiency

This measure mimics the restriction dossier preparation and assessment processes under REACH, where ECHA (at the request of the Commission) or a Member State submits a restriction dossier documenting and justifying the restriction measure. Subsequently, the merits of a proposed restriction are assessed by the relevant Committees of ECHA which then delivers an opinion to the Commission. In terms of procedure, the difference lies in that the decision-making would in this case be done with the advice of a dedicated expert group established under the new Regulation and enacted via delegated acts under this new regulation (instead of under REACH).

From the point of view of the scope, the stand-alone mechanism proposed could overcome the limitation of REACH that excludes the possibility of imposing specific risk management measures on the handling of waste from end-of-life vehicles. This aspect, which was highly relevant and debated in the negotiations of the Commission's proposal for a Batteries Regulation, is deemed less important in the case of vehicles (see further analysis under *Conclusions*, below).

As regards the management and review of existing exemptions this measure maintains the *status quo* under ELV, with a well-established process that is known to stakeholders and would require no legal changes. The only difference with the baseline, in this regard, is that the Commission would be supported by ECHA, instead of by external consultants, thereby providing, potentially, a more homogeneous, stable and robust assessment of exemptions.

For the purpose of restricting **new substances** in vehicles and components of vehicles, this measure would have a similar effectiveness to that of measure 5b, with the caveat that procedural and technical experience to restrict substances under ELV is currently lacking, as no new substances have been restricted under this legislation and setting up the process, in cooperation with ECHA would likely have a steep initial learning curve (and therefore an initial somewhat lower efficiency). As regards **existing restrictions** and the maintenance of their derogations Measure 5a, which is very similar to the *status quo*, is not expected to bring about any significant changes in this regards.

From then point of view of effectiveness in protecting human health and the environment, extending the objectives and scope of the ELV Regulation to include human health among its protection targets, requiring a full-life cycle approach, updating the definition of “hazardous

²²⁵ COM(2020) 798 final and 2020/0353 (COD). . <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52020PC0798>

substance” and introducing a reference to “substances of concern” is envisaged to be an improvement both in terms of protection coverage, legal clarity and alignment with current chemicals and product legislation and policy documents. This applies in an equal manner to Measures 5a, 5b and 5c.

By providing such legal certainty about the objectives of the reviewed ELV Regulation and the scope of substances for which minimisation of their use in vehicles is required, operators will be able to better identify and implement measures to substitute or minimise such use. This measure should therefore lead to the minimisation of the presence of substances of concern in vehicles by introducing legal certainty as to the substances in scope.

9.2.3 9.2.3 Coherence

The European Green Deal²²⁶ requires the Commission to use better the EU’s agencies and scientific bodies and to move towards a process of ‘one substance – one assessment’. The Chemicals Strategy for Sustainability²²⁷ further specifies that the Commission will rationalise the use of expertise and resources by proposing the reattribution of technical and scientific work on chemicals performed under the relevant pieces of legislation to European agencies. The proposal to rely on the support of ECHA to carry out the assessment of all new restrictions of substances relevant to vehicles, as well as for the maintenance of existing restrictions and exemptions, is coherent with this approach. On the other hand, the proposal for the Ecodesign for Sustainable Products Regulation²²⁸ (ESPR), indicates in its Article 6(3) that *“Performance requirements based on the product parameter set out in Annex I, point (f), shall not restrict the presence of substances in products for reasons relating primarily to chemical safety”*²²⁹.

This approach, according to which, all restrictions on chemicals due to primarily their chemical risk, should not be done under specific product legislation but rather under REACH, also followed in the Commission’s recent proposal for a Regulation on Packaging and Packaging Waste²³⁰, would not be respected under Measure 5a and therefore, would be somewhat incoherent with the general approach proposed under product policy.

9.2.4 9.2.4 Ease of implementation

Similar to measure 5b, implementation of this measure for the restriction of new substances in vehicles would be relatively simple as the approach relies largely on procedures run by ECHA and already put in place and functioning under the REACH. In this case a separate decision-making procedure would take place under the new Regulation replacing ELV Directive which would require the drafting and adoption of a Commission delegated act, with the support of a dedicated waste expert group dealing with ELVs. Given that this expert group already exists and that the efforts to discuss and negotiate a measure therein would be similar to those under REACH, in the REACH Committee, no additional workload or difficulties in the

²²⁶ COM(2019) 640 final.

²²⁷ COM(2020) 667 final.

²²⁸ COM(2022) 142 final.

²²⁹ This is further explained in recital 22 which states that *“This Regulation should not enable the restriction of substances based on chemical safety, as done under other Union legislation. Similarly, this Regulation should not enable the restriction of substances for reasons related to food safety.”*

²³⁰ COM(2022) 677 final.

development of new substance restrictions, and their exemptions are envisaged, beyond those to ensure the availability of adequate chemicals risk management expertise, and the initial procedural learning, in the responsible Commission service.

As regards the **maintenance and review of exemptions to existing restrictions** on the four substances, this measure reflects the *status quo*, with some improvements in terms of the scope of the assessment of alternatives and in relying on ECHA for this assessment. From the point of view of implementation this is legally less problematic and procedurally simpler than a potential transfer of the existing ELV restrictions to REACH, which is currently not well suited for the systematic review of multiple exemptions to restrictions (heavy procedure).

From the practical point of view, and as a result of the distribution of responsibilities in the Commission, the procedure under such a dedicated instrument would most likely be lighter and potentially somewhat faster, given the absence of co-responsibility of DG ENV and DG GROW in the procedure under the new Regulation replacing ELV Directive, contrary to the situation under REACH. It is also likely that, under the specific procedure described in this measure, the prioritisation of restrictions of substances in vehicles, with respect to other substances, could be dealt with advantageously, benefiting from a dedicated budgetary allocation and legal mandate to ECHA (as opposed to dealing with all restriction priorities under the general REACH workflow and budget).

As regards the updated definition of scope in terms of definition of hazardous substances and substances of concern, protection of human health and full-life cycle approach, this should not pose a major difference in terms of implementation, given that having information about hazardous substances in vehicles (as defined originally under the Dangerous Substances Directive – 67/548/EEC²³¹) was already required to meet the existing minimisation obligation defined in Article 4(1)(a) of the ELV Directive²³² (“*to limit the use of hazardous substances in vehicles and to reduce them as far as possible*”).

Therefore, the proposed amended provisions does not change due-diligence obligation of manufacturers to undertake all reasonable efforts to know what substances are present in the vehicles and components of vehicles they place on the market. Information on the classification of substances can be found in Annex VI of the CLP Regulation (harmonised classifications) and in the C&L inventory²³³ maintained by the European Chemicals Agency. Consequently, in this sense, no additional burdens are envisaged in terms of implementation.

9.2.5 9.2.5 Administrative burden

No additional administrative burden would be imposed upon the Commission or Member States by running new substance restrictions under the new Regulation as compared to the preparation and running of restriction proposals for new substances under REACH. As described above the only differences would be internal, in terms of the services responsible

²³¹ Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances (OJ 196, 16.8.1967, p. 1), repealed by the CLP Regulation.

²³² Article 2(11) of the ELV Directive, as originally adopted in 18 September 2000, stated: “hazardous substance” means any substance which is considered to be dangerous under Directive 67/548/EEC”

²³³ <https://echa.europa.eu/information-on-chemicals/cl-inventory-database>

for overseeing the restriction process, ensuring coordination with ECHA and drafting and negotiating the draft proposals.

Additional administrative burden is to be expected for stakeholders that would be affected by the scope of a new specific restriction on a substance used in vehicles. Such burden would translate into efforts to comply with the proposed restriction, including the implementation of required risk management measures or those required to substitute or reduce the use of the restricted substance.

For the review of **exemptions to existing restrictions** on the four substances, the burden of doing these assessments under Measure 5a and proposing amendments closely resembles the current baseline, with efforts by the responsible Commission services to coordinate with contractors to support the assessment, being shifted towards efforts to coordinate with ECHA (which would likely be somewhat smaller in the sense that tendering procedures by the Commission would not be necessary). Assessment work supporting the granting of exceptions currently done by contractors would be taken over by ECHA, with a level of dedication that, on a first assessment, could resemble that of assessing an application for authorisation under REACH (this effort being potentially lower for reviews of existing exemptions). Adequate resourcing of ECHA, to undertake this support task to the Commission would therefore have to be envisaged in the financial fiche for the new regulation proposal. Assessment of possible **exemptions from new restrictions to be developed in the future** would follow an equivalent path and would represent a similar, but additional effort, to that done to maintain existing exemptions.

As regards the updated definition of scope in terms of definition of hazardous substances and substances of concern, protection of human health and full-life cycle approach, no additional burden is expected for authorities as compared with the previous provision, with the exception of possible work under ELV to define substances of concern which may hinder recycling for reasons not primarily associated to chemical safety. This work would be the same under all options considered and cannot be anticipated at this time, given specific substances falling under this category remain to be identified. In both cases a general obligation regarding minimisation of hazardous substances is defined that can only be controlled via targeted market surveillance or inspection and audit of materials used in vehicle manufacturing.

No significant additional administrative burden beyond that related to substances of concern which may hinder recycling for reasons not primarily associated to chemical safety, is envisaged for producers of vehicles given the obligation to be informed about hazardous substances in materials used to manufacture vehicles, and the associated supply chain communication due diligence, already exist, in order to comply with the provision of Article 4(1)(a) of the ELV Directive. Furthermore, it is worth noting that supply chain communication obligations are defined in article 33 of REACH for “substances of very high concern” have applied for over a decade and that the automotive industry has in place an exhaustive system (IMDS) for managing information on substances in vehicles²³⁴. This provides a solid basis for the sector to handle information on hazardous substances in vehicles be it under the previous or the updated definition.

²³⁴ In addition, the automotive sector has notified information on SVHCs in articles to the SCIP database, pursuant to Article 9 of the Waste Framework Directive, making this information available to the general public, supply chain actors and waste managers.

9.2.6 9.2.6 Economic impacts

Economic impacts resulting from restrictions fall to a large extent on the stakeholders that have an economic interest in the manufacture or use of the substance/s that are restricted. These are case-specific and, in the case of substances used in vehicles, can impact manufacturers/ importers of the substances or mixtures themselves as well as on the OEMs manufacturing components for vehicles or assembling the full vehicles.

These economic impacts can take the form of substitution costs, process adaptation costs, loss of revenue due to decreased sales of the chemicals concerned, etc. An analysis published by ECHA in 2021 of the costs and benefits of restrictions under REACH done between 2016 and 2020 indicate that the monetised health benefits to citizens, including reduced risk of cancers, sexual development disorders, sensitisation and occupational asthma are estimated to be around 2.1 billion EUR per year while the associated costs add up to 0.5 billion EUR ²³⁵.

Every restriction adopted under REACH has associated enforcement costs which are borne by the competent authorities of each Member State. By way of illustration of potential enforcement costs for authorities, ECHA has included, in a number of recent opinions²³⁶ on restriction dossiers, an estimate of average enforcement costs across EU Member States which they have determined to be approximately EUR 55,600 per year (as total for all Member States). These costs are reported to be an order-of-magnitude estimate of administrative costs, are not specific to any individual restriction and do not include testing costs. This same figure is quoted in a recent restriction proposal by France²³⁷. It is expected that enforcement costs would be comparable for restrictions on substances in vehicles enacted under the new Regulation.

These costs are not negligible but seem well within the possibilities of national competent authorities, and in line with enforcement costs for purposes other than restriction of substances in vehicles, done under REACH.

From the point of view of costs to the Commission's budget it is estimated that two full-time equivalents per year, in term of human resources, would have to be allocated to ECHA in order to support the Commission to deal with new substance restrictions under ELV as well as with reviews of existing or new entries. Resources for ECHA associated with new restrictions on substances in batteries, or associated to reviewing the current lead and cadmium exceptions for batteries in vehicles defined under ELV-related legislation are already addressed in the financial fiche of the Batteries Regulation and therefore do not need further consideration here.

Resources, largely equivalent to those currently used in external contractors, amounting to approximately 60.000 EUR per contract and 0.1-0.2 FTE per year would have to be allocated

²³⁵ Costs and benefits of REACH restrictions proposed between 2016-2020. ECHA (2021). https://echa.europa.eu/documents/10162/17228/costs_benefits_reach_restrictions_2020_en.pdf/a96dafc1-42bc-cb8c-8960-60af21808e2e?t=1613386316829

²³⁶ Opinion on PFHxS restriction (June 2020). <https://echa.europa.eu/documents/10162/fdaed5b0-b6e4-9a21-b45d-ca607c05f845>; Opinion on PFNA, PFDA, PFUnDA, PFDoDA, PFTrDA, PFTDA; their salts and Precursors (September 2018) - <https://echa.europa.eu/documents/10162/3336e40c-b52c-d9f6-3745-3b4caf61599e>

²³⁷ Annex XV restriction dossier for (certain) substances in single-use baby diapers (15 December 2020). <https://echa.europa.eu/documents/10162/99f020fd-e8ae-1b66-4fe6-0ec40789db8a>

to ECHA to support the Commission in reviewing the active exemptions that currently remain in the Directive. This is already factored in the estimation of 2 FTE indicated above.

9.2.7 9.2.7 Social impacts

A quantitative estimate of the **health benefits** that the restriction of further substances of concern in vehicles would bring about could not be developed in the context of this impact assessment and will certainly be very case and substance specific. The referred analysis published by ECHA in 2021 on the costs and benefits of restrictions²³⁸ does however provide a clear indication of average benefits of restrictions under REACH and can be considered as an indication of the costs and benefits of restrictions on substances that could be developed under the new regulation replacing ELV Directive.

Health benefits, for instance, in terms of reduced risk of cancers, disorders in sexual development, sensitisation and occupational asthma were equivalent to over 2.1 billion EUR per year. These health benefits or reduced risks relate to all observed adverse health effects for more than 7 million consumers and workers per year. Since 2010, there have been 12 cases where the benefits of restriction could be monetised. For these cases, the annual benefits amounted to 2.1 billion EUR – four times higher than the associated costs of 0.5 billion EUR.

Under Measure 5a it would be possible to overcome the limitation in REACH which impedes imposing specific risk-management measures on activities which take place once vehicles become waste. From this point of view, Measure 5a could be seen to provide a somewhat more effective tool to ensure protection of human health, especially workers, from the substances of concern in vehicles, especially during waste management operations.

9.2.8 9.2.8 Environmental impacts

Similar to social / health impacts, a quantitative estimate of the environmental benefits that the restriction of substances of concern in vehicles would bring about could not be estimated in the context of this impact assessment and will certainly be very case and substance specific. The referred ECHA cost-benefit study on REACH restrictions indicated a reduction of 95,000 tonnes of environmental emissions of the regulated substances per year (although potentially only a fraction of this figure would be relevant to substances used in automobiles). This leads to potential health benefits through a cleaner environment and reduced exposure to hazardous chemicals in water, food and air.

For the provisions on the four substances restricted in the ELV Directive, it can be concluded that the environmental benefits have been achieved. An ex-post analysis of the restriction on the four substances shows environmental benefits of past restrictions: lifecycle emission reductions between 2000 – 2005 for **lead** were estimated at 99.6%, for **cadmium** at 96% and for **Cr(VI)** at 99.99%²³⁹.

Overall, environmental impacts are expected to be similar in the case of Measures 5a and 5b. Under Measure 5a it would be possible to overcome the limitation in REACH which impedes imposing specific risk-management measures on activities which take place once a material

²³⁸ Ibid.

²³⁹ Oeko-Institut 2010 on behalf of ACEA.

becomes waste^{240 241}. From this point of view measure 5a could be seen to provide a somewhat more effective tool to ensure protection of the environment from the substances of concern in vehicles, also during waste management operations.

9.2.9 9.2.9 Stakeholder views

Feedback obtained from the open public consultation (OPC) on whether the revised ELV Directive should ban hazardous substances in vehicles, taking into account that restrictions on hazardous substances are also specified in other pieces of EU legislation (notably REACH) indicates that:

- 66 of the responding stakeholders (32%) were of the view that all substances in vehicles should be regulated in the future under chemicals regulation.
- 32% of responding stakeholders indicated that substances currently prohibited under ELV legislation should remain there, but that future prohibitions should be addressed under chemical legislation. In practice this would mean that for all new substance prohibitions, 64% of stakeholders would prefer regulation under chemical legislation than under new legal instrument regulating the ELVs.
- Only 20% (41 individuals) were of the opinion that all substances in vehicles should continue to be regulated under ELV legislation.
- For waste management operators, public authorities, environmental NGOs and dealers and repair shops the distribution between these answers was similar.
- Automotive producers had a stronger tendency to support the options where chemical legislation would be used for future substance prohibitions (not for existing ones) as opposed to the ELV Directive.

9.3 Assessment of measure 5b – Restrictions of substances under REACH²⁴² and other existing legislation

9.3.1 9.3.1 Description of the measure

Under Measure 5b, the restriction of substances in vehicles and component parts of vehicles would be done under other existing legislation and, in particular REACH (the EU umbrella legislation on chemicals) and, as appropriate, under the Batteries Regulation²⁴³ or the Regulation on Persistent Organic Pollutants (POPs)²⁴⁴. This would in particular mean that no dedicated restriction provisions would remain under the new Regulation replacing ELV Directive for substances to be restricted due to primarily, their chemical risks.

²⁴⁰ Article 2(2) of REACH states that “Waste as defined in Directive 2006/12/EC of the European Parliament and of the Council is not a substance, mixture or article within the meaning of Article 3 of this Regulation”

²⁴¹ Recital 14a of the politically agreed text of the draft Batteries Regulation states: “This Regulation should complement the REACH and CLP Regulations and allow the adoption of risk management measures related to substances including the waste phase”. See document 5469/23 dated 18 January 2023. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CONSIL:ST_5469_2023_INIT&from=EN

²⁴² Registration, Evaluation, Authorisation and Restriction of Chemicals. Regulation (EC) No 1907/2006.

²⁴³ COM(2020) 798 final and 2020/0353 (COD). Political agreement achieved in trilogue of 9 December 2022.

²⁴⁴ Regulation (EU) 2019/1021 on Persistent Organic Pollutants.

The prohibitions and restrictions on substances regulated under the Stockholm Convention (such as some PBDEs), and any exemptions to these relevant to vehicles, would be addressed under Regulation (EU) 2019/1021 on Persistent Organic Pollutants (POPs)²⁴⁵ as this is the EU instrument that implements the chemical prohibitions and restrictions agreed internationally under the Convention. For substances found in the batteries used in vehicles, the recently agreed Batteries Regulation (adoption pending) would be *lex specialis* for this purpose and would be used for adopting restrictions of chemicals relevant to batteries, preferentially over REACH.

The possibility to expand Directive 2011/65/EU (the RoHS Directive)²⁴⁶ to address electronic components of vehicles was considered but not further analysed given that:

- RoHS Directive manages its exceptions in an “authorisation-like” system, where operators make requests for exceptions and for their renewal (this differs from the ELV Directive approach);
- Criteria for granting derogations under RoHS Directive are different from those in ELV Directive and, although similar, are developed in lesser detail than for restrictions under REACH. Given that REACH provides an exhaustive methodology to assess the impacts of restrictions on chemicals on human health on the environment through their entire life cycle, as well as of social and economic impacts, referral to REACH, which is the core EU legislation on chemicals, is considered more appropriate.
- RoHS Directive would only be relevant to two “active” exemptions laid down in ELV Directive Annex II with a review date [Annex II points 8€ and 8(g)(ii)]. The proportionality of introducing changes in RoHS Directive only for this purpose is questionable.
- Additionally, such changes in RoHS Directive would also have an impact on the scope of article types covered under the WEEE Directive and would require its amendment. The associated complexity and knock-down effects do not seem justified solely to deal with these ELV electronics-related exemptions under RoHS Directive.

Consequently, the new Regulation replacing ELV Directive would need to clarify that, unless there is *lex specialis*, all chemical risk related restrictions would be addressed under REACH. Where there is *lex specialis*, such as for batteries these would be addressed under the Batteries Regulation and, for the POP substances, under the POPs Regulation (to be clarified in the recitals of the measure). Current restriction provisions in the Directive as regards the four substances (cadmium, lead, mercury and hexavalent chromium) would be removed from the Regulation text and need to be taken up under REACH, following a transitional period, as appropriate.

The main elements of the proposed **Measure 5b** can be summarised into:

- Limitations due to chemical risks of all vehicle-relevant chemicals are removed from the ELV legislation²⁴⁷ and are addressed under REACH (or as appropriate the Batteries

²⁴⁵ Regulation (EU) 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants (OJ L 169, 25.6.2019, p. 45–77).

²⁴⁶ Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (OJ L 174, 1.7.2011, p. 88–110).

²⁴⁷ It should be noted that the requirements under the Authorisation title of REACH for those substances of very high concern (SVHCs) listed in Annex XIV to REACH (such as certain chromium VI salts) applies, regardless of whether restriction

Regulation or covered by the POPs Regulation). This would be done under the existing REACH procedures and workstreams for restriction or, as appropriate as defined under the POPs Regulation or the Batteries Regulation. In the case of REACH such amendments (of Annex XVII) would be done via the regulatory procedure with scrutiny. The legal feasibility of this would need to be further examined given the different legal basis and objectives for introducing restrictions under REACH and under the ELV Regulation. Amendments of the POPs Regulation and the Batteries Regulation would take place via delegated acts.

- The objectives and scope in Articles 1 and 4 are changed to cover impacts of chemicals in vehicles on human health and the environment across the full life cycle of vehicles (and not only focus on waste management). These objectives would be fulfilled under the processes carried-out under REACH, POPs and the Batteries Regulation.
- Existing restrictions on the four substances and their exceptions are no longer maintained under ELV legislation. These restrictions and their exemptions (currently in Annex II of the ELV Directive) would require an “*ad hoc*” transfer to REACH Annex XVII (restrictions Annex) during co-decision.
- Relevant active exceptions having a review date [Annex II points 2(c)(ii), 3, 8(e) and 8(g)(ii)] would be maintained and reviewed under REACH via dedicated reviews of the corresponding restrictions introduced during co-decision. Other “inactive” exceptions that do not require a review would also be listed in Annex XVII of REACH or in a separate dedicated Appendix, that would have to be introduced in REACH.
- Exceptions for the use of lead and cadmium under ELV Directive which are specific to batteries [Annex II points 5(a) and 5(b) (lead) and 16 (cadmium)] are, following a transition process, taken up by the Batteries Regulation (*lex specialis*) and removed from the new Regulation replacing ELV Directive.
- The possibility to limit substances of concern in vehicles, for sustainability reasons that do not relate primarily to chemical risks could be introduced in the ELV legislation if necessary (similarly to what has been proposed in the Ecodesign Regulation and in the proposal of Regulation on Packaging and Packaging Waste (PPWR)).
- For any expansion in scope of ELV legislation to **L-category vehicles, lorries, buses and trailers**, restrictions on the four heavy metals, and possible exceptions, and any restrictions on new substances, would require the initiation of new restrictions under REACH.
- The definition of “hazardous substance” in ELV legislation is updated to be consistent with CLP Regulation. Similar to the approach in PPWR, reference to the definition of “substance of concern” is also to be included²⁴⁸.

provisions for substances in vehicles remain in ELV legislation or are transferred to REACH or sector / product-specific legislation.

²⁴⁸ The PPWR refers to Article 2(28) of proposal for a Regulation on Eco-design for Sustainable Products.

Consequently, the text of the new Regulation replacing ELV Directive should clearly explain, most likely in recitals, the rationale of addressing all chemical-risk related restrictions under REACH or exceptionally, in other specific legislation such as the Batteries Regulation, as appropriate. It should also include provisions expanding its objectives and scope to address human health and environmental impacts of substances in vehicles throughout their full life cycle and also, to enable addressing within ELV legislation, the restriction of substances of concern for broader sustainability reasons, similarly to what is provided for in the Commission's proposals on Ecodesign and Packaging and Packaging Waste.

9.3.2 9.3.2 Effectiveness / efficiency

This procedure would use the effective and well-tested assessment and regulatory mechanisms under the REACH restriction title to restrict substances in vehicles for which there is an unacceptable risk to human health and/or the environment, and as applicable, under the generic risk management approach, relevant to substances in consumer articles as provided for under Article 68(2) of REACH.

Restriction dossiers would be prepared by ECHA, at the request of the Commission, or by Member States, which share the right of initiative in proposing restrictions under REACH. Following the assessment by ECHA's committees²⁴⁹, the Agency would deliver an opinion to the Commission, which would then serve to prepare a proposal to amend Annex XVII of REACH so as to include a specific restriction on a substance, or group of substances in vehicles. Such a decision would be adopted according to the regulatory procedure with scrutiny which requires an opinion of the members of the REACH Committee.

This well-tested approach requires approximately three years to execute, counting from the beginning of drafting a restriction dossier to the adoption of the restriction. REACH restrictions have over the years proven to be an efficient and cost-effective approach^{250 251} to protect human health and the environment from the risks posed by hazardous chemicals.

As indicated under Measure 5a as regards the management and review of existing exceptions on four substances, Measure 5b would pose considerable legal implementation challenges, as compared to 5a, given it is uncertain that an *ad-hoc* transfer of existing restrictions and their exemptions to Annex XVII of REACH during the co-decision process would be acceptable to co-legislators or legally sound (given this would circumvent the established restriction process defined under REACH). Furthermore, dealing under REACH with multiple exemptions, some of which are time-limited, and potentially subject to multiple reviews, is complex under REACH given this requires the preparation of new restriction dossiers and running the full restriction process. This is a heavy procedure to review exemptions in currently in ELV Directive which, in most cases, are rather small and specific.

²⁴⁹ Committee for Risk Assessment and Committee for Socio-economic Analysis

²⁵⁰ Cost and benefit assessments in the REACH restriction dossiers. ECHA (2016).

https://echa.europa.eu/documents/10162/17228/cost_benefit_assessment_en.pdf/b780a657-b4aa-4274-8c74-3a80bae8e883

²⁵¹ "The restriction procedure is generally working, though further improvements in efficiency are needed". Actions 8 to 10 include proposals to improve the restriction process, further enhance the involvement of Member States and better frame the application of the precautionary principle. Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee on Commission General Report on the operation of REACH and review of certain elements. Conclusions and Actions. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0116&from=EN>

As regards the updated definition of scope in terms of definition of hazardous substances and substances of concern, protection of human health and full-life cycle approach, these provisions apply to the three sub-measures considered (5a, 5b and 5c) and therefore considerations to this respect mentioned under 5a, are equally valid for this measure.

9.3.3 9.3.3 *Ease of implementation*

Ease of implementation of this measure as regards the restriction of **new substances** in vehicles **would be high** as no additional legal or procedural instruments need to be put in place. Following the possible prioritisation of substances to be addressed in vehicles, the Commission (or a Member State) could request ECHA, under REACH, to assess a dossier for the restriction of relevant substances in vehicles.

As explained in Measure 5a, the take-up by REACH of existing restrictions on the four substances and the review of their exemptions is legally problematic and procedurally complex, given REACH is currently not well suited for the systematic review of multiple exemptions to restrictions (heavy procedure) and given the different legal bases and objectives for introducing restrictions under REACH and under ELV.

From the practical point of view, specific restrictions of substances in vehicles would be handled under the same budgetary allocation and as part of the same work-stream and prioritisation exercise as all other restrictions under REACH. This means that priority substances flagged for restriction due to vehicle-specific concerns would, in a way, compete for resources and “slot allocation” with restrictions backed by other priorities and motivations under REACH. Such coordination work would be ensured by the Commission, in cooperation with Member States, in future reviews of the “Restrictions roadmap”²⁵² elaborated under REACH.

As regards the updated definition of scope in terms of definition of hazardous substances and substances of concern, protection of human health and full-life cycle approach, these provisions apply to the three sub-measures considered (5a, 5b and 5c) and therefore considerations to this respect mentioned under 5a, are equally valid for this measure.

9.3.4 9.3.4 *Coherence*

As discussed under Measure 5a, Measure 5b, which also relies on ECHA to carry out the assessment of all restrictions of substances relevant to vehicles, as well as for the maintenance of existing restrictions and exemptions, is coherent with the “one substance, one assessment” approach. In this case, Measure 5b would also be coherent with the general approach under the Ecodesign for Sustainable Products Regulation, according to which all restrictions on chemicals due to primarily their chemical risk, should not be done under specific product legislation but rather under REACH.

9.3.5 9.3.5 *Administrative burden*

No additional administrative burden would be imposed upon the Commission or Member States as compared to the preparation and running of restriction proposals for **new**

²⁵² See SWD(2022) 128 final. Restrictions Roadmap under the Chemicals Strategy for Sustainability. 25.04.2022. <https://ec.europa.eu/docsroom/documents/49734>

substances, as this already happens under REACH. As described under Measure 5a the only differences would be internal, in terms of the services responsible for overseeing the restriction process, ensuring coordination with ECHA and drafting and negotiating the draft proposals. Restrictions on substances of concern, that could be potentially required for substances hindering recycling for broader sustainability reasons, not primarily related to chemical safety, would remain under ELV and constitute an additional effort. This work would be the same under all options considered and cannot be anticipated at this time, given specific substances falling under this category remain to be identified.

Additional administrative burden is to be expected for stakeholders that would be affected by the scope of a specific restriction on a substance used in vehicles. Such burden would translate into efforts to comply with the proposed restriction, including the implementation of required risk management measures or those to substitute or reduce the use of the restricted substance.

The administrative burden to transfer existing restrictions on four substances, and their exemptions, to REACH and to further review them under REACH is likely to be considerably higher than under Measure 5a, given that this review under REACH requires a new restriction and is a rather heavy process, not very suited to the multiple exemptions and reviews under ELV legislation. Although, conceivably, the remaining active exemptions under ELV legislation could be bundled in a single package for the purpose of assessment under REACH, this would be a rather *ad-hoc* and novel process under REACH and for ECHA, requiring involvement of a larger number of services (waste and chemicals units in DG ENV, REACH and automotive units in DG GROW) and therefore likely to be more burdensome, require more time and more resources.

As regards the updated definition of scope in terms of definition of hazardous substances and substances of concern, protection of human health and full-life cycle approach, these provisions apply to the three sub-measures considered (5a, 5b and 5c) and therefore considerations to this respect mentioned under 5a, are valid for this measure.

9.3.6 9.3.6 *Economic impacts*

The economic impacts of Measure 5b are expected to be similar to those of Measure 5a, as explained under that measure. From the point of view of costs to the Commission budget of Measure 5b, this would be addressed under the general REACH budget both of ECHA and of the Commission. Therefore, a specific budget allocation for dealing with vehicle relevant substances would not have to be considered in the financial fiche of the new Regulation replacing ELV Directive.

As in Measure 5a, resources for ECHA associated with new restrictions of substances in batteries or associated to reviewing the current lead and cadmium exemptions for batteries in vehicles under ELV, are already addressed in the financial fiche of the Batteries Regulation and therefore do not need further consideration here.

Further resources, largely equivalent to those currently used under ELV to pay the services of external contractors, would have to be additionally allocated to ECHA, under the REACH budget, to support the Commission in reviewing the remaining active exemptions (subject to uncertainties stated about the legal possibility of such “ad hoc” transfers of restrictions).

9.3.7 9.3.7 Social impacts

A quantitative estimate of the health benefits that the restriction of substances of concern in vehicles would bring about could not be estimated in the context of this impact assessment and will certainly be very case and substance specific. See the description of social impacts under Measure 5a, as these are estimated to be equivalent for Measure 5b.

9.3.8 9.3.8 Environmental impacts

Similar to social / health impacts, a quantitative estimate of the environmental benefits that the restriction of substances of concern in vehicles would bring about could not be estimated in the context of this impact assessment and will certainly be very case and substance specific. See the description of environmental impacts under Measure 5a, as these are estimated to be equivalent for Measure 5b.

A restriction of a substance adopted under REACH is capable of imposing prohibitions and risk management measures on all aspects related to the placing on the market and use of a substance during the product life-stage of vehicles. Addressing the use of a substance of concern in the manufacture of vehicles will also have a profound effect on the waste generated by such vehicle when it becomes waste at the end of its service life.

However, given that waste is not a substance, a mixture or an article (as per Article 2(2) of REACH), REACH is not the most suitable instrument to implement specific risk management measures on activities dealing with waste from vehicles (i.e. specific exposure control or emissions reduction measures during recycling or disposal).

9.3.9 9.3.9 Stakeholder views

See summary of stakeholder views provided under Measure 5a.

Although unrelated to the current impact assessment, a recent position paper by several industry associations²⁵³, issued in the context of the discussions in co-decision of the Commission's proposal for a regulation on Batteries and Waste batteries²⁵⁴, a clear preference was stated, in relation to procedures to restrict hazardous substances in batteries, to "*refer to the already existing REACH, OSH²⁵⁵ and IED²⁵⁶ processes and therefore benefit from existing horizontal legislation rather than to create additional product specific requirements*".

9.4 Assessment of measure 5c – Hybrid restrictions approach

9.4.1 9.4.1 Description of the measure

Measure 5c is a hybrid of Measures 5a and 5b, according to which restrictions on the four substances already existing in the ELV Directive and their exemptions are kept and maintained in the proposed new Regulation, under enhanced provisions. Future restrictions on

²⁵³ Chemicals management in batteries. Position paper by EUROBAT, Eurometaux and RECHARGE. January 2022. <https://www.eurobat.org/news-publications/position-papers/510-chemicals-management-in-batteries>

²⁵⁴ COM(2020) 798 final.

²⁵⁵ Occupational Safety and Health.

²⁵⁶ Industrial Emissions Directive.

other substances in vehicles, and their possible exemptions, would be primarily²⁵⁷ developed, managed, enacted and maintained under REACH or, as appropriate covered by the POPs Regulation or the Batteries Regulation (as applicable to substances in batteries in vehicles).

Measure 5c presents the main advantages of Measures 5a and 5b, while avoiding the legal and practical challenges of a full transfer to REACH (Measure 5b). The possibility of full integration into REACH could be reassessed in the future, after the ongoing review of REACH has been concluded and sufficiently implemented, to assess its adequacy to a scenario such as that proposed under Measure 5b.

The main features of **Measure 5c** are:

- Limitations due to chemical risks of all vehicle-relevant **new substances** are addressed under REACH²⁵⁸ (or as appropriate the POPs Regulation or the Batteries Regulation). This would be done under the existing REACH procedures and workstreams for restriction (via the regulatory procedure with scrutiny) or, as appropriate, as defined under the POPs Regulation or the Batteries Regulation (via delegated acts).
- The **objectives and scope** in Articles 1 and 4 of the ELV Directive are updated in the new Regulation replacing ELV Directive to cover impacts on human health and the environment across the full life cycle of vehicles (and not only focus on waste management).
- **Existing restrictions** on four substances and their **exemptions** are maintained under ELV legislation and reviewed via delegated acts with the support of ECHA (rather than using contractors, as currently). Relevant active exemptions having a review date [Annex II points 2(c)(ii), 3, 8(e) and 8(g)(ii)] are maintained and reviewed under ELV legislation, with the support of ECHA. Other exemptions that do not require a review are also maintained in ELV legislation. The possibility of a transfer of these restrictions, and any remaining exemptions, to REACH would be **reassessed** in the future once the ongoing REACH review is concluded and sufficient implementation time has elapsed to assess its functioning (potentially in 7 - 10 years).
- As an exception to the point above, **exemptions for the use of lead and cadmium** under ELV Directive which are **specific to batteries** [Annex II points 5(a) and 5(b) (lead) and 16 (cadmium)] are, following a transition process, taken up by the Batteries Regulation (*lex specialis*) and as appropriate removed from the Regulation replacing ELV Directive.
- The **scope of the assessment of the exemptions** remaining under ELV legislation is widened beyond the current description in Article 4(2) of the ELV Directive, which only takes into account whether the “*the use of the substances is unavoidable*”. A broader approach, similar to that used in assessing applications for authorisation under REACH, including an analysis of alternatives, a socio-economic analysis and a comparative

²⁵⁷ With the exception of substances in vehicle batteries, addressed under the Batteries Regulation, substances covered by the POPs Regulation and substances of concern that hinder recycling, that could be restricted for broader sustainability reasons not primarily related to their chemical risk (which would be restricted under ELV).

²⁵⁸ It should be noted that the requirements under the Authorisation title of REACH for those substances of very high concern (SVHCs) listed in Annex XIV to REACH (such as certain chromium VI salts) applies, regardless of whether restriction provisions for substances in vehicles remain in ELV or are transferred to REACH or sector / product-specific legislation.

analysis of the health and environmental impacts of alternatives (at least at the level of comparing the hazards of the different alternative substances) should be included.

- For any **expansion in scope of ELV legislation to L-category vehicles, lorries, buses and trailers**, a new dedicated restriction process, implemented via delegated acts, would be run under the new Regulation replacing ELV Directive, with the support of ECHA and/or consultants within a given timeframe in case of restrictions regarding the four currently restricted substances or addressed as new restrictions under REACH in case of restrictions regarding other substances. The feasibility and appropriateness of addressing these under REACH would be decided once the ongoing REACH review is concluded and sufficient implementation time has elapsed to assess its functioning (potentially 7 – 10 years). The new Regulation should include the necessary empowerments to, in due time, be able to act according to either of these options.
- The definition of “hazardous substance” in ELV legislation is updated to be consistent with CLP Regulation. Similar to the approach in PPWR, reference to the definition of “substance of concern” is also to be included²⁵⁹.

The text of the Regulation would have to clearly assign to ECHA a supporting role in the review of active exemptions that remain in the new Regulation as well as, as appropriate, in studies that could be carried out to scope and prepare relevant restriction actions on lead, cadmium, mercury and hexavalent chromium associated to a possible increase in scope of the ELV legislation to additional vehicle types. In addition, addressing all new substance restrictions under REACH²⁶⁰ or, as appropriate the POPs Regulation or the Batteries Regulation would have to be explained in recitals. This will require a definition of tasks for ECHA under the Regulation replacing ELV Directive together with the required budgetary allocation, indicated in its financial fiche.

9.4.2 9.4.2 Effectiveness / efficiency

As regards the **restriction of new substances** in vehicles, this measure is identical to Measure 5b. This procedure would use the effective and well-tested assessment and regulatory mechanisms under the REACH restriction title to restrict substances in vehicles for which there is an unacceptable risk to human health and/or the environment, or as applicable, under a generic approach to risk management for substances in articles that may be used by consumers (as provided for under Article 68(2) of REACH).

As regards the existing restrictions on four substances and the **management and review of existing exemptions** this measure maintains the *status quo*, using an also well- established process that is known to stakeholders and would require no significant legal changes. The only difference with the baseline, in this regard, is that the Commission would be supported by ECHA, instead of by external consultants, thereby providing, potentially a more homogeneous, stable and robust assessment of exemptions. This approach poses fewer legal and practical implementation challenges than measure 5b, requires minimal legal changes and maintains consistency with current approach towards the management of exemptions.

²⁵⁹ The PPWR refers to Article 2(28) of proposal for a Regulation on Eco-design for Sustainable Products.

²⁶⁰ With the exception of substances of concern that hinder recycling, that would be restricted due to broader sustainability reasons, nor primarily related to chemical safety, under ELV.

As indicated, the possibility of addressing the restriction on the four heavy metals, and the review of their exceptions, under REACH, and any efficiency gains that could be gained from it, can be reassessed in the future, following the review of REACH and its implementation.

9.4.3 9.4.3 Coherence

As discussed under Measures 5a and 5b, Measure 5c also relies on ECHA to carry out the assessment of all restrictions of substances relevant to vehicles, as well as for the maintenance of existing restrictions and exemptions and therefore is coherent with the “one substance, one assessment” approach. Measure 5c would also be coherent with the general approach under the Ecodesign for Sustainable Products Regulation (by carrying out all new restrictions of substances in vehicles under REACH. This is coherent with the principle that all restrictions on chemicals due to primarily their chemical risk, should not be done under specific product legislation but rather under REACH (only the historical restrictions on the four heavy metals would remain under ELV legislation).

9.4.4 9.4.4 Ease of implementation

As indicated for **new substance restrictions** in Measure 5b (under REACH, POPs and Batteries Regulations) and for existing substance restrictions and the review of their exceptions under Measure 5a, implementation of each of these elements is envisaged to be relatively easy given in the first case this process already takes place smoothly under REACH (avoiding the additional complexity to implement this under an additional new instrument – ELV). As regards the four substances currently restricted under the ELV Directive the current, well-tested process under ELV Directive to review existing exemptions remains, but would be supported by ECHA for additional robustness, consistency and reliability. Therefore this hybrid approach would not require significant changes from the legal or methodological point of view in existing processes and therefore is expected to have lower implementation risks and higher acceptance by stakeholders than measures 5a and 5b.

As explained in Measure 5a, the “transfer” to REACH of existing restrictions on the four substances and the review of their exceptions is legally problematic and procedurally more complex given that REACH is currently not well suited for the systematic review of multiple exemptions to restrictions (heavy procedure) and given that the legal basis and objectives associated to introducing restrictions under REACH and under ELV are different. As regards substances present in batteries, these would be addressed under the new Batteries Regulation and therefore in this aspect measures 5a, 5b and 5c are equal.

9.4.5 9.4.5 Administrative burden

As explained under Measure 5b, no additional administrative burden would be imposed upon the Commission or Member States by the running of restriction proposals for new substances in vehicles under REACH. The same applies to substances restricted under the Batteries Regulation (using a REACH-like process). Similarly for the review of exemptions from the existing restrictions on four substances, which would be assessed with the support of ECHA, the process for the Commission and stakeholders is envisaged to be essentially the same in terms of burden, with additional optimisation and burden reduction for operators than can be achieved via the envisaged increase in consistency and structuring of the process and use of centralised IT tools brought about by the new role of ECHA in the process. Consequently, this

hybrid approach is considered to offer the best outcome, in terms of burden, as compared with Measures 5a and 5b.

For each new restriction, additional administrative burden is to be expected for stakeholders that would be affected by the scope of a specific restriction on a substance used in vehicles. Such burden would translate into efforts to comply with the proposed restriction, including the implementation of required risk management measures or those to substitute or reduce the use of the restricted substance. This is common to all three measures discussed.

9.4.6 9.4.6 *Economic impacts*

As indicated above, measures 5a and 5b are similar as regards the economic impact on operators in terms of compliance costs given that under both measures these have to implement and adjust to the limitations set on the use of substances in vehicles, including substitution costs, monitoring, process modifications, etc. This is independent to whether these limitations are imposed via the new Regulation replacing ELV Directive, REACH or other chemical-related legislation. Arguably having to follow and implement several sets of legislation introduces additional costs and complexity in terms of the process for operators, but this is already the case given currently both ELV legislation and REACH already apply to vehicle manufacturers and other OEMs. Consequently, being measure 5c a combination of elements in measures 5a and 5b, which themselves have estimated similar economic impacts, measure 5c should have similar economic impacts to 5a or 5b, potentially being slightly advantageous over these given in terms of process, it represents the approach requiring the least adaptation efforts by operators (in the sense that existing substance restrictions continue being addressed under ELV and new substance restrictions are primarily addressed under REACH²⁶¹, which is a well known process, that has already addressed vehicle-relevant substances).

9.4.7 9.4.7 *Social impacts*

A quantitative estimate of the health benefits that the restriction of substances of concern in vehicles would bring about could not be estimated in the context of this impact assessment and will certainly be very case and substance specific. See the description of social impacts under Measure 5a, as these are estimated to be equivalent for Measure 5c.

9.4.8 9.4.8 *Environmental impacts*

Similar to social / health impacts, a quantitative estimate of the environmental benefits that the restriction of substances of concern in vehicles would bring about could not be estimated in the context of this impact assessment and will certainly be very case and substance specific.

As described in Measure 5a, very significant reductions of emissions of lead, hexavalent chromium and cadmium have already been achieved via the existing restriction under ELV Directive. For new restrictions that could be adopted under REACH important reductions in emissions over the whole life cycle of vehicles are expected, as supported by studies on

²⁶¹ With the exception, as appropriate, of substances to be restricted in vehicle batteries, those covered by the POPs Regulation, or specific substances to be restricted for broader sustainability reasons not related primarily to their chemical risks.

reduction of emissions brought about by other REACH restrictions. Addressing the use of substances of concern in the manufacture of vehicles will also have a profound effect on the waste generated by such vehicle when it becomes waste at the end of its service life.

For further details see the description of environmental impacts under Measure 5a and 5b, as these are estimated to be equivalent for Measure 5c (which represents a combination of both).

9.4.9 9.4.9 Stakeholder views

See summary of stakeholder views provided under Measure 5a. There is clear support of a majority of stakeholders to address all new substance restrictions in vehicles under REACH as the central EU chemicals management legislation. A majority of stakeholders responding to the open public consultation also support that substances already regulated under ELV Directive should remain there (and thus also their exceptions).

This approach is consistent with what is proposed under this Measure 5c.

9.5 Summary and conclusion

As can be seen from the analysis above, measures 5a and 5b are similar in terms of effectiveness and efficiency given in both cases a system to restrict new substances in vehicles and vehicles components is established relying on the support and expertise of ECHA.

All three measures are coherent with the “one substance, one assessment” approach, as in all cases the assessments of the merits of restricting substances due to their chemical risks are carried out with the support of ECHA. However, in terms of their coherence with the general approach to address substances which pose a problem in products due to primarily their chemical risks, Measure 5a would deviate from this approach, whereas measures 5b and 5c would be consistent with it, given in both cases all new restrictions would be primarily done under REACH.

As regards implementation simplicity, both measures 5a and 5b, although in principle feasible, have some associated difficulties. In the case of measure 5a a new methodology to restrict new substances due to their chemical risks would have to be developed and implemented under ELV legislation, with support of ECHA. Although methodologically this would largely resemble REACH, the creation of new procedures under the new Regulation would unavoidably require additional efforts and adaptation both of operators as well as of ECHA and the responsible Commission services. On the other hand, to fully transfer all vehicle restrictions to REACH would require similar efforts for operators but offers serious doubts. They regard legal and practical possibilities to transfer the existing restrictions on the four substances, and their exemptions, to REACH and to subsequently maintain and review them under REACH, in its current form.

In this regard, measure 5c provides a hybrid solution which in terms of implementability appears clearly advantageous, also in terms of representing the least administrative burden for operators, given it maintains “old restrictions” and their exemptions under ELV legislation and all new substance restrictions under REACH (for which this process is already in place).

The overall economic, social and environmental impacts of the three measures are estimated to be largely equivalent, given in all cases restrictions on substances in vehicles would be

enacted resulting in the same positive impacts in terms of protection of human health and the environment and with equal associated costs to ensure compliance, adapt manufacturing processes, implement alternatives and, as appropriate, apply for exemptions. Small differences in costs and administrative burden may exist from the point of view of the Administrations (Commission and Member States) depending on the specific services involved, and their pattern of interaction, but these are estimated to be small as compared to costs to comply with restrictions.

As regards the views of stakeholders consulted, a majority of them shows a preference for new restrictions to be carried out under the REACH Regulation, with support also expressed to maintaining the *status quo* for existing restrictions on the four substances and their exemptions. This is best aligned with hybrid measure 5c with the exception of restrictions of lead and cadmium in vehicle batteries, which in all cases would be addressed under the new Batteries Regulation, as *lex specialis*. The preference of Member States to centralise to the extent possible new restrictions on chemicals in products under REACH, clearly expressed during the co-decision process of the Batteries Regulation, is also respected and largely aligned under Measure 5c.

A comparative summary of the three measures is provided in the table below:

Table 9.1 Comparative summary measures

	M5a (ELV)	M5b (REACH + other existing)	M5c (hybrid)
Effectiveness / efficiency	++	++	++
Coherence	+	++	++
Ease of implementation	++	+	+++
Administrative burden	-	-	- / +
Economic impacts	-	-	-
Social impacts	++	++	++
Environmental impacts	++	++	++
Stakeholder views	+	++	+++
Impact summary	++	++	+++

Finally, although as abundantly discussed in the co-decision process of the Batteries Regulation, restrictions carried-out under REACH are to some extent limited. They cannot specifically impose risk management measures in the waste phase, given waste is excluded from the scope of REACH. This does not imply that REACH restrictions cannot have an impact on the safety of waste management, given restrictions on the product phase will also limit the chemicals that are ultimately present in waste (i.e. if a ban or a content limitation in products is imposed).

The need introduce dedicated risk management measures to address risks resulting from the management of end-of-life vehicles, using a dedicated legal instrument to enact restrictions that would enable implementing such specific risk management measures to waste, e.g. during recycling operations (as would be possible under measure 5a) does not, contrary to the case of substances in batteries, have a strong justification.

In the case of batteries, hazardous substances such as lithium compounds, cobalt compounds, lead compounds, etc, are the core of the battery, which contains them in large quantities. The

importance placed on recovering these hazardous substances, some of which are critical raw materials, justifies having the possibility of imposing specific risk management measures²⁶², as appropriate and complementing existing provisions under existing environmental and worker protection legislation, on battery recovery / treatment operations. These are expected to largely increase in the EU²⁶³ in the coming years.

In the case of end-of-life vehicles, although the presence of hazardous substances in waste is certainly a source of concern, these are not major constituents of the vehicle, nor the target substances for recovery. Therefore, in order to address possible risks occurring during waste management of ELVs, the downstream effects on waste of chemical restrictions imposed on the vehicles (e.g. via REACH), together with provisions in the applicable existing environmental (e.g. Industrial Emissions Directive) and worker protection legislation (Chemical Agents Directive, Carcinogens and Mutagens Directive), are considered sufficient to manage these risks.

Based on all the above, the hybrid restriction approach defined under **Measure 5c** is considered the preferred policy option.

²⁶² These considerations were very relevant in the negotiation of the Batteries Regulation and contributed to the agreement on a self-standing restriction mechanism under the Batteries Regulation.

²⁶³ Resulting from provisions on recycling targets in of the Batteries Regulation and envisaged further promotion of recycling via the Raw Materials Act.



EUROPEAN
COMMISSION

Brussels, 13.7.2023
SWD(2023) 256 final

PART 4/4

COMMISSION STAFF WORKING DOCUMENT
IMPACT ASSESSMENT REPORT

ANNEXES 10 TO 15 to the IMPACT ASSESSMENT REPORT

Accompanying the document

Proposal for a Regulation

of the European Parliament and of the Council on circularity requirements for vehicle design and on management of end-of-life vehicles, amending Regulations (EU) 2018/858 and 2019/1020 and repealing Directives 2000/53/EC and 2005/64/EC

{COM(2023) 451 final} - {SEC(2023) 292 final} - {SWD(2023) 255 final} -
{SWD(2023) 257 final}

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ANNEX 10: LEGAL ENVIRONMENT

10.1 Legal Basis

Discussions on waste from ELVs dating back to the 1970s focussed on the concerns caused by the illegal disposal of hazardous waste and the difficulties to treat plastic waste derived from ELVs. Increasing quantities of plastic waste were found in the Light Shredder Residues (LSR) and, due to its limited compacting characteristics, used a large amount of volume within landfills. Incineration of plastic waste was also challenging as it required pre-treatment operations. The treatment of exhaust gas of waste incinerators was less developed at that time. In addition, other environmental and health risks, such as contamination of the metal scrap with heavy metals, raised public concerns. All these factors determined the primary objective of the ELV Directive, to minimise the impact of ELVs on the environment and to improve the environmental performance of all the economic operators involved in the life-cycle of vehicles, as defined in Article 175 of the Treaty establishing European Community¹. Article 7(4) of the ELV Directive tasked the Commission to propose an amendment to the type-approval Directive² and promote European standards relating to design for dismantling, recoverability and recyclability of vehicles. As a result, Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability (3R type-approval Directive) was adopted in 2005³. Based on the internal market legal base (Article 95 TEC⁴), the 3R type-approval Directive constitutes one of the separate directives within the framework of the EU vehicle type-approval system which was originally established by Council Directive 70/156/EEC and which is now covered by the type-approval Regulation (EU) 2018/858⁵. Article 7(4) of Directive 2000/53/EC required that the measures to be adopted have to be incorporated into the vehicle type-approval procedure. It is a basic principle of EU type-approval legislation that Member States do not prohibit, restrict or impede the placing on the market, the registration or the entry into service of vehicles, systems, components or separate technical units that comply with the requirements of EU type-approval. To safeguard a consistency of rules between placing a product on the market and the disposal of that product, a single binding set of EU rules is necessary.

It is therefore necessary that the legislative proposal replacing ELV and 3R type-approval Directives is based on Article 114 of the TFEU, which is the appropriate legal basis for measures that aim to establish or ensure the functioning of the internal market. This is essential as it is designed to set out requirements which govern the placing of vehicles on the EU market. Harmonised rules are necessary to ensure that all goods placed on the EU market comply with similar conditions and that manufacturers can rely on a type approval issued by

¹ TEC; in the current legal state, the wording corresponding to Article 175 TEC is expressed in Article 192 TFEU.

² Council Directive 70/156/EEC of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers (OJ L 42, 23.2.1970, p. 1–15).

³ OJ L 310, 25.11.2005, p. 10.

⁴ In the current legal state, the wording corresponding to Article 95 TEC is expressed in Article 114 TFEU.

⁵ OJ L 151, 14.6.2018, p. 1.

one Member State for the entire Internal Market. This is line with the overall regulatory framework on type-approval for motor vehicles.

The change compared to the ELV Directive, which was based on the environmental empowerment of Article 175 TEC (Article 192 TFEU) is justified as this proposal also regulates the design aspects of vehicles and the free circulation.

The choice of Article 114 TFEU as a legal basis allows to build environmental-related requirements as the core elements of conditions on the type-approval and thereby the placing on the EU market of vehicles. It follows other examples of legislative proposals tabled by the Commission recently, which also aim at covering in one single instrument sustainability/circularity requirements applying to the whole lifecycle of products, like the proposal for a Batteries Regulation, proposal for a Regulation on Eco-design for Sustainable Products and the proposal for a Regulation on Packaging and Packaging Waste.

10.2 Articulation with other EU policies and legislations

The 3R type-approval Directive is the main EU-level instrument dealing with vehicles design for recycling, re-use and recovery, and the ELV Directive regulates the requirements of vehicles end-of life. There are also provisions on vehicles or provisions which are relevant for vehicles in other EU legislation. Table 10.1 below lists and compares specific aspects of the different initiatives, showing their interaction, with the ELV and 3R type-approval revision.

Table 10.1: Comparison of the ELV and 3R type-approval revision with specific aspects of other EU initiatives

1	Critical Raw Materials (CRM) Act ⁶ and CRM Communication ⁷
Legislative or non-legislative?	CRM Act: Legislative, mandatory. Status: Commission proposal for a Regulation was adopted on 16 March 2023. CRM Communication: Non-legislative.
Brief description	The aim of the CRM Act is to ensure EU the access to a secure and sustainable supply of critical raw materials in order to allow the EU to achieve its climate and digital ambitions. The proposal aims to strengthen different stages of CRMs value chains, diversify the EU imports to reduce strategic dependencies, improve EU capacity to monitor and mitigate risks of disruptions to the supply of CRMs, and improve circularity and sustainability. The proposal lays down list of critical raw materials and strategic raw materials as well as the methodology for their review. It establishes a framework to select and implement strategic projects eligible for streamlined permitting processes and having a simplified access to financial opportunities. The act develops a mechanism for coordinated monitoring of CRMs supply chains and provides measures to mitigate

⁶ Proposal for a Regulation of the European Parliament and of the Council establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU) 168/2013, (EU) 2018/858, 2018/1724 and (EU) 2019/1020 (COM/2023/160 final).

⁷ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A secure and sustainable supply of critical raw materials in support of the twin transition (COM(2023) 165 final).

	supply risks, such as obligations for large importers and manufacturers to regularly audit their supply chains and facilitate the joint purchases of strategic raw materials. The proposal focuses also on CRMs circularity, addressing in particular permanent magnets, for which it envisages detailed information obligations. It also empowers the Commission to establish in the future recycled content targets for certain CRMs include in these magnets via delegated acts. The proposal enables Member States to adopt and implement specific measures aim at circularity, particularly with respect to waste streams with high CRM recovery potential. The CRM Communication lays down actions to be taken in areas of development of standards of CRMs-related industrial processes, education and training, research and innovation projects, financing CRM-related activities as well as establishing cooperation with partners to strengthen supply chains of these materials. It recognises the need to incentivise CRMs recycling by commercialisation of efficient recycling technologies, designing products containing CRMs so that these materials can be easily removed or accessed and requiring provision of information on CRMs and their location in certain products. The Communication specifically announces that the Commission will revise the ELV Directive to include specific requirements for design and end-of life treatment of vehicles focusing on CRM recovery. It also states that the Commission should provide recommendations to Member States in order to improve the separate collection of consumer electronics rich in CRMs, consider introduction of measures promoting substitution of CRMs in new products and review waste legislation in order to, where relevant, establish specific rules of CRMs recovery from certain product categories.
Interaction with the ELV and 3R type-approval revision	The presence of CRMs used in vehicles are expected to increase due to their electrification, therefore the new legislative proposal replacing ELV and 3R type-approval Directives will be one of the key legal acts relevant from the CRM perspective. The ELV Directive already contains provisions related to recovery and recycling of CRMs from end-of life vehicles. Its revision aims to strengthen recovery and recycling, by, inter alia, developing requirements effectuating design for dismantling and design for recycling, as well as to address the end-of life phase by reinforcing collection of ELVs and their recycling. Both proposals will address the issues related to CRMs present in vehicles and their components, in particular providing information on their presence in order to improve CRMs recycling and subsequent use of recycled materials in new products. The CRM Acts establishes requirements related to certain types of permanent magnets⁸ present in selected products, including motor vehicles. Operators placing vehicles containing such magnets on the market are obligated to mark them with label specifying type of magnets contain in them, and, in the future, also to provide digitalized information on the weight, location and chemical composition of all individual magnets, presence of coatings, glues and any additives, as well as

⁸ Permanent magnet types addressed by CRM Act are: Neodymium-Iron-Boron; Samarium-Cobalt; Aluminium-Nickel-Cobalt; Ferrite. All of described obligations stemming from CRM Act, except for labelling of product containing the magnet specifying its type, do not apply to ferrite permanent magnets.

	information enabling access and removal of such magnets. CRM Act requires operators placing products containing certain amount of such magnets to inform about the share of neodymium, dysprosium, praseodymium, terbium, boron, samarium, nickel and cobalt recovered from post-consumer waste present in the permanent magnets incorporated in the product. The Commission is also empowered to set out recycled content targets for these CRMs via delegated acts after 2030. The new proposal replacing ELV and 3R type-approval directives will foresee an obligation for the manufacturers to draft declarations on the CRM content in vehicles and present it during the type-approval process and will require to remove parts and components containing CRMs prior to vehicles' shredding. It will also empower the Commission to set out recycled content targets for these materials. Despite the fact, that both initiatives concern CRMs present in vehicles, their provisions will be complementary. To avoid legal uncertainty, CRM Act contains clear rules specifying that in case of adoption of EU harmonised legislation on recycling or recycled content of permanent magnets⁹, this harmonised legislation will apply instead of provisions of the CRM Act. The new Regulation replacing ELV and 3R type-approval Directives would be an example of such legislation (<i>lex specialis</i>). Both analysed initiatives have the same objective, as they aim to improve the recovery and recycling of CRMs and promote inclusion of such recycled materials in new vehicles. Revision of ELV Directive is also specifically listed in the CRM Communication, as it is a key element from the CRM perspective.
2	Eco-design Directive¹⁰ / Eco-design for Sustainable Products Regulation (ESPR) Proposal¹¹
Legislative or non-legislative?	Legislative, mandatory. Status: Directive in force; Commission proposal for a Regulation, repealing this Directive, was adopted on 30 March 2022.
Brief description	The Eco-design Directive establishes minimum product-related and, where relevant, information requirements, for 'energy-related products', on energy efficiency and other environmental aspects. This is being operationalised via implementing regulations per product category, in accordance with regular working plans. These regulations, for a given product category, prevent the worst-performing products to enter the EU market. Since the first Circular Economy Action Plan (2015) the Commission systematically includes circular economy aspects (in addition to energy efficiency) in product requirements under the Eco-design Directive, including inter alia reparability, durability, upgradability and recyclability when drafting new or revising existing eco-design requirements. The proposal for a Regulation on eco-design for sustainable products will extend the Eco-design framework beyond energy-related products,

⁹ Articles 27(9) and 27 () of CRM Act.

¹⁰ Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (OJ L 285, 31.10.2009, p. 10–35).

¹¹ Proposal for a Regulation of the European Parliament and of the Council establishing a framework for setting eco-design requirements for sustainable products, amending Regulation (EU) 2019/1020 and repealing Directive 2009/125/EC (COM/2022/142 final).

	excluding food and feedstuff. It will also enable the setting of eco-design requirements for groups of products sharing common characteristics. The ESP Regulation is a framework regulation, it will enable the setting of additional legislative measures which will strengthen products sustainability and facilitate more informed choices for consumers. Eco-design requirements to be set under ESPR will be mandatory. The ESPR will enable the setting of requirements that improve information flows through, inter alia, establishing a Digital Product Passport. The Digital Product Passport would give access along the value chain to relevant product characteristics (e.g. durability and reparability of products, presence of substances of concern, handling at the end of life etc.), with differentiated access to consumers, businesses and compliance authorities were appropriate.
Interaction with the ELV and 3R type-approval revision	The ESPR will enable the setting of appropriate minimum performance and information requirements for a wider range of physical products, including vehicles and its parts. However, the Directives under revision already lay down certain requirements and obligations related to vehicles circularity. The 3R type-approval Directive requires that vehicles should be constructed in such a manner, that they are reusable and/or recyclable to a minimum of 85 % by mass, and reusable and/or recoverable to a minimum of 95 % by mass. The ELV Directive sets out re-use, recycling and recoverability at the corresponding levels. It also encourages vehicle manufacturers to use recycled materials and limit the use of hazardous substances and design vehicles suitable for dismantling and recycling. Also, the design and manufacture of vehicles are subject to overall type-approval legislation, in particular the type-approval Regulation 2018/858/EU of the European Parliament and of the Council¹², which lays down sector specific requirements for vehicles. These requirements are much different from the rules applicable for other products placed on the EU market, as they were established in order to address the specificity of the automotive sector. In addition it needs to be noted, the ESPR is based on the New Legislative Framework: Regulation (EC) No 765/2008 of the European Parliament and of the Council¹³ and Decision No 768/2008/EC of the European Parliament and of the Council¹⁴. However, the sector automotive legislation related to type-approval do not follow the New Legislative Framework. The procedure of obtaining a type-approval is set out specifically for vehicles in its scope, in order to consider all the modalities related to their design and use. As the legal framework for vehicle design and end-of life already exists and it takes into the account the characteristics of the automotive sector, new requirements should be built on it rather than developed based on the ESPR. However, it needs to be underlined, that the level of ambition

¹² Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, amending Regulations (EC) No 715/2007 and (EC) No 595/2009 and repealing Directive 2007/46/EC (OJ L 151, 14.6.2018, p. 1–218).

¹³ Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93 (OJ L 218, 13.8.2008, p. 30–47).

¹⁴ Decision No 768/2008/EC of the European Parliament and of the Council of 9 July 2008 on a common framework for the marketing of products, and repealing Council Decision 93/465/EEC (OJ L 218, 13.8.2008, p. 82–128).

	in transition to circularity and sustainability will be similar in the new legislative proposal replacing the ELV and 3R type-approval Directives as it would be if new provisions were established through delegated acts based on the ESPR. Nonetheless, certain design requirements for vehicles or its parts could be set out under ESPR. It could concern vehicles which are outside the scope of this proposal, as well as other automotive related products, such as tyres. It is intended to propose development of recycled content targets for rubber via a delegated act prepared under the ESPR Framework. The Commission has ensured complementarity and consistency between the future legislation and the ESPR and delegated acts adopted on its basis, for example for the definition of the respective requirements and empowerments (e.g. using the same definition of 'recycled content') and making use of the same methodologies for their implementation (e.g. on measurement of recycled content).
3	Type-Approval Regulation (EU) 2018/858¹⁵
Legislative or non-legislative?	Legislative, mandatory. Status: Regulation in force.
Brief description	The legal framework for the type-approval of motor vehicles aims at facilitating the free movement of automotive products in the internal market by laying down common requirements designed to achieve environmental, energy performance and safety objectives which are specified in several separate legal acts. These legal acts deal with a multitude of detailed technical requirements for different vehicle systems and components and are frequently updated to adapt them to technical progress while at the same time minimising the regulatory burden on industry. The type-approval Regulation sets the central procedural framework for the requirements for the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles. As such it lays down the rules on conformity of vehicle types with the requirements of several pieces of legislation which are listed in the Annexes to the Regulation. Once the compliance with the various requirements of different legislations is checked by the national type-approval authority, the vehicle type can be placed on the market and registered in the internal market. It follows that the placing on the market or registration of the vehicle type cannot be refused for requirements for which the vehicle type has gone through the type-approval procedure.
Interaction with the ELV and 3R type-approval revision	The requirements of the 3R type-approval Directive are currently controlled in the process of vehicle type-approval established by the Type-Approval Regulation. With the inclusion of the 3R type-approval Directive and the ELV Directive in one new regulation, the requirements that will be formulated in the new instrument for type-approval will also need to be verified in accordance with the rules of Type-Approval Regulation. Therefore, the new proposal will cross-refer to provisions of the analysed regulation, not only for the type-approval procedures but

¹⁵ Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, amending Regulations (EC) No 715/2007 and (EC) No 595/2009 and repealing Directive 2007/46/EC, (OJ L 151 14.6.2018, p. 1).

	also in relation as market surveillance.
4	Euro 7 Regulation Proposal¹⁶
Legislative or non-legislative?	Legislative, mandatory. Status: Commission proposal for a Regulation was adopted on 10 November 2022.
Brief description	The general objective of the initiative is to ensure the proper functioning of the single market by setting more adequate, cost-effective and future-proof rules for vehicle emissions as well as to ensure a high level of environmental and health protection in the EU by further reducing air pollutant emissions from road transport. This initiative will contribute to achieving the general objective by pursuing the following three specific objectives. It will reduce complexity of the current Euro emission standards, provide up-to-date limits for all relevant air pollutants and improve control of real-world emissions. The proposal is in support of aims in the Ambient Air Quality Directive¹⁷ by setting limits for pollutants which are currently also covered by rules on the ambient air concentrations of specific air pollutants such as Ammonia, particles or NOx. Key new elements are the alignment of emission rules in a technology neutral way and by combining rules for Light-Duty Vehicles and Heavy-Duty Vehicles. Furthermore, the emission limits will be valid and verified in a wider and clearer defined range of conditions.
Interaction with the ELV and 3R type-approval revision	Both initiatives concern the environmental performance of vehicles and their design. The requirements set out in these acts will be verified in accordance with procedures established in the Type-Approval Regulation. While the Euro 7 proposal aims at reducing vehicle emissions during a longer part of a vehicle's lifetime by extending durability requirements, the revision of the ELV Directive focuses on designing the vehicles in a more circular way, to facilitate the reuse, recycling and recovery of vehicles and their parts and the actual treatment of the vehicle at the end of its life. The new proposal will also contribute to achievement of overall emission objectives of Euro 7 proposal, as it will limit the export of non-roadworthy, often polluting, used vehicles outside the EU. This proposal will also provide more detailed rules on removal and recycling of certain vehicle components, such as emission control systems, necessary to achieve the limit values in Euro 7 proposal, including catalysts, which contain significant amounts of CRMs. The Euro 7 proposal envisages also creation of Environmental Vehicle Passport, a digital tool granting access to information on the environmental performance of a vehicle at the moment of registration, including the level of pollutant emission limits, CO₂ emissions, fuel consumption, energy consumption, electric range and engine power, and battery durability and other related values. The new proposal replacing ELV and 3R type-approval Directives will build on this, extending the scope of information that could be accessed via this passport to data facilitating the disassembly, reuse, recycling and recovery of vehicles

¹⁶ Proposal for a regulation on type-approval of motor vehicles and engines and of systems, components and separate technical units intended for such vehicles, with respect to their emissions and battery durability (Euro 7) (COM(2022) 586).

¹⁷ Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (OJ L 152, 11.6.2008, p. 1).

	and their parts.
5	Waste Framework Directive¹⁸ (WFD)
Legislative or non-legislative?	Legislative, mandatory. Status: Directive in force; Commission proposal for amending directive expected to be adopted in 2023.
Brief description	The WFD establishes horizontally applicable concepts and definitions related to waste generation and waste management, including waste treatment, recycling and recovery. It lays down waste management principles, which should contribute to the reduction of adverse impact of the waste management to human health and the environment, with an emphasis on waste prevention. It follows from the waste hierarchy laid down in the WFD that waste prevention comes on top of the hierarchy followed by preparation for re-use and recycling in second and third place. Other recovery options, e.g. energy recovery shall finally take precedence over disposal. Additionally, it outlines conditions for waste to be considered a by-product and regulates the end-of-waste status. Pursuant to Art. 9 of the WFD, Member States must undertake actions to prevent waste generation, with measures encouraging the re-use of products, promoting and supporting sustainable production and consumption and reduction of hazardous substances in materials and products. The WFD sets targets for the preparation for re-use and the recycling of waste materials from municipal waste, which were increased in the 2018 revision through the setting of targets for the years 2025, 2030 and 2035. The WFD obliges Member States to ensure the functioning of Extended Producer's Responsibility (EPR) schemes, which is a set of measures taken by Member States to ensure that producers of products bear financial responsibility or financial and organisational responsibility for the management of the waste stage of a product's life cycle. The WFD sets up a set of minimum requirements for EPR schemes to that end. In the new Circular Economy Action Plan, adopted in March 2020, the Commission committed to take steps towards: - significant reduction of generation of waste, - better use of secondary raw materials and - environmentally sound waste management. The Commission furthermore committed itself to assess feasibility of harmonising the separate waste collection systems in the Member States. The ongoing revision of the WFD is focused on textiles and food waste. Another revision, of a larger scope, is envisaged for 2025.
Interaction with the ELV and 3R type-approval revision	One of the aims of this proposal is to provide more clarity in the determination when a used vehicle should be considered waste. Therefore, the definition of end-of life vehicle will be revised, addressing the practical difficulties experienced in its application in the Member States, but it will remain in line with the general definition of waste provided for in the WFD. The definition of "recycling" in the proposal for a Regulation will be aligned with the definition in the WFD, in particular it will exclude backfilling operations from its scope. The ELV Directive revision envisages also clearer methodology to

¹⁸ Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312 22.11.2008, p. 3).

	calculate recycling rates, ensuring that what is accounted as “recycled” only includes materials which are effectively recycled, and not just collected for recycling, and improving the reporting on recycling targets. This change fits into the logic of the WFD, which aims to ensure high-quality recycling. The WFD, through the Commission Implementing Decision (EU) 2019/1004¹⁹ adopted on its basis, provides for more correct and precise measurement of the amounts of recycled waste, by defining terms such as ‘calculation point’, ‘measurement point’ or ‘preliminary treatment’. This implementing act establishes specific rules for calculation of recycled waste, indicating different calculation points for various waste materials and recycling operations and provided rules concerning reflecting the preliminary treatment operations in the calculation. Further to these rules, data on waste recycling will be more accurate, as currently all waste collected for recycling is reported as recycled while all waste in practice is not currently effectively recycled. Similar changes in the calculation of the amount recycled waste stemming from ELVs will be done under the new legislative proposal. The proposal will also contain provisions laying down EPR rules for ELVs. The ELV Directive was adopted before the WFD. It contains provisions on the responsibility of vehicles manufacturers for the end-of life phase of vehicles. These provisions are however not aligned with the provisions set out in the WFD. This will be adjusted with the revision of the ELV Directive and the provisions on EPR would build on Articles 8 and 8a of the WFD.
6	Batteries Directive²⁰ / Batteries Regulation (BR) Proposal²¹ and final compromise agreement text²²
Legislative or non-legislative?	Legislative, mandatory. Status: Directive in force; Commission proposal for a Regulation, repealing this directive, was adopted on 10 December 2020. A final compromise text was agreed by the co-legislators on 18 January 2023 and should be published in the course of 2023 in the EU Official Journal.
Brief description	The Batteries Directive establishes general requirements for the treatment and recycling of batteries at the end of their life, but does not cover other aspects of the production and use phases of batteries, such as electrochemical performance and durability, GHG emissions, or responsible sourcing. The proposal for a Batteries Regulation aims to ensure that batteries placed in the EU market are sustainable and safe throughout their entire life cycle. The proposal introduces also progressive requirements to minimise the carbon footprint over the life cycle of batteries. It strengthens the functioning of the EU internal market for batteries and promotes the circular economy by closing the materials loop. The new Regulation lays takes over existing restrictions for mercury and cadmium in batteries and defines a procedure for introducing new

¹⁹ Commission Implementing Decision (EU) 2019/1004 of 7 June 2019 laying down rules for the calculation, verification and reporting of data on waste in accordance with Directive 2008/98/EC of the European Parliament and of the Council and repealing Commission Implementing Decision C(2012) 2384 (notified under document C(2019) 4114).

²⁰ Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC (OJ L 266, 26.9.2006, p. 1–14).

²¹ Regulation of the European Parliament and the Council of [date] 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC (OJ L [...]).

²² Interinstitutional file: 2020/0353 (COD).

	substance restrictions in batteries. It also includes provisions on mandatory recycled content targets and requirements on electrochemical performance and durability parameters. It obligates manufacturers to draft carbon footprint declaration for certain battery types and to ensure batteries' removability and replaceability. It requires the economic operators placing certain types of batteries on the market to implement supply chain due diligence policies verified by a notified body and conduct detailed risks assessment. The Regulation lays also down targets on collection, recycling efficiencies and materials recovery.
Interaction with the ELV and 3R type-approval revision	The Batteries Regulation will significantly contribute to putting the automotive industry on a circular path with respect to batteries. This is crucial due to the battery's environmental footprint, in particular for batteries in future EV. However, it needs to be underlined, that the environmental impact of vehicles is not limited to batteries, but covers also the manufacture and end-of life treatment of other elements of vehicles. Therefore, in order to address this need, the ELV needs to be revised so that it complements the Batteries Regulation with a similar objective to increase circularity. The new proposal will be fully complementary with the Batteries Regulation. Both initiatives are prepared in close cooperation, in the view of significant increase in the electrification of passenger cars, buses and, to a lesser extent, vans and lorries that can be observed nowadays and the observed trend of its rapid growth. All the batteries used in vehicles are within the scope of Batteries legislation. Both: the design of batteries and their treatment, when removed, is regulated by the Batteries Regulation. The new proposal replacing ELV Directive will clearly oblige economic operators to ensure that batteries used in vehicles are designed to allow for their removal, as well as oblige the ATFs to remove the battery from the ELVs before shredding, as a part of a depollution treatment of the vehicle. The main overlaps between these two legal acts regard: (a) prohibition using certain substances in automotive batteries, (b) treatment of waste vehicle batteries. The Batteries Regulation provides restrictions related to use of mercury and cadmium in certain types of batteries. In case of cadmium, it foresees an exemption for batteries used in vehicles that benefit from a derogation under Annex II to ELV Directive. Moreover, the Batteries Regulation indicates that all exemptions from restrictions on the use of lead, mercury, cadmium or hexavalent set out in Annex II to the ELV Directive (points 5(a) and 5(b) (lead) and 16 (cadmium)) concerning batteries, should be complied with by battery manufacturers²³. The preferred policy option envisages, that these exemptions for the use of lead and cadmium will, following a transition period, be taken up by the Batteries Regulation and removed from the new regulation replacing ELV Directive. Consequently, all batteries-related restrictions and exemptions therefrom will be regulated in the Batteries Regulation. The Batteries Regulation sets out comprehensive rules concerning the design, collection, treatment and recycling of batteries. It also reinforces

²³ Article 6(2) of the Batteries Regulation states: "In addition to the restrictions set out in Annex XVII of Regulation (EC) No 1907/2006 and in Annex II of Directive 2000/53/EC, batteries shall not contain substances for which Annex I contains a restriction unless they comply with the conditions of that restriction".

	the principle of extended producer responsibility for the collection, transport and treatment/recycling of all batteries, including those coming from vehicles. Similar changes are contained in the future legislation on ELV, for the rest of the vehicle. This will result in ensuring coherence between these two initiatives.
7	Waste Shipment Regulation²⁴ (WSR) / Waste Shipment Regulation Proposal²⁵
Legislative or non-legislative?	Legislative, mandatory. Status: Regulation in force; Commission proposal for a Regulation, repealing the previous one, was adopted on 17 November 2021.
Brief description	The Waste Shipment Regulation applies to shipments of waste: • Between EU countries within the EU borders or transiting via non-EU countries; • Imported into the EU from non-EU countries; • Exported from the EU to non-EU countries; • In transit through the EU, on the way from or to non-EU countries. Shipments of hazardous waste from the EU to non-OECD countries are prohibited, while shipments of hazardous waste between Member States or from the EU to OECD countries are subject to the “prior information and consent procedure”. Shipments of “green-listed” non-hazardous wastes within the EU and OECD do not usually require the prior consent of the authorities, but information requirements apply. In applying the regulation all parties involved must ensure that waste is managed in an environmentally sound manner, respecting EU and international rules, throughout the shipment process and when it is recovered or disposed of. The proposal for a new WSR adopted in November 2021 aims to (a) improve the functioning of internal market for waste fit for re-use and recycling, which would result in boosting the market for secondary raw materials, (b) guarantee that waste are shipped outside the EU only when they can be managed in environmentally sound manner and (c) tackle illegal shipments of waste. The proposal simplifies procedures for shipments of waste within the EU through their digitalisation. The proposal would allow the export of waste to non-OECD countries only if they notify to the Commission their willingness to import EU waste and demonstrate ability to deal with it in a sustainable manner. Exports of waste to OECD countries will be closely monitored. Economic operators engaged in such export activities will be obligated to set up third party audit schemes to ensure that the facilities treating their waste manage it in an environmentally sound manner. The proposal strengthens enforcement of the Regulation, lays down more stringent provisions on inspections and penalties and enables OLAF to investigate waste trafficking in the EU.
Interaction with the ELV and 3R type-	The new legislative proposal replacing the ELV Directive will not contain any specific provisions on the shipment of ELVs. All shipments

²⁴ Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste (OJ L 190, 12.7.2006, p. 1).

²⁵ Proposal for a Regulation of the European Parliament and of the Council on shipments of waste and amending Regulations (EU) No 1257/2013 and (EU) No 2020/1056 (COM/2021/709 final).

approval revision	of ELVs, within the EU as well as with third countries, will continue to be governed by rules of the WSR. As, prior to their depollution, ELVs are classified as hazardous waste, their export to a third country outside the OECD is banned. The new legislative proposal replacing the ELV Directive also aims to clarify when a used vehicle becomes an ELV, which is crucial for determination if the WSR applies to shipment of such vehicles. This clarification will be done by amending the definition of ELV, taking into consideration the existing waste shipment correspondents' guidelines²⁶. The new legislative proposal will also establish restrictions regarding the export of used vehicles not classified as ELVs. Such exports will be authorised only provided that the vehicle has a valid roadworthiness certificate. This change is not directly linked with the WSR, as it will not establish similar procedures as when exporting waste, but is necessary to avoid the export of old polluting and not roadworthy vehicles to third countries.
8	Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals²⁷ (REACH)
Legislative or non-legislative?	Legislative, mandatory. Status: Regulation in force; Commission proposal for amending regulation expected to be adopted in 2023.
Brief description	REACH is the key Union legal instrument to ensure the safe use of chemical substances, as such, in mixtures or in articles. REACH aims to ensure a high level of protection of human health and the environment from risks resulting from the intrinsic properties of chemicals, as well as the free circulation of substances on the internal market, while enhancing competitiveness and innovation. REACH is organised around four processes, namely the registration, evaluation, authorisation and restriction of chemicals. Manufacturers and importers of substances are generally required to gather information on the properties of their chemical substances and to identify the uses and conditions under which they can be safely used. Substances manufactured or imported in quantities exceeding 1 tonne per year must submit a registration dossier to ECHA containing information about the substance. The European Chemicals Agency (ECHA) is empowered to assess the completeness and compliance of the registrations during the evaluation process. Restrictions of substances included in Annex XVII to REACH ban or limit the manufacturing, placing on the market or use of the substances concerned (varying from a complete ban to a restricted use under specific conditions), including as part of articles (term 'article' is understood under REACH as products). Restrictions can be adopted in case of an unacceptable risk to human health or the environment (Art.68(1)), following a dedicated procedure involving the agency ECHA (Art. 69-73), or, via a simplified procedure, that does not require the involvement

²⁶ Cf : https://ec.europa.eu/environment/pdf/waste/shipments/correspondents_guidelines9_en.pdf

²⁷ Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (OJ L 396 30.12.2006, p. 1).

	of ECHA for substances presenting specific hazards (carcinogenicity, germ cell mutagenicity or reproductive toxicity on Categories 1A and 1B) and could be used by consumers (Art. 68(2)). The Chemicals Strategy for Sustainability announces the targeted revision of the REACH Regulation, which will be limited to achieving the specific aims set out in the strategy. Considered measures include, among others, extending the generic approach to risk management (currently in REACH Art 68(2), restrictions based on hazardousness) to other categories of substances and strengthening enforcement. The revision will not impact the scope of REACH.
Interaction with the ELV and 3R type-approval revision	The main interplay between these two legal acts regard restrictions on use of certain substances in vehicles and its parts. Although these products fall into the scope of REACH, the current Annex XVII applies to them only to the extent to which vehicles are covered in some specific substance restrictions. Specific restrictions on use of lead, mercury, cadmium or hexavalent chromium, as well as exemptions from them, are laid down in ELV Directive. The preferred option envisages that: (a) any new vehicle-related limitation in uses of certain substances will be addressed under REACH or as appropriate under the Batteries Regulation or be covered under the POPs Regulation, using the existing procedures; (b) existing restrictions under ELV on four substances will be maintained in the new Regulation and reviewed via delegated acts with the support of ECHA. The scope of the assessment of exemptions for the four substances remaining under ELV legislation will be widened so that it would cover not only the cases of ‘unavoidable use’ of these substances (Article 4(2) of the ELV Directive) but also socio-economic, health and environmental impacts²⁸. The possibility of a transfer of the restrictions on the four substances and any exemptions therefrom to REACH can be reassessed in the future once the ongoing REACH review is concluded and sufficient implementation time has elapsed to assess its functioning.
9	Regulation on persistent organic pollutants (POPs)²⁹
Legislative or non-legislative?	Legislative, mandatory. Status: Regulation in force.
Brief description	The Stockholm Convention ³⁰ is implemented in the EU through the POPs Regulation, which bans or limits the production of persistent organic pollutants and their use in both chemical products and articles.
Interaction with the ELV and 3R type-approval revision	The POPs Regulation applies to vehicles. Restrictions on POPs affect not only the substances and materials used for the production of new vehicles but also the treatment of materials recovered from ELVs, which subsequently may impact the ability of ELV operators to fulfil the targets specified in new proposal. The most important POP-related issue for the treatment of ELVs relates to the presence and disposal of the flame retardant decabromodiphenyl

²⁸ It will be similar as the assessment used when evaluating applications for authorisation under REACH.

²⁹ Regulation (EU) 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants (OJ L 169, 25.6.2019, p. 45–77).

³⁰ More information on the Stockholm Convention on Persistent Organic Pollutants <http://www.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx>

	ether (DecaBDE) and other POP-BDE in shredder residue. The disposal and recovery of waste containing such POPs and the placing on the market or recovered materials from ELVs containing POPs is regulated through the POPs Regulation. The recently adopted Regulation that amends the waste annexes of the POPs Regulation ³¹ further reduces the limit values for substances such as POP-PBDEs and HBCDD in waste and introduces limits on newly listed substances such as PFOA and PFHxS.
10	Directive on the Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS)³²
Legislative or non-legislative?	Legislative, mandatory. Status: Directive in force.
Brief description	The RoHS Directive aims to prevent the risks posed to human health and the environment related to the management of electronic and electrical waste. It does this by restricting the use of specific hazardous substances in electronic and electrical equipment (EEE) if they can be substituted by safer alternatives. These restricted substances include certain heavy metals, flame retardants and plasticizers. It thus includes a set of restrictions for a specific sub-set of products. The RoHS Directive also promotes the recyclability of EEE, as EEE and its components that have become waste contain fewer hazardous substances due to the restrictions. The RoHS Directive empowers the Commission to, by means of delegated acts, change or add restrictions with a view to achieving the objectives set out in Article 1, i.e. to contribute “to the protection of human health and the environment, including the environmentally sound recovery and disposal of waste EEE.”
Interaction with the ELV and 3R type-approval revision	RoHS Directive, similarly as WEEE Directive, excludes from its scope of application (a) means of transport for persons or goods, except for electric two-wheel vehicles which are not type-approved, and (b) equipment which is specifically designed, and is to be installed, as part of another type of equipment that is excluded or does not fall within the scope of the Directive, which can fulfil its function only if it is part of that equipment, and which can be replaced only by the same specifically designed equipment. Therefore, also in this case, the new legislation on ELV will be complementary to the existing legal act on EEE. It also needs to be noted, that there is a group of EEE used in vehicles, which falls into the scope of RoHS Directive, for example equipment which is not specifically designed for vehicles but could be used in them. This EEE shall be compliant with RoHS Directive requirements. As in certain situations determination of whether a given EEE falls into the scope of ELV or RoHS Directive was in practice problematic, the new legislative proposal on ELV aims to provide a clearer distinction between the scopes of these two legal acts. It should be also noted, that the rationale of restrictions and derogations therefrom is based on different principles in these two regimes. The ELV Directive focuses on the criterion of ‘avoidability’ of certain uses of the

³¹ Regulation (EU) 2022/2400 of the European Parliament and of the Council of 23 November 2022 amending Annexes IV and V to Regulation (EU) 2019/1021 on persistent organic pollutants (OJ L 317, 9.12.2022, p. 24–31).

³² Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (OJ L 174, 1.7.2011, p. 88–110).

	heavy metals in a given application, whereas the RoHS Directive takes into account the availability of substitutes, the socioeconomic impact of substitution, potential adverse impacts on innovation and, where relevant, life-cycle thinking on the overall impacts of the exemption. This distinction will be kept also in the future legislation.
11	European Climate Law³³
Legislative or non-legislative?	Legislative, mandatory. Status: Regulation in force.
Brief description	The European Climate Law writes into law the goal set out in the European Green Deal for Europe's economy and society to become climate-neutral by 2050. The law also sets the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels and envisages a process for setting a 2040 climate target.
Interaction with the ELV and 3R type-approval revision	The revision of the ELV Directive contributes to achieving climate neutrality both for the automotive sector and other connected industrial sectors. With the electrification of the vehicle fleet, the production and end-of life stages become relevant for the carbon footprint of a vehicle, compared to the use phase. The new legislation will contribute to decreasing the carbon footprint of vehicles through new measures favouring the use of secondary materials in the production of new vehicles. Secondary materials to be used in the automotive sector generally have a lower carbon intensive footprint than primary materials. This is especially the case for aluminium, steel, copper and CRMs like magnesium and REEs which are energy intensive to produce. The same counts for plastics from fossil fuel based production where recycling avoids incineration at end-of life and related carbon emissions. In addition, the new legislation will lay down new measures to increase the quality of metal scraps from ELVs, so that they can be used for high quality recycling/reprocessing by the steel or aluminium industry. The use of scrap is one of the main drivers for the decarbonisation of these industries.
12	Regulation on emission standards for new passenger cars and vans³⁴ and proposal of its amendment³⁵
Legislative or non-legislative?	Legislative, mandatory. Status: Regulation in force; Commission proposal for amending regulation was adopted on 14 July 2021. A compromise text was agreed by the co-legislators on 16 November 2022 and should be published in the course of 2023 in the EU Official Journal.
Brief description	This regulation lays down CO ₂ emission performance requirements for

³³ Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') (OJ L 243, 9.7.2021, p. 1–17).

³⁴ Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO₂ emission performance standards for new passenger cars and for new light commercial vehicles, and repealing Regulations (EC) No 443/2009 and (EU) No 510/2011 (OJ L 111, 25.4.2019, p. 13–53).

³⁵ Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/631 as regards strengthening the CO₂ emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition (COM/2021/556 final).

	new passenger cars and light commercial vehicles in order to contribute to the achievement of the reduction targets from the Paris Agreement³⁶. It sets CO₂ reduction targets for the EU fleet for new registrations of vehicles categories M₁ and N₁. The Regulation contains also incentives for the update of zero- and low-emission vehicles. The proposal for amending this regulation aims to align its ambition in order to contribute to the achievement of the reduction targets from the European Climate Law and sets more ambitious EU fleet targets for 2030 and lays down a 100% EU fleet-wide reduction target for new passenger cars and new vans to apply from 1 January 2035 onwards.
Interaction with the ELV and 3R type-approval revision	The Regulation on CO₂ emission standards focuses on the emissions generated in the use phase of vehicles categories M₁ and N₁. The new regulation replacing ELV and 3R type-approval Directives will focus on the manufacture and end-of life phase of these vehicles. In the view of the ongoing electrification process of the automotive fleet, in particular for these vehicles categories, the emissions generated during the production and treatment phase. As described above, reduction of CO₂ emissions will be achieved mainly by ensuring high quality recycling, strengthening the possibility to retrieve secondary raw materials from the ELVs and stimulating their use in the manufacture of new cars. Therefore, the new legislative proposal will be complementary to regulation on emission standards.
13	Regulation setting CO₂ emission performance standards for new heavy-duty vehicles³⁷ and proposal of its amendment³⁸
Legislative or non-legislative?	Legislative, mandatory. Status: Regulation in force; Commission proposal for amending regulation was adopted on 14 February 2023.
Brief description	This regulation lays down CO₂ emission performance requirements for new heavy-duty vehicles in order to contribute to the achievement of the reduction targets from the Paris Agreement. It sets CO₂ reduction targets for the EU fleet for 2025 and 2030 – respectively 15% and 30% – compared to the reported emissions generated in the period 1 July 2019 – 30 June 2020. The Regulation contains also incentives for the update of zero- and low-emission vehicles. The proposal for an amending regulation sets CO₂ emissions reduction targets for certain types and sub-groups of heavy-duty vehicles and introduces binding CO₂ emissions reduction targets for heavy-duty vehicles for 2035 and 2040 onwards, respectively 65% and 90% – compared to the reported emissions generated in the period 1 July 2019 – 30 June 2020. It also widens the scope of this instrument i.e. to vehicles belonging to M₂, M₃, O₃ and O₄ and provides new rules on the monitoring and reporting.
Interaction with the ELV and 3R type-	The Regulation on CO₂ emission standards focuses on the emissions generated in the use phase of vehicles within its scope. The new

³⁶ [Paris Agreement](#) (OJ L 282, 19.10.2016, p. 4).

³⁷ Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 setting CO₂ emission performance standards for new heavy-duty vehicles and amending Regulations (EC) No 595/2009 and (EU) 2018/956 of the European Parliament and of the Council and Council Directive 96/53/EC (OJ L 198, 25.7.2019, p. 202–24).

³⁸ Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/1242 as regards strengthening the CO₂ emission performance standards for new heavy-duty vehicles and integrating reporting obligations, and repealing Regulation (EU) 2018/956 (COM(2023) 88 final).

approval revision	regulation replacing ELV and 3R type-approval Directives will focus on the manufacture and end-of life phase of these vehicles. Certain obligations will apply also to these heavy-duty vehicles: using certain heavy metals in their components will be restricted, manufacturers will have to provide information on their dismantlability and users will be obliged to hand them to the authorised treatment facilities at their end-of life. The carbon footprint of these vehicles will be decreased, as valuable secondary raw materials, having a much less carbon intensive footprint than primary material will be retrieved from the vehicles and made available for the manufacture of new vehicles. The new regulation will also improve the quality of recycling operations, in particular with respect to steel and aluminium scrap, what will also contribute to the decarbonisation of automotive sector.
14	Directive on Vehicle Registration Documents³⁹
Legislative or non-legislative?	Legislative, mandatory. Status: Directive in force; Commission proposal for a revision of this directive expected to be adopted in 2023.
Brief description	The Directive harmonises the form and content of vehicle registration certificates. Such certificates should be recognized by other Member States for identification of vehicle in international traffic or for its re-registration in another Member State. The Directive obliges the Member States to record electronically data on all vehicles registered on their territory and to ensure, that technical vehicle data is made available for the purpose of periodic roadworthiness testing. The directive specifies also, that in the event that the competent authority of a Member State receives notification that a vehicle has been treated as an ELV, the registration of that vehicle shall be cancelled permanently and information to that effect should be added to the electronic register.
Interaction with the ELV and 3R type-approval revision	One of the objectives of the ELV revision is to address the problem of 'missing vehicles'. This will be done, inter alia, by introducing changes regarding registration, re-registration and de-registration of vehicles. Firstly, the scope of information exchanged among the Member States should also include reasons of vehicles' de-registration. Secondly, Member States should report to the Commission the number of vehicles registered, de-registered, treated as ELVs and shipped outside the EU, and to this end, the Commission Decision 2005/293/EC ⁴⁰ will be supplemented. The new legislative proposal replacing the ELV Directive aims also to introduce more stringent rules on export of used vehicles allowing for such exports provided that such a vehicle has a valid roadworthiness certificate. In order to ensure proper enforcement, the Vehicle Identification Number (VIN) of such vehicles should be made available to customs authorities Introducing of these changes would be done through the future roadworthiness package ⁴¹ . The objective of the latter is to ensure better

³⁹ Council Directive 1999/37/EC of 29 April 1999 on the registration documents for vehicles (OJ L 138, 1.6.1999, p. 57–65).

⁴⁰ Commission Decision 2005/293/EC of 1 April 2005 laying down detailed rules on the monitoring of the reuse/recovery and reuse/recycling targets set out in Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles (OJ L 94, 13.4.2005, p. 30–33).

⁴¹ [Tougher vehicle testing rules to save lives \(europa.eu\)](https://europa.eu), [Vehicle safety – revising the EU's roadworthiness package \(europa.eu\)](https://europa.eu)

	exchange of relevant vehicle roadworthiness data at EU level in order to enforce road safety measures more effectively. Although the objective of revisions are different, close cooperation within the Commission on these proposals would ensure the cohesion of these two initiatives and achievements of their objectives.
15	Roadworthiness Directives⁴²
Legislative or non-legislative?	Legislative, mandatory. Status: Directives in force; Commission proposals for revision of these directives expected to be adopted in 2023.
Brief description	The Roadworthiness Directives aim to increase road safety in the EU and to ensure the environmental performance of vehicles, by means of regular testing of vehicles throughout their operational lifetime. They contribute also to reducing air pollutant emissions by detecting more effectively vehicles that are over-emitting due to technical defects, as the rules require periodic technical inspections and roadside inspections. In the view of digital transformation of EU road transport, the revision of these Directives aims to improve road safety, contribute to more sustainable and smarter mobility and to facilitate and simplify the free movement of people and goods in the Union. The specific objectives include ensuring the functioning of modern electronic safety components, advanced driver assistance systems and automated functions during the vehicles' lifetime, performing meaningful emission tests during vehicle inspections and improving the electronic storage, read-out and exchange of roadworthiness-relevant vehicle identification and status data between EU Member States as well as performance data, building amongst others also on the digitalisation of administrative documents and certificates.
Interaction with the ELV and 3R type-approval revision	One of the objectives of the ELV revision is to increase the collection of ELVs in the EU. This aim is to be achieved, inter alia, by introducing requirements concerning export of used vehicles outside the EU, making exports dependent on the vehicles being roadworthy. Therefore, the assessment of vehicle's roadworthiness will be even more important under the new legal framework. Introducing these requirements will contribute to increasing the safety on the roads also outside the EU, as well as the level of environmental protection.
16	Clean Vehicles' Directive⁴³
Legislative or non-legislative?	Legislative, mandatory. Status: Directive in force.
Brief description	The directive aims at promoting and stimulating the market for clean and energy-efficient vehicles. It requires Member States to ensure that contracting authorities and contracting entities take into account lifetime energy and environmental impacts, including energy consumption and emissions of CO ₂ and of certain pollutants, when procuring certain road transport vehicles categories. The Directive defines 'clean light-duty

⁴² Directive 2014/45/EU of the European Parliament and of the Council of 3 April 2014 on periodic roadworthiness tests for motor vehicles and their trailers and repealing Directive 2009/40/EC (OJ L 127, 29.4.2014, p. 51–128) and Directive 2014/47/EU of the European Parliament and of the Council of 3 April 2014 on the technical roadside inspection of the roadworthiness of commercial vehicles circulating in the Union and repealing Directive 2000/30/EC (OJ L 127, 29.4.2014, p. 134–218).

⁴³ Directive (EU) 2019/1161 of the European Parliament and of the Council of 20 June 2019 amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles (OJ L 188, 12.7.2019, p. 116–130).

	vehicles' by referring to emission levels and 'clean heavy-duty vehicles' referring to types of fuels used by this vehicle. The Directive sets separate targets for each Member State, depending on the vehicle category, for the periods 2.08.2021 – 13.12.2025 and 01.01.2026 – 31.12.2030. It applies to vehicles procured through purchase, lease, rent or hire-purchase contracts, public service contracts and service contracts.
Interaction with the ELV and 3R type-approval revision	The Directive aims to ensure, that public authorities procure vehicles that do not emit certain amounts of substances to the air during the usage phase. It does not allow for addressing other important environmental aspects, such as circularity in design – it mentions recyclability aspects only in a recital⁴⁴, which focuses further on batteries. This legal instrument cannot be used currently to address issues of vehicles' reusability, recyclability and recoverability. Therefore, in order to ensure that circularity is also taken into account then procuring vehicles, the revision of the Clean Vehicles' Directive, currently planned for 2027, will aim to include minimum green public procurement criteria related to vehicles circularity – their recyclability, reusability and recoverability characteristics in the revised Directive.

⁴⁴ Recital 20.

ANNEX 11: 3R TYPE-APPROVAL DIRECTIVE EVALUATION REPORT

EVALUATION of Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability ('3R' Type-approval Directive)

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Glossary

<i>Term or acronym</i>	<i>Meaning or definition</i>
3R	Reusability, recyclability and recoverability (also reuse, recycling and recovery)
3R Directive	Directive 2005/64/EC of the European Parliament and of the Council of 26 October 2005 on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability and amending Council Directive 70/156/EEC
ACEA	European Automobile Manufacturers Association
ATF	Authorised Treatment Facility
CFRP	Carbon-fibre-reinforced plastic
ELV	End-of-life vehicles
ELV Directive	Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles
EU	European Union
EU-27	The 27 Member States of the European Union
IDIS	International Dismantling Information System
KBA	German Federal Motor Transport Authority (<i>Kraftfahrt-Bundesamt</i>)
REACH	Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
SMEs	Small and medium enterprises
SWD	Staff Working Document
TEC	Treaty establishing the European Community
TFEU	Treaty on the Functioning of the European Union
UNECE	United Nations Economic Commission for Europe

11.1 Introduction

Directive [2005/64/EC](#) on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability⁴⁵ (hereinafter, the “3R Directive”) was adopted in 2005. This Directive is part of the EU type-approval framework, which ensures that motor vehicles meet certain safety, environmental, and technical standards before they can be sold and used in the European Union (EU). The framework is based on several pieces of EU legislation that set out the requirements for type approval. The type-approval process is administered by national type-approval authorities and involves the review of technical and test data and the performance of tests to ensure that the vehicles meet the required standards.

The 3R Directive is the main piece of EU legislation linking the design of new vehicles with their reusability, recyclability and recoverability. The main motivation for its adoption was the need to ensure coherence between the type-approval procedures⁴⁶ and the obligations contained under the Directive [2000/53/EC](#) on end-of-life vehicles⁴⁷ (hereinafter referred to as the “ELV Directive”). The latter contains rules on the collection, treatment and recovery of end-of-life vehicles and their components, as well as restrictions on hazardous substances in new vehicles.

Neither the 3R Directive, nor the ELV Directive have undergone substantial revision since their respective adoptions in 2005 and 2000. Meanwhile, the way type-approval is carried out in the EU has known plenty of changes. The European regulatory framework has been revised to restore the confidence in the type-approval system and to include controls during market surveillance. Regulation (EU) [2018/858](#)⁴⁸ has introduced from September 2020 new related EU type-approval rules (better quality and independence of vehicle type-approval and testing authorities, more controls of technical services, more checks on the roads, new EU wide recalls and penalties).

11.1.1 Purpose of the evaluation

This evaluation is being carried out following the presentation of the European Green Deal⁴⁹ in December 2019 as a new growth strategy that will foster the transition to a climate-neutral, resource-efficient and competitive economy. Both the European Green Deal and the new Circular Economy Action Plan⁵⁰ contain a commitment to review the legislation on end-of-life vehicles with the aim to “promote more circular business models by linking design issues to end-of-life treatment, consider rules on mandatory recycled content for certain materials, and improve recycling efficiency”. This is in line with the New Industrial Strategy⁵¹, which promotes continued efforts towards sustainable

⁴⁵ [Directive 2005/64/EC](#) on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability.

⁴⁶ [Council Directive 70/156/EEC](#) on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers.

⁴⁷ [Directive 2000/53/EC](#) on end-of life vehicles.

⁴⁸ [Regulation \(EU\) 2018/858](#) on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles.

⁴⁹ [COM\(2019\) 640 final](#), The European Green Deal.

⁵⁰ [COM\(2020\) 98 final](#), A new Circular Economy Action Plan.

⁵¹ [COM\(2020\) 102 final](#), A New Industrial Strategy for Europe, [COM\(2021\) 350 final](#), Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe’s recovery.

product design to strengthen the competitiveness of Europe's industry. The reason for this being that, increasing circularity in the automotive sector can deliver substantial material savings throughout the value chain and production processes, generate extra value and unlock economic opportunities.

To confirm the need for a review of the end-of-life vehicle legislation, an evaluation of the ELV Directive⁵² was carried out and published in March 2021. This evaluation also touched upon some of the 3R elements and illustrated that the 3R Directive provides useful information how to demonstrate reusability, recyclability and recoverability. However, some of its provisions were found to be unclear, leaving room for interpretation that could weaken its objectives. In addition, the evaluation of the ELV Directive pointed out that no monitoring mechanism for the implementation of the 3R rates has been put in place by the Member States or the vehicle manufacturers. Lastly, this evaluation raised that the 3R Directive has not appeared to incentivise the transition to a circular economy in the automotive sector. While the latter was not an explicit objective of the Directive, it potentially affects its relevance in today's context of the new Circular Economy Action Plan.

Although the evaluation of the ELV Directive contains brief conclusions on the functioning of the 3R Directive, no formal evaluation of the latter has so far been carried out. Hence, the purpose of this evaluation of the 3R Directive is to analyse to what extent the Directive has achieved its objectives and has led to environmental improvements. In line with the Better Regulation Guidelines⁵³, the evaluation examines five evaluation criteria, namely: the effectiveness, efficiency, coherence, EU added value and relevance. In particular, the evaluation investigates the following:

- ✓ **Effectiveness:** the extent to which the actions defined under the Directive have been implemented and whether this has resulted in achieving the 3R objectives;
- ✓ **Efficiency:** assessing whether the obligations arising from the implementation of the 3R Directive have been implemented in a cost-effective way and if there is a potential for further synergies to strengthen delivery while minimising costs and administrative burden, including impact on SMEs;
- ✓ **Coherence:** assessing coherence of the 3R Directive with the EU wide policy objectives on circular economy, as well as possible inconsistencies and overlaps of the 3R Directive with other related EU legislation;
- ✓ **EU added value:** assessing what has been the added value of the 3R Directive compared to what Member States could have achieved acting alone at national or international level;
- ✓ **Relevance:** assessing whether the issues addressed by the 3R Directive still match current needs and contribute to solutions to issues addressed by wider EU policies on circular economy, climate change, plastics, resource efficiency, raw materials, etc.

⁵² [SWD\(2021\) 60 final](#) Commission Staff Working Document Evaluation of Directive (EC) 2000/53 on end-of-life vehicles.

⁵³ https://ec.europa.eu/info/sites/default/files/br_toolbox_-_nov_2021_-_chapter_6.pdf

Since the adoption of the 3R Directive in 2005, the automotive sector has undergone considerable changes. The ongoing transition to greener, decarbonised mobility represents a further transformation of the business model and manufacturing practices of the sector, notably with the increase in rare earth elements used in electric vehicles, which are mainly imported from China. In addition, the current geo-political landscape and the related supply chain disruptions and corresponding shortages of the early 2020s stress the relevance of moving towards more circularity in the automotive industry through improving recycling efficiency on the one hand and increasing the use of recycled materials in the production of new vehicles on the other hand. In that way, a further circular transition would allow for improved mitigation of price volatility and supply risk.

The Commission decided to follow a back-to-back approach in which the evaluation of the 3R Directive and the joint impact assessment for the revision of both the ELV and the 3R Directive are conducted in parallel as a single process. The findings of the 3R evaluation will be used to provide further reflection on where improvements may be needed at the vehicle design and type-approval stage to further facilitate the transition to a circular automotive industry. Potential issues or pitfalls of the back-to-back approach were identified on a continuous basis. An example of this is the formulation of problems identified and preliminary policy options following the evaluation, which were subsequently targeted in the impact assessment of the joint revision of the ELV and the 3R Directive.

11.1.2 11.1.2 Scope of the evaluation

This evaluation covers Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability and Commission Directive 2009/1/EC amending, for the purposes of its adaptation to technical progress, Directive 2005/64/EC (the 3R Directive).

It should be noted that the current 3R Directive only sets requirements for the light-duty segment –i.e., M1 and N1 vehicles (cars and vans). Today, no similar legislation is in place for the heavy-duty segment, or for L-category vehicles (which include motorcycles). This is consistent with the scope of the ELV Directive, from which the 3R Directive derives.

The evaluation covers the period from the adoption of the 3R Directive in 2005 up until the recent past (2022). Geographically, the evaluation focuses on the achievements of the 3R Directive in the European Union. Hence, the evaluation covers the EU-27 Member States and additionally considers the implementation in former Member State, the United Kingdom. Therefore, this report analyses both the issues deriving from the nature of the legislation itself as well as those deriving from its transposition and implementation in Member States, including monitoring and enforcement.

However, the EU automotive sector is not an isolated sector, since many of the manufacturers and their suppliers selling vehicles on the EU market are global players. These players come in direct contact with other requirements in terms of vehicle design and production on other major market, which will be considered throughout the analysis.

This staff working document is supported by a study on the evaluation of the 3R Directive and the impact assessment for the review of the ELV and the 3R Directive and its effectiveness, which was carried out from August 2020 to December 2022⁵⁴.

The methodology followed for the evaluation of the 3R Directive included a stakeholder consultation and the performance of ten targeted interviews with type-approval stakeholders, followed by targeted consultation through a survey of additional stakeholders (type-approval authorities, technical services, vehicle manufacturers and component suppliers) and a targeted review of the 3R Directive and its linkages to the ELV Directive⁵⁵.

This evaluation of the 3R Directive has several limitations. Firstly, it is difficult to accurately measure the environmental impact of the directive, as this would have required long-term data collection and analysis, both on the design characteristics of new vehicles as they enter the EU market and on their treatment at their end of life. Due to a lack of detailed monitoring requirements in both the 3R and the ELV Directives, such detailed historic data are not available. Second, the impact of the 3R Directive on the automotive industry and the wider economy is difficult to isolate from that of the 3R Directive and from technical progress and general automotive industry trends towards greater sustainability. The costs and benefits of the directive for vehicle manufacturers, consumers, and the environment (and their complex interactions across value chains) were particularly difficult to assess quantitatively.

11.2 What was the expected outcome of the intervention?

To minimise the environmental impact of vehicles as they reach their end-of-life stage, vehicle manufacturers should take incorporate waste minimisation into vehicle design considerations. The 3R Directive therefore establishes the link between the design and production stages of certain road vehicles and their end-of-life treatment by setting type-approval requirements for these vehicles regarding their reusability, recyclability and recoverability. It lays down the administrative and technical provisions for the implementation of the minimum rates for the reuse and recovery of end-of-life vehicles set out in Article 7 of the ELV Directive. Vehicles of categories M1 and N1 can only be placed on the European internal market if the manufacturer is able to demonstrate that vehicles are either re-usable, recyclable, or recoverable at least up to the ‘3R rates’ of reusability, recyclability and recoverability set by the 3R Directive.

11.2.1 11.2.1 Description of the intervention and its objectives

The evaluation of the ELV Directive describes how discussions on waste from ELVs date back to the 1970s. Back then, the main concerns were the illegal disposal of hazardous waste and the difficulties to treat plastic waste derived from ELVs. Increasing quantities

⁵⁴Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023.

⁵⁵The fourteen-week public stakeholder consultation was carried out between 20 July and 26 October 2021 as well as an extensive targeted stakeholder consultation carried out late 2021 and early 2022, stakeholder workshops and Member State meetings in March 2022, and extensive desk research.

of plastic waste were found in the Light Shredder Residues⁵⁶ (LSR) and, due to their limited compacting characteristics, took up a large amount of volume within landfills, while their incineration was challenging as it required pre-treatment operations.⁵⁷ In addition, other environmental and health risks, such as contamination of the metal scrap with heavy metals, raised public concerns.

As a response, under the Article 175(1) TEC (current Article 192 TFEU), the ELV Directive was adopted in 2000 to minimise the impact of ELVs on the environment and to improve the environmental performance of all the economic operators involved in the life-cycle of vehicles. To achieve this, the ELV Directive set rules on the collection, treatment and recovery of end-of-life vehicles and their components, as well as restrictions on hazardous substances in new vehicles. These rules include quantified **targets (by weight) for the re-use and recycling (85%) of ELVs as well as re-use and recovery (95%) of components** from ELVs.

For such targets to be achieved, the ELV Directive requires that vehicles should be designed and manufactured in a way that allows this. The need to incorporate end-of-life measures in the design of new vehicles was first realised in the 1990s.⁵⁸ At that time, bilateral agreements were concluded between vehicle manufacturers and Member States – first in France and the Netherlands, later in other Member States – that aimed at setting realistic recycling and recovery targets. Subsequently, the concept of ‘design to be recycled’ was brought into the design criteria of vehicles meant for the EU market by vehicle manufacturers active in research in recycling processing.

To translate the above into binding legal requirements at EU level, the ELV Directive committed to the preparation of an amendment for the European vehicle type-approval legislation in which new vehicle models are tested and granted type-approval to meet a minimum set of regulatory and technical requirements before being placed on the EU market (Article 7(4) of the ELV Directive).

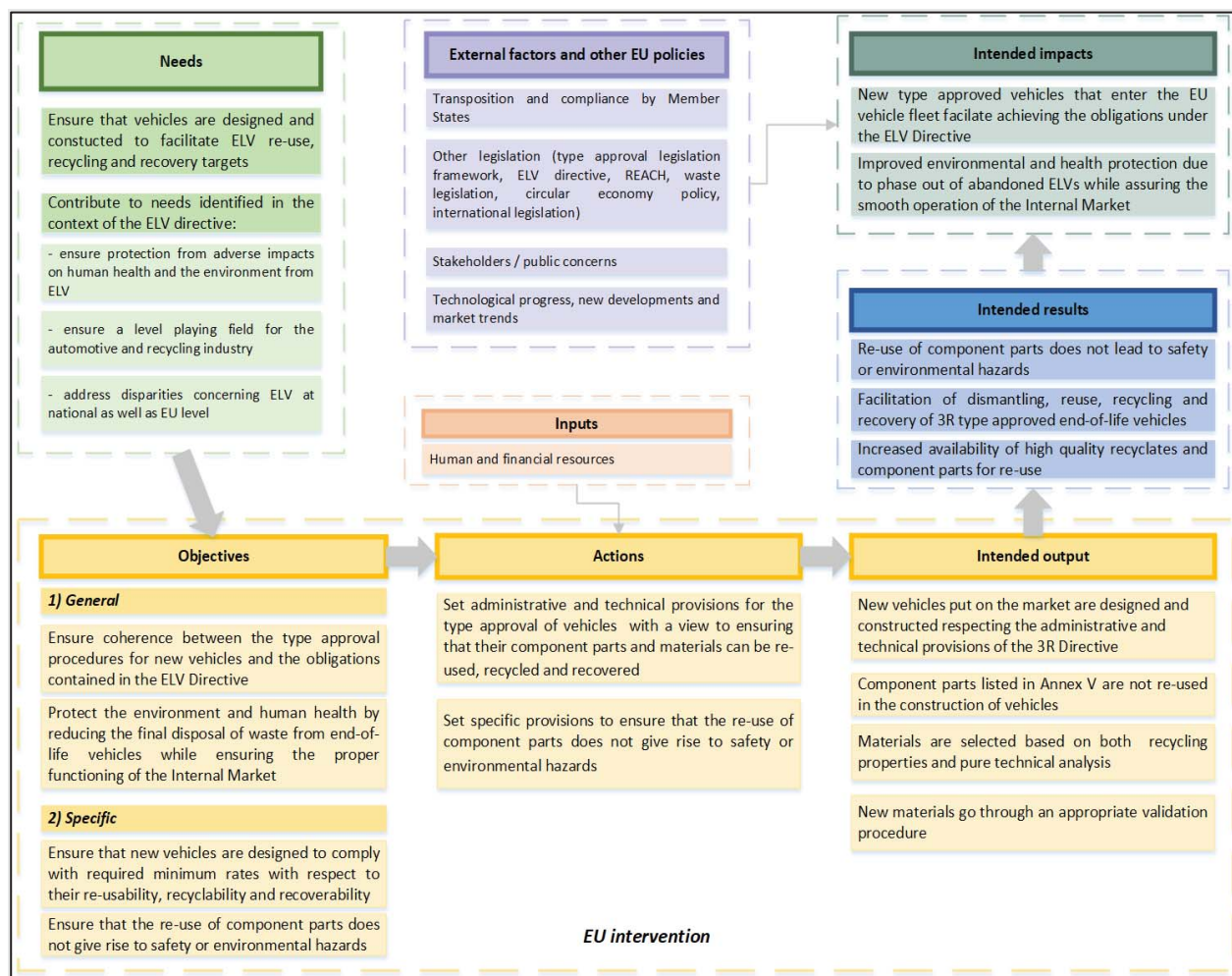
Figure 11.1 gives an overview of how the overarching needs or problems were translated into general and specific objectives for the 3R Directive. These objectives were in turn translated into specific activities at EU level. That way, the 3R Directive aimed at ensuring the dual objectives of (i) ensuring the coherence between the type-approval procedures for new vehicles and the obligations contained in the ELV Directive and (ii) protecting the environment and human health by reducing the final disposal of waste from ELVs while ensuring the proper functioning of the Internal Market. The intervention logic of how the Directive was expected to work can be summarised along two main actions:

⁵⁶Light Shredder Residue are all the light fractions left over from recycling ELVs. This material contains many different materials: plastics, rubber, glass, sand, textiles, wood, metals, and others.

⁵⁷The treatment of exhaust gas of waste incinerators was less developed at that time.

⁵⁸[COM\(2004\) 162 final](#). Proposal for a Directive on the type-approval of motor vehicles with regard to their re-usability, recyclability and recoverability and amending Council Directive 70/156/EEC.

Figure 11.1 – Intervention logic of type-approval Directive 2005/64/EC on vehicle reusability, recyclability and recoverability



A. *Set administrative and technical provisions for the type-approval of vehicles with a view to ensuring their component parts and materials can be reused, recycled and recovered*

The main requirements set in place by the 3R Directive directly translates the targets of the ELV Directive into design requirements for vehicles. In particular, the 3R Directive prescribes that M1 and N1 vehicles (cars and vans) shall be constructed as to be:

- reusable and/or recyclable to a minimum of 85 % by mass, and;
- reusable and/or recoverable to a minimum of 95 % by mass.

To verify this, the 3R Directive includes three main administrative and technical elements. A first element introduced in the 3R Directive is the preliminary assessment of the manufacturer to be carried out by the competent authority before granting any type-approval. Through this assessment, the manufacturers must demonstrate that they manage properly the collection of relevant data received from their suppliers with a view to calculating the recyclability and recoverability rates for any version within a vehicle type to be produced. In this context, the manufacturers should inform the authorities of the strategy they recommend in the field of re-use, recycling and recovery. After the

competent authority has completed all necessary checks of the preliminary assessment, it will issue a certificate of compliance to ascertain that the manufacturer satisfies the obligations under the Directive. This certificate is designated ‘Certificate of Compliance with Annex IV to Directive 2005/64/EC’.

Secondly, **compliance with the requirements of the Directive shall be verified in accordance with general rules on vehicle type-approval.** During the type-approval process, the manufacturers shall demonstrate that the vehicle type has been designed and constructed to meet the above rates. The calculation of these shall be carried out on calculation sheets conform to the standards ISO 22628:2002⁵⁹ to be submitted to the type-approval authority or designated technical service. Subsequently, the latter issues a validation of the calculation in the light of the above documentation of the certificate of compliance and should conduct physical controls on vehicle prototypes to verify the information submitted by the manufacturer and its suppliers.

Third, in-line with the commonly applied worst-case approach in vehicle type-approval and for the sake of simplification, detailed calculations are restricted to those vehicles within the type that are expected to constitute the greatest challenge in reusability, recyclability and recoverability – i.e., reference vehicle(s).

B. Set specific provision to ensure that the re-use of component parts does not give rise to safety or environmental hazards

To ensure that road safety and the protection of the environment are not impaired by the re-use of component parts, the 3R Directive contains a list of component parts, which are not allowed to be re-used in the construction of new vehicles (Table 11.1). These parts play a key role in the protection of vehicle occupants and in the general safe use of vehicles making that reusing them in another vehicle after being dismantled from end-of-life vehicles would entail many risks.

Table 11.1 - List of component parts deemed to be non-reusable from Annex V of Directive 2005/64/EC

– List of component parts deemed to non-reusable	
•	All airbags (1), including cushions, pyrotechnic actuators, electronic control units and sensors
•	Automatic or non-automatic seat belt assemblies, including webbing, buckles, retractors, pyrotechnic actuators
•	Seats (only in cases where safety belt anchorages and/or airbags are incorporated in the seat)
•	Steering lock assemblies acting on the steering column
•	Immobilisers, including transponders and electronic control units
•	Emission after-treatment systems (e.g., catalytic converters, particulate filters)
•	Exhaust silencers

⁵⁹ [ISO 22628:2002](#) on Road vehicles — Recyclability and recoverability — Calculation method.

While separate legislation on safety and environmental vehicle type-approval was already in place⁶⁰, there was not yet any harmonised legislation to ensure that reused component parts continue to offer the same level of performance that is required to obtain type-approval. Component parts such as catalytic converters and exhaust silencers, dismantled from end-of-life vehicles, cannot be guaranteed to offer the required level of environmental protection. In addition, it is extremely difficult to check whether dismantled parts from end-of-life vehicles will meet the durability requirements as provided for in the relevant separate legislation on the Euro standards for vehicle emissions.⁶¹ Similarly, separate legislation was already in place providing test procedures to ensure that component parts such as safety belts and airbags operate safely in the case of accidents.⁶² The test procedures entailed resistance tests to traction as well as durability tests on retractors, which can only be performed on prototype parts representative of production parts. Such tests performed on reusable component parts would render them unfit for use.

To adapt 3R to technical progress, the Directive underwent a minor amendment in Commission Directive [2009/1/EC](#).⁶³ This amendment was appropriate to ensure that competent authorities can verify –for the purpose of reusability, recyclability and recoverability– the existence of contractual arrangements between the vehicle manufacturer concerned and his suppliers and the communication of arrangements.

11.2.2 11.2.2 Point of comparison

The achievements of the 3R Directive will be assessed and compared to a baseline. In this context, the baseline is defined by the date of entry into force of the Directive (2005). Back then, no formal impact assessment of the intervention with an assessment of how the situation would have developed and what could have happened in the absence of the intervention (i.e., counterfactual) was carried out, which limits the possibility to present a comprehensive overview of the original baseline. Nevertheless, the evaluation considers the situation prior to the adoption of the Directive. Considering that the ELV Directive was adopted in 2000, the additional achievements of the 3R Directive over the initial achievements of this closely linked Directive will be assessed to the extent possible.

As indicated above, the ELV Directive committed to the preparation of an amendment to the European vehicle type-approval legislation in which new vehicle models are tested and granted type-approval to meet a minimum set of requirements regarding their reusability, recyclability and recoverability before entering the EU market. Still, the ELV Directive includes some other provisions to improve vehicle design and production in this context.

⁶⁰ In this respect, most of the component parts listed as non-reusable cannot be tested on new vehicle types because the test procedures already required destructive or durability tests to be performed on several samples.

⁶¹ At the time of the proposal of the 3R Directive, Euro 3 was in the process of being revised for the purpose of Euro 4.

⁶² [Commission Directive 96/37/EC](#) of 17 June 1996 adapting to technical progress Council Directive 74/408/EEC relating to the interior fittings of motor vehicles (strength of seats and of their anchorages) OJ L 186, 25.7.1996, p. 28.

⁶³ [Commission Directive 2009/1/EC](#) of 7 January 2009 amending, for the purposes of its adaptation to technical progress, Directive 2005/64/EC of the European Parliament and of the Council on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability.

Firstly, the Directive requires Member States to promote the prevention of waste by encouraging the design and production of new vehicles which take into full account and facilitate the dismantling, reuse and recovery, in particular the recycling, of end-of-life vehicles, their components and materials.

Secondly, under the ELV Directive the Member States shall require in each case the relevant economic operators to publish information on the design of vehicles and their components with a view to their recoverability and recyclability.

Although it is highly unlikely that these two provisions – one being an encouragement and the other being an information requirement – would have the same results on the actual reusability, recyclability and recoverability of end-of-life vehicles as the 3R type-approval Directive, the ELV Directive provisions could in principle have led to some improvements in the baseline after 2000. However, the evaluation of the ELV Directive⁶⁴ which dived into the specific achievements of the provisions on vehicle design and production, contradicts this assumption. The evaluation found that the provisions in the ELV Directive are insufficiently specific and measurable, while several enforcement problems were also identified for the whole ELV Directive. No information is available which shows that Member States have taken measures in this context. Therefore, we can assume that these provisions had little to no impact on the design and manufacturing of new vehicles making it unlikely that the ELV Directive alone has resulted in new vehicles being easier to dismantle and recycle than they were in 2000.

Some interesting initiatives have been adopted by some car manufacturers, notably to promote the reuse of spare parts, the remanufacturing of components or recycling of materials, as well as the use of recycled materials. These initiatives were taken on a voluntary basis and cannot be traced back to the implementation of the ELV Directive and 3R Directive. This shows that due to business incentives, some improvements in vehicle design for reusability, recyclability and recoverability would most probably still have taken place, even in the absence of the 3R Directive.

Due to a lack of data, this evaluation cannot quantify what share of today's improvements is a direct result of the 3R Directive distinctly from the share due to the ELV Directive or other business incentives.

11.3 How has the situation evolved over the evaluation period?

11.3.1 11.3.1 Current state of play

The 3R Directive indicates that the preliminary assessment of the manufacturer and the issuing of a certificate of compliance in accordance with the 3R prescriptions shall be carried out by a competent body. The competent body may be a technical service or type-approval authority, provided its competence in this field is properly documented.

Since there are no reporting requirements for Member States on the implementation of the Directive, evaluating the 3R implementation comes with challenges. Still, the new type-approval framework Regulation reinforces the type-approval testing of new cars and

⁶⁴ See footnote 52.

vans on the EU market and where tests and investigations show non-compliance, the market surveillance authority of the Member State can decide to demand a recall or, in severe cases, full withdrawal from the market.

For the 3R Directive to contribute to circularity of the automotive sector, vehicle types that are granted a 3R type-approval first need to find their way to the European vehicle fleet before eventually being treated at an Authorised Treatment Facility (ATF) as an end-of-life vehicle. Article 10 of the 3R Directive illustrates that the requirements were to be implemented in type-approval in three distinct stages. These stages are summarised in Table 11.2. Only from July 2010 on, five years after the adoption of the Directive, were all new cars and vans entering the EU market required to be type-approved in line with the 3R prescriptions. Considering that the service life of vehicles routinely spans twenty years and beyond, the share of vehicles type-approved under the 3R regime in the vehicles that are currently reaching the end-of-life stage is still expected to be limited (with differences across EU Member States).

Table 11.2 – Implementation roadmap of the 3R Directive in type-approval

Implementation stages of 3R Directive in type-approval		
1	Allowed for new type of vehicles / new vehicles*	12/2006
2	Required for new type of vehicles	12/2008
3	Required for new vehicles	07/2010

*Article 7 on the reuse of component parts also applied from this date.

In addition, observations from other type-approval legislation indicate that most vehicle manufacturers are not early implementers of new type-approval requirements. Taking this into account, Figure 11.2 makes a rough visualisation of the share of 3R type-approved vehicles in the current EU vehicle fleet for cars and vans.⁶⁵ In 2020, only about 55% of cars and vans in the EU vehicle fleet were expected to be 3R type- approved. To put these developments in the context of ELVs, Figure 11.3 displays the annual number of new registrations of 3R type-approved vehicles against the annual number of vehicles leaving the EU fleet and the share of ELVs in this last number. In every year of the 8-year period, the new vehicle registrations for cars and vans 3R type- approved outweigh the number of vehicles leaving the fleet which confirms the continuous growth in the EU fleet.

⁶⁵ This approximation of the cumulative number of registered vehicles conform to the 3R Directive does not consider new vehicles conform to the Directive before July 2010 and/or early termination of new vehicles conform with the Directive.

Figure 11.2 – Approximation of 3R type-approved vehicles in the EU vehicle fleet for cars and vans between 2011 and 2019, based on: ACEA⁶⁶

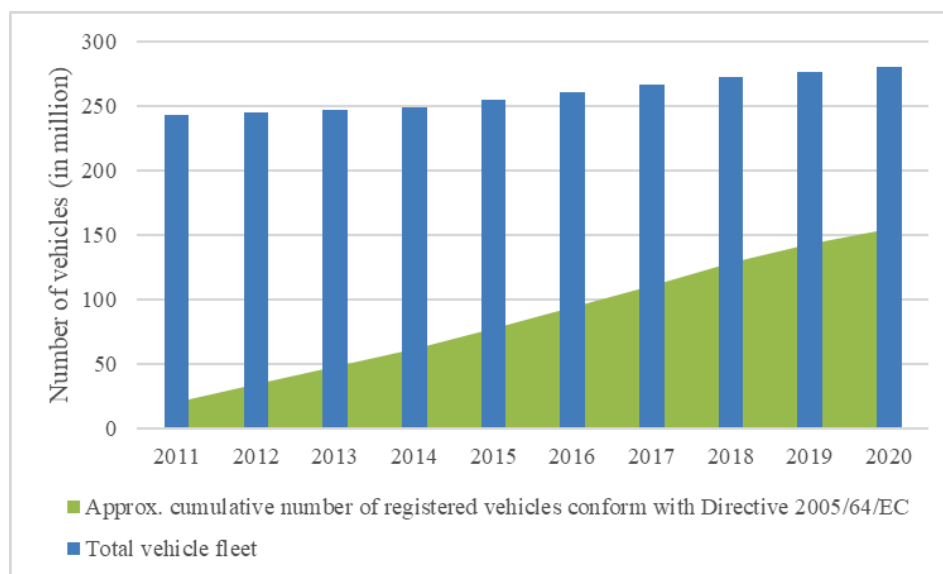
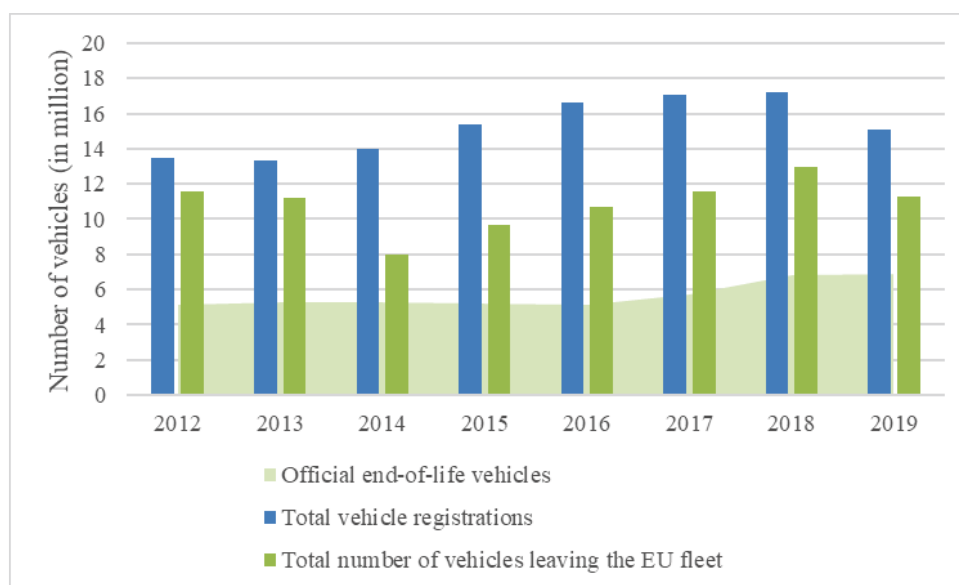


Figure 11.3 – Annual number of vehicle registrations in comparison to the number of vehicles leaving the EU fleet between 2012 and 2019, based on: ACEA⁶⁷ and Eurostat⁶⁸



11.3.2 11.3.2 Member State implementation of the 3R Directive

Many national and Commission reports have been published regarding the implementation of the ELV Directive. However, the progress of the implementation of the 3R Directive has not been documented in the same manner throughout Member

⁶⁶ ACEA, 2022. Size and distribution of the EU vehicle fleet; ACEA, 2022. Passenger car registrations in Europe 1990-2021, by country; ACEA, 2022. Vehicles in use Europe 2011-2021.

⁶⁷ See footnote 66 (ACEA data).

⁶⁸ [Eurostat, 2021](#). End-of-life vehicle statistics.

States. All Member States transposed the Directive 2005/64/EC within their national deadlines between 2006 and 2007. Subsequently, Directive 2009/1/EC, amending the 3R Directive, was transposed in all Member States between 2009 and 2010.⁶⁹ An overview of the national transposition is presented in Table 11. 3.

Table 11. 3 – Overview of national transposition of 3R Directive and amendment 2009/1/EC⁷⁰

Member State	Transposition 3R Directive 2005/64/EC	Transposition amendment 2009/1/EC
Austria	11.10.2007	27.04.2010
Belgium	03.10.2006	01.10.2009
Bulgaria	27.10.2006	21.05.2010
Croatia	2011	2011
Cyprus	24.02.2006	12.02.2010
Czechia	06.08.2013	06.08.2013
Denmark	03.03.2006	08.03.2010
Estonia	01.06.2006	13.06.2011
Finland	27.07.2006	18.09.2009
France	09.05.2007	06.05.2009
Germany	31.12.2005	15.04.2009
Greece	18.04.2007	17.02.2010
Hungary	26.12.2006	2010
Ireland	25.04.2006	04.05.2010
Italy	18.07.2007	24.10.2009
Latvia	04.07.2006	31.12.2009
Lithuania	16.11.2006	16.01.2010
Luxembourg	07.04.2006	14.01.2010
Malta	25.07.2006	06.11.2009
Netherlands	07.12.2006	29.06.2009
Poland	15.11.2006	2010
Portugal	16.05.2007	12.03.2010
Romania	20.10.2005	26.11.2009
Slovakia	15.12.2006	03.02.2010
Slovenia	11.08.2006	28.08.2009
Spain	23.02.2006	27.03.2009
Sweden	2006	2010
United Kingdom	2007	2009

To date, no infringements have been recorded in relation to the 3R Directive, which could suggest that Member States are effectively implementing the measures regarding the reusability, recyclability and recoverability of motor vehicles. However, this could also be a direct result of the lacking reporting or monitoring obligations upon Member States in the 3R Directive that hamper its enforcement.

⁶⁹ The only exception being Croatia, which only became a Member State in 2013 and transposed the Directive 2009/1/EC in 2011.

⁷⁰ Based on information from <https://eur-lex.europa.eu/legal-content/EN/NIM/?uri=celex:32005L0064> and <https://eur-lex.europa.eu/legal-content/EN/NIM/?uri=CELEX:32009L0001>.

In general, this absence of reporting and monitoring obligations makes it particularly difficult to obtain extensive data regarding the progress of the Directive's implementation. Moreover, Member States have differing monitoring and market surveillance methods which hampers consistent practice. As an example, the implementation of the 3R Directive in Member State Germany is elaborated further in

Box 11.1.

Box 11.1 – German implementation of the 3R Directive

In Germany, the Federal Motor Transport Authority (KBA) is the designated entity for market surveillance regarding the 3R Directive. Amongst other measures, the KBA oversees awarding manufacturers the 'certificate of compliance with Annex IV' once they have an adequate 3R management strategy in place. Audi – which is part of Volkswagen Group – was the first German brand that fulfilled the requirements of the Directive even before its implementation, with most of its vehicle models being recyclable to a high degree.⁷¹ Later, also other German brands including BMW, Volkswagen and Mercedes started to publish reports concerning their vehicle recycling strategies. In the meantime, Germany set up a list of designated test laboratories to assist the KBA with the attribution of the compliance certificate to vehicle manufacturers.⁷²

The German federal state of Sachsen-Anhalt published a handbook on how to monitor the implementation of the ELV Directive, including what is required under the 3R Directive to put vehicles on the EU market.⁷³

11.4 Evaluation findings (analytical part)

This section provides the analysis and the results for the five evaluation criteria of effectiveness, efficiency, relevance, coherence, and EU added value. The findings presented are based on the results from desk research, as well as results obtained through stakeholder consultations.

11.4.1 11.4.1 To what extent was the intervention successful and why?

This section provides the analysis and the results for the evaluation criteria of effectiveness, efficiency, and coherence.

11.4.1.1 Effectiveness

Evaluation question 1: To what extent have the objectives of the 3R Directive been met and monitored

Overall conclusion: The 3R Directive has been effective in ensuring that the recyclability, reusability and recoverability rates of vehicles under its scope (as evaluated according to the ISO 22628:2002 standard at the type-approval stage) mirror the

⁷¹ [Automobilwoche, 2007](#). Audi erfüllt als erster EU-Richtlinie zum Recycling.

⁷² [KBA, 2022](#). Designated test laboratories (EU).

⁷³ [Ministerium für Landwirtschaft und Umwelt](#) (sachsen-anhalt.de) (pp. 10-11).

requirements of the ELV Directive on vehicle recycling, reuse and recovery at end of life.

However, recyclability, recoverability and reusability have an uneven treatment in the 3R Directive, which focuses mostly on recyclability and does not directly address reusability. This is, to a considerable extent, driven by the ISO 22628:2002 standard (Road Vehicles – Recyclability and recoverability – Calculation method). Whereas reuse is implicitly covered by these the recyclability and recoverability rates, it is not specified individually and thus there can be no requirement to report on reusability individually in the calculation. The ISO 22628:2002 standard does define “reusability” separately and specifies criteria for when a component can be considered as “reusable, recyclable or both based on its dismantlability”. The logic of the standard results in no obligation for manufacturers to provide separate data about the total weight and composition of components with a greater potential for reuse.

A core part of the 3R type-approval process relates to the specification of components and materials that are considered as recyclable. This is addressed in the ELV “pre-treatment” and “dismantled” fractions that are covered by the ISO 22628:2002 standard calculation. It is also addressed in the ISO 22628:2002 standard calculation section on “metal separation” (i.e., all metals separated from the vehicle through shredding) and on non-metallic residue treatment (specification of recyclable materials). On the other hand, the 3R Directive does not distinguish between treatment technologies, aside from the differentiation into pre-treated, dismantled, metal separation and non-metallic residue treated fractions. If a treatment type falls under the definition of recycling⁷⁴, it will be counted towards achieving the reuse and recycling target. Thus, there is no prioritisation of technologies that achieve higher recycling qualities or that reduce the losses of certain materials.

In that sense, we can conclude that the 3R Directive has ensured the required levels of recyclability and recoverability of the vehicles, but the method to qualify the recyclability of the different components of the vehicles has resulted in a simplified process that provides little granularity and does not support the most advanced recycling technologies.

The 3R Directive has also ensured that reused components do not cause any safety or environmental risk by providing a list of components parts that are banned from being reused in new vehicles (such as airbags, seat belts and steering locks), and that the materials used for the construction of a vehicle type comply with the provisions of Article 4(2)(a) of the ELV Directive on the prevention of use of lead, mercury, cadmium and hexavalent chromium in new vehicles.

Overall compliance with the requirements of the 3R Directive has been ensured by the strength of the type-approval framework, which is upheld by the application of the available enforcement mechanisms by EU Member State authorities. There is, however, no systematic monitoring or studies that compare between the targets reported in type-approval declarations of vehicle manufacturers for specific vehicle types and between their actual performance at end-of-life.

⁷⁴ Linked to the ELV Directive definition under Article 2(7): “‘recycling’ means the reprocessing in a production process of the waste materials for the original purpose or for other purposes but excluding energy recovery. Energy recovery means the use of combustible waste as a means to generate energy through direct incineration with or without other waste but with recovery of the heat.”

Effect of 3R Directive on achieving the targets ELV Directive

When assessing the interaction between the ‘3R requirements’ of the 3R Directive and those of the ELV Directive, it is important to note the semantic differences between them: whereas the requirements of the 3R Directive are on recyclability, reusability and recoverability (i.e., on circularity potential of vehicles as evaluated at the design and production stages), ELV Directive 3R requirements are on recycling, reuse and recovery rates (i.e., on effective treatment rates at the end-of-life stage). Moreover, the requirements apply to different actors (3R Directive requirements concern Member States and vehicle manufacturers, whereas the ELV Directive requirements concern the Member States) and at various levels (the 3R Directive operates at the vehicle type level, and the ELV Directive looks at aggregated annual level for the ‘average vehicle’, i.e., for the flow of end-of-life vehicles, with no recycling rate targets applying specifically to vehicle types or vehicle manufacturers). Therefore, although the nominal values of the 3R rates of both directives are the same (85% for reuse (reusability) and/or recycling (recyclability) and 95% reuse (reusability) and/or recovery (recoverability)), the targets have distinct meanings and carry different consequences for authorities and economic operators.

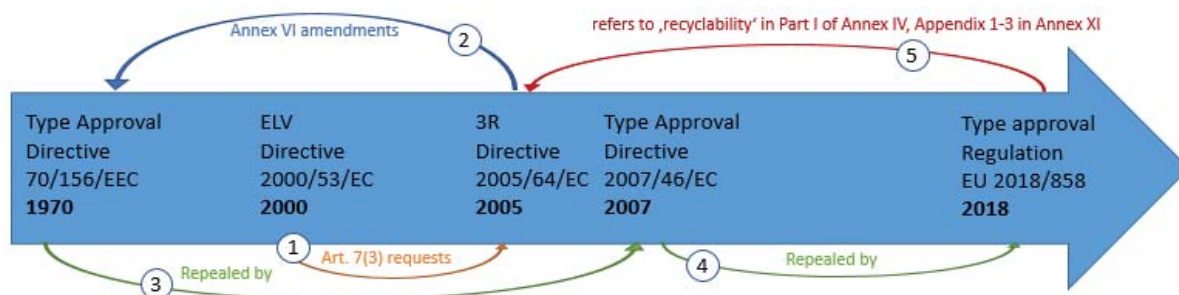
A second point to consider (also more generally when considering the interaction between both Directives, beyond the 3R rates) is that the effect of 3R Directive provisions on ELV Directive targets is mediated by the useful life of vehicle types and the rate at which vehicles reach the end of life: at any given point, the vehicles reaching authorised treatment facilities include vehicles that have been type approved decades ago, vehicles that only very recently entered the market, and everything in between.

A third and last point to consider is that, whereas every Member State in the EU hosts Authorised Treatment Facilities that process end-of-life vehicles, the number of 3R type approvals performed per Member State varies largely. Some Member States have not issued any 3R type approvals since Directive 2005/64/EC came into force (e.g., Latvia, Finland) but do report on type approvals for second stage of N category vehicles. Some Member States perform 3R type approvals regularly (between 6 and 9 annually).

The 3R Directive has remained as part of the EU type-approval framework for motor vehicles through two major overhauls: after two revisions, Directive 70/156/EC on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers (referred to in the 3R Directive) was repealed by Directive 2007/46/EC, which was in turn repealed by Regulation 2018/858/EU (Figure 11.4).

The changes made in the Regulation on type approval following the amendment prescribed in Annex VI of Directive 2005/64/EC have been maintained throughout the revisions. Therefore, the Regulation on type approval from 2018 further relates to the 3R Directive (step 5 in Figure 11.4). Based on the amendment that 3R Directive, Annex VI stipulates for the general type approval that, if the manufacturer does not meet the requirements of the 3R Directive, no type approval shall be granted.

Figure 11.4 – Timeline of amendments of ELV Directive, 3R Directive and related type-approval legislation. Source: Oeko-Institut.



According to the 3R Directive (recital 2), to facilitate the treatment of vehicles at their end of life, ‘manufacturers should be requested to include [reusability, recyclability and recoverability] at the earliest stages of the development of new vehicles’. This is rephrased in recital 15 of the 3R Directive which states that ‘the objective of this Directive [is] to minimize the impact of end-of-life vehicles on the environment by requiring that vehicles be designed from the conception phase with a view to facilitating reuse, recycling and recovery’. Both recitals point out the importance of the design phase to ensure the effectiveness of the ELV Directive.

The 3R Directive has therefore acted as the link between the vehicle design and production stages and the end-of-life stage by requiring that the design of a vehicle type meets the requirements that ensure that it will not hinder the achievement of the ELV Directive 3R targets that are relevant at the end-of-life stage of a vehicle. It is by virtue of the slow replacement of old vehicles by new vehicles compliant with 3R Directive, and by the gradual arrival of these vehicles at the end-of-life stage, that the flow of end-of-life vehicles being treated at authorised treatment facilities became increasingly more reusable, recyclable and recoverable. This is visible both in the historic and recent data for the attainment of ‘3R rates’ for ELVs by the different EU Member States (Figures 11.5 and 11.6).

Figure 11.5 – Total recovery and reuse rate of end-of-life vehicles (% of weight of vehicles), 2008-2020. Source: Eurostat, 2021. End-of-life vehicle statistics.

Total recovery and reuse rate of end-of-life vehicles, 2008–2020
(% of weight of vehicles)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU (*)	85.8	85.3	87.6	89.2	89.9	90.6	91.4	92.8	92.7	93.7	92.9	95.0	96.0
Belgium	90.2	90.6	91.2	90.6	93.0	93.0	94.2	96.7	96.4	97.3	97.3	97.1	97.3
Bulgaria	86.7	89.2	89.2	92.0	91.3	94.1	95.0	95.1	95.6	98.8	95.8	96.5	96.6
Czechia	86.0	86.3	86.3	86.3	86.3	86.3	86.3	95.7	95.4	95.6	99.3	97.3	101.9
Denmark (*)	82.9	82.3	90.7	92.9	92.6	86.7	86.1	97.6	97.1	99.6	98.2	102.6	102.3
Germany	92.9	96.7	106.2	108.2	106.3	103.8	101.4	95.8	98.0	98.4	95.7	93.6	94.0
Estonia	92.7	87.4	78.4	79.0	85.1	86.4	88.4	87.0	89.8	89.9	91.2	91.9	91.3
Ireland	81.8	82.3	77.4	82.7	87.8	91.6	90.7	91.8	92.8	94.6	95.2	95.2	97.1
Greece	85.7	87.4	86.5	87.7	90.3	91.5	85.5	68.9	108.0	99.5	108.3	77.2	98.8
Spain	85.7	86.0	85.7	87.4	88.2	91.5	93.5	95.0	93.4	94.0	92.6	92.4	93.1
France	81.4	82.1	81.9	84.8	87.0	89.3	91.3	94.3	94.8	94.6	94.2	95.0	95.7
Croatia	.	.	.	.	99.9	100.0	96.2	99.5	99.5	99.7	97.7	96.7	97.5
Italy	87.1	84.6	85.4	85.3	82.3	82.8	85.1	84.7	82.6	83.2	82.6	84.2	84.9
Cyprus	79.8	92.9	86.9	86.6	86.9	86.6	90.2	90.7	93.2	91.9	96.8	95.8	97.2
Latvia	89.0	86.0	86.1	86.0	97.9	92.6	92.4	87.0	94.5	84.1	96.0	89.1	84.6
Lithuania	85.0	86.0	88.5	87.4	90.1	92.4	94.4	95.0	95.4	95.1	95.4	95.1	95.1
Luxembourg	85.0	85.0	88.0	90.9	95.0	95.0	95.0	97.0	96.0	96.2	95.9	97.8	98.0
Hungary	84.4	86.2	86.8	86.2	86.2	91.7	95.6	95.2	95.8	96.9	95.8	95.4	97.7
Malta (*)	.	.	64.2	87.1	96.0	91.9	45.0	77.7	54.4	56.1	81.0	79.2	90.1
Netherlands	85.6	85.2	95.3	96.2	96.1	95.9	96.0	97.0	98.7	98.7	98.4	98.5	98.3
Austria	96.1	96.1	96.5	97.6	94.2	96.7	96.1	96.9	96.9	97.9	97.8	97.8	97.4
Poland	80.1	88.0	89.8	91.5	92.8	90.3	88.0	97.0	96.3	98.6	95.3	122.2	.
Portugal	87.2	86.9	86.8	87.9	87.6	90.5	92.7	92.7	92.1	93.8	94.9	96.7	98.9
Romania	96.5	95.3	95.5	96.8	96.0	87.4	88.5	90.8	92.1	92.6	92.2	92.4	91.6
Slovenia	89.7	87.3	90.6	90.3	103.0	.	91.3	95.6	96.5	109.9	103.7	95.4	117.2
Slovakia	88.8	89.6	90.2	94.6	91.2	93.7	96.0	89.4	97.4	97.5	96.8	97.1	97.1
Finland	81.0	81.0	95.0	95.0	95.0	95.0	97.3	97.3	97.3	97.3	97.3	95.2	95.2
Sweden	91.0	90.0	91.1	90.8	90.6	91.3	91.3	96.8	94.6	97.2	95.3	96.8	96.7
Iceland (*)	98.3	83.0	95.2	82.0	100.0	99.6	97.7	98.5	96.8	97.6	97.6	97.4	92.3
Liechtenstein (*)	100.0	92.3	92.3	92.4	92.7	89.0	90.6	90.8	85.6	84.7	85.7	87.1	80.3
Norway	82.7	86.0	94.7	93.3	93.8	94.7	97.5	96.7	97.7	97.2	97.4	96.6	97.2

(.) not available

(*) Eurostat estimates between 2008 and 2011 as well as in 2013 and 2020.

(*) 2013 data: estimated.

(*) 2012 data: low reliability.

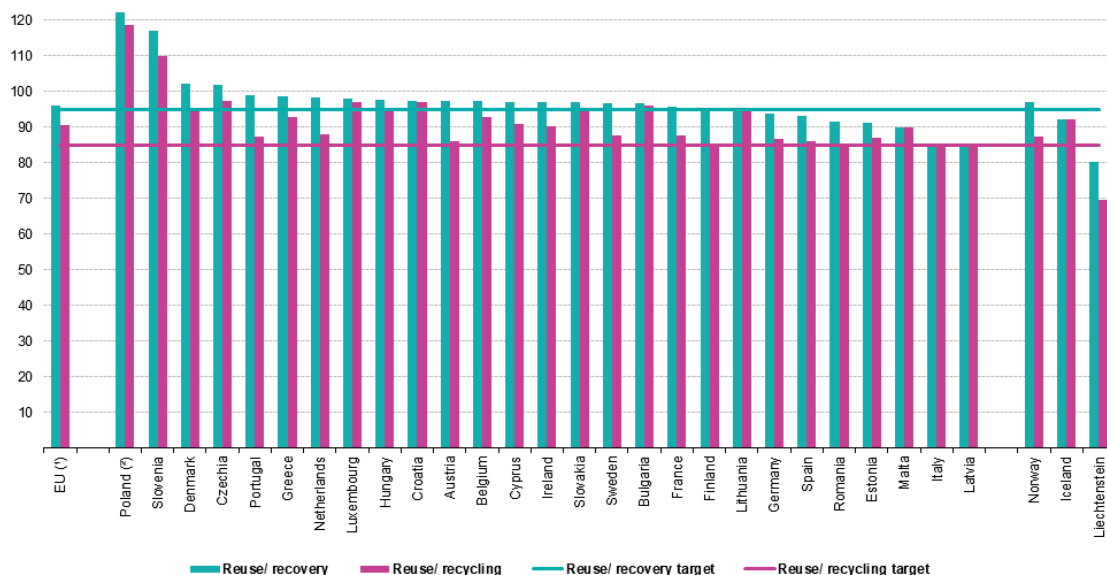
(*) 2008 data: Eurostat estimate.

Source: Eurostat (online data code: env_wasevt)

eurostat

Figure 11.6 – Reuse/recovery and reuse/recycling rate for end-of-life vehicles (% of weight of vehicles), 2008-2020. Source: Eurostat, 2021. End-of-life vehicle statistics.

Reuse/recovery and reuse/recycling rate for end-of-life vehicles, 2020
(% of weight of vehicles)



Note: Countries are ranked in decreasing order by reuse/recovery.

(*) Eurostat estimates.

(*) 2019 data instead of 2020.

Source: Eurostat (online data code: env_wasevt)

eurostat

Remaining obstacles in vehicle design

Under the ISO 22628:2002 calculation method, all materials considered to be recyclable (even to a low degree) are fully accounted for compliance with the “reuse and recycling” target. Two limitations are observed here in terms of the 3R type-approval process facilitating recycling by fostering the necessary changes in vehicle design.

For the case of materials for which there are no available recycling capacities in the EU at the time of type approval, the application of the ISO 22628:2002 standard leads to a material being considered recyclable when there are technologies which have been successfully tested, at least on a laboratory scale. The logic behind this is that vehicles have a long service life (it is not rare for vehicle to remain in use for more than 20 years, although a minority of vehicles can have much longer or much shorter lives, e.g., if they are wrecked in an accident) in which it can be expected that a technology at laboratory stage would reach maturity in terms of available recycling capacities. However, it is observed that vehicles that have been type-approved may include materials in substantial amounts that end up being poorly recyclable at end of life.

For materials that can be recycled, the ISO 22628:2002 standard prescribes that the full weight of the material is considered for the calculation of the share of the vehicle that is reused and recycled. Material losses during waste operations are not taken into consideration, even though materials are not recycled at 100% efficiency. In addition, there is no differentiation in this case between high-quality recycling (which generates secondary raw materials that can be used in vehicle manufacture or equivalent uses) and downcycling, such as backfilling or construction filling materials.

Achievements of the 3R Directive in preventing safety and environmental hazards from reuse of components

The ELV Directive (in Art. 7(4)) refers to 3R targets as the only provision for which the type-approval shall be used to ensure the compliance. In addition, Art. 7(5) of ELV Directive states that amendment of Directive 70/156/EEC should also take consideration that the reuse of components does not give rise to safety or environmental hazards. Article 7 of the 3R Directive refers to the list of ‘Component parts deemed to be non-reusable’ specified in its Annex V that cannot count toward recyclability and recoverability rates and that cannot be used in the construction of vehicles covered by type approval legislation. These parts (which include, among others, airbags, electronic control units and sensors, seat belt assemblies, emission after-treatment systems and exhaust silencers) play a key role in the protection of vehicle occupants and in the general safe use of vehicles.

During the stakeholder consultation, upon being asked the question ‘One of the objectives of the 3R Directive is to prevent safety and environmental hazards through restrictions on re-use of certain component parts (e.g., airbags, seat belt assemblies). Has this objective been achieved in your view?’, of the 34 stakeholders that responded, nine agreed that the objective had been met, five did not agree and the rest did not know. There is no evidence that these safety critical parts are reused in the construction of new vehicles. The type-approval framework (beyond the 3R Directive) effectively prevents

such reuse because the test procedures for such test components require destructive or durability tests to be performed on several samples.

Reporting and monitoring the achievements of the 3R Directive

The lack of monitoring provisions in the 3R Directive has led to an absence of dedicated monitoring of compliance with the 3R Directive. In any case, because the 3R Directive is incorporated in the type-approval framework, type-approval authorities in each EU Member State are responsible for ensuring that the vehicle types comply with the provisions of the 3R Directive before the type approval can be granted and the type can be placed in the market. It is likely that the relative simplicity and lack of ambiguity of the text of the 3R Directive has facilitated a uniform application of its provisions by type-approval authorities in the different Member States.

Hazardous substance and plastic coding provisions are specifically part of the checks to be performed by the competent body (3R Directive, Annex IV). The legal text states that ‘the competent body shall ensure that the manufacturer has taken the necessary measures’ and that ‘the vehicle manufacturer shall be required to demonstrate’ that compliance is ensured. There are additional explanations as to what is accepted as a necessary measure, e.g., supply chain management and communication with the manufacturer’s staff. It is expected that where the competent body is checking these requirements, they will find the requested information, as the legal text appears clear for this aspect. In both cases, that is point 3.1(f) of Annex IV for the coding and Article 6(2) of the 3R Directive and subsequently article 4.1 and 4.2 of Annex IV for the hazardous substances, there is a reference made to the ELV Directive. These requirements being checked in the preliminary assessment means that they are not checked for each vehicle type to be approved. The 3R Directive, Annex II (‘Information Document for EC vehicle type approval’) does not contain an information request on hazardous substances or material coding. Therefore, documents and data as to how the manufacturer organizes the information flows on hazardous substances and plastic coding in his value chain is being checked every two years with the update of the preliminary assessment. But, for the types approved, there is no indication whether they contain hazardous substances, e.g., where ELV Directive annex II exemptions cover the use of a prohibited substance in a material and/or component part. On the other hand, the masses obtained in the steps of the ISO 22628:2002 standard calculation, i.e., recyclability and recoverability are indicated for each new type to be approved.

One instrument to ensure circularity of vehicles is the ‘strategy for dismantling, reuse of component parts, recycling and recovery of materials’. The manufacturer submits the strategy for dismantling etc. during the preliminary assessment phase (described in Article 6 of the 3R Directive). Although the consultation process confirmed that the strategies of the vehicles manufacturers are checked and approved by type-approval authorities, in practice this strategy does not go beyond commitments to certain strategic goals of the company and is not specific to the vehicles to be type-approved. It can be assumed that this is because there are no explicit requirements as to the content of the strategy, except for that it ‘shall take into account the proven technologies available or in development at the time of the application for a vehicle type approval’. The purpose of the dismantling strategy is not fully clear, and whether its current implementation is relevant to the achievement of the goals of the 3R Directive goals may be questionable.

During the evaluation, it was investigated whether type-approval authorities performed any sort of monitoring of the (actual) achievability of the (potential) 3R targets in the type approval phase at end-of-life; i.e., whether the recyclability, reusability and recoverability (potentials) translated into corresponding effective 3R when the vehicles were disposed of. Most are not performing such monitoring, or even studies that look at this aspect, and only one type-approval service provider taking part in the consultation would occasionally visit authorised treatment facilities to see how dismantling is performed and check how this compares with the data provided by the vehicle manufacturer at type approval. This highlights the need to ‘close the circle’ and bridge information and cooperation gaps between vehicle manufacturers, type-approval authorities and vehicle dismantlers and recyclers.

Evaluation question 2: How effective are the 3R provisions in verifying a vehicle’s reusability, recyclability and recoverability?

Overall conclusion: The 3R type-approval process requires manufacturers to compile various data on the vehicle being type-approved as a means of showing its potential reusability, recyclability and recoverability. Though the 3R type-approval process requires manufacturers to specify recycled amounts separately, it does not require a differentiation between qualities of recycling (high quality recycling vs. downcycling). It also does not require taking recycling inefficiencies into account. For this reason, it cannot be considered effective in facilitating recycling of components and material parts to their highest recycling potential.

The scope of the ISO 22628:2002 standard refers to its use for the purpose of calculating the “recyclability rate” and the “recoverability rate”. Reuse is covered by these two rates but is not specified individually and thus there is also no requirement to report on reuse individually in the calculation. The standard defines “reusability” separately and specifies criteria for when a component can be considered as “reusable, recyclable or both based on its dismantlability”, however, here too, there is no obligation for manufacturers to provide separate data about e.g., the total weight and composition of components with a potential for reuse.

Components removed for reuse or recycling prior to the shredder can be specified in the data provided on the “pre-treated” fraction and on the “dismantled” fraction. For the former, the standard specifies a list of components and materials for which data must be provided. Many of these component parts and materials appear under the ELV Directive Annex I, part 3 and 4 (e.g., depollution and removal requirements), though not all. For the latter, i.e., the ‘dismantled fraction’, there is no specification, however the calculation format provided in Annex A of the standard requires that data provided is specified in relation to a specific component. In practice, it is understood that each manufacturer will specify different components in this section, “based on the dismantling strategy”⁷⁵.

The method of calculation set out through the reference to the ISO 22628:2002 standard refers to specification of components that can be dismantled and reused, but it does not require manufacturers to address reuse separately in their 3R type approval applications. It can be understood that manufacturers rarely refer in their calculation to components that can be reused as it is not possible to make a meaningful assumption of what

⁷⁵ This observation is based on documents submitted as examples of type-approval submissions by a Type-approval Authority), and confirmation with other stakeholders (Member State Type-approval Authorities).

components will be dismantled and reused in practice at end of life (because this depends on several factors, notably the state of the parts once the vehicle reaches its end of life, and the future demand for such parts).

However, different type approval documents submitted to the consultants as part of the stakeholder input suggest that the number of components specified can vary greatly. Of two submission examples, one specified a single component (material composition was not specified) and the other close to twenty, of which all were composed of plastic aside from a reference to glass. Based on the component types and composition, the consultants assume that, in the latter case, the components were considered dismantlable for the purpose of recycling. As dismantled components can be relevant for reuse and/or recycling, it is concluded that a vehicle can achieve the 3R rates required at type approval without referring to components that are relevant for reuse. This was explicitly confirmed in a stakeholder interview and, more generally, most stakeholders stated that the verification of reusability of parts and components of ELVs is not facilitated by the 3R Directive.

Most stakeholders who were interviewed or surveyed (e.g., Member State type-approval authorities but also vehicle manufacturers) support this view and specified that reuse is not taken into consideration in the type-approval process. Various stakeholders (including two vehicle manufacturers) explained that reuse is solely based on market demand and that, in principle, every part is reusable – however it is not possible in the design phase to estimate what will be reused when the demand is not yet known.

Evaluation question 3: What are (other) benefits of the 3R Directive for industry, environment and citizens?

Overall conclusion: The other benefits of the 3R Directive are tied to the benefits of the ELV Directive as far as the former plays a supporting role towards the objectives of the latter. In this light, the environmental benefits of the 3R include avoided damages to the environment due to improved handling of ELVs (i.e., increased rates of recovery, recycling and reuse made possible by the changes in vehicle design supported by the 3R Directive). Indirect benefits may include the lower environmental damage associated with resource extraction avoided due to recycling and reuse of materials and components from ELVs and avoided damage to human health due to exposure to hazardous substances whose use is limited by 3R. Other social benefits include the employment and income generation for employees across the EU in the dismantling sector and other economic operators, the majority of which are small and medium enterprises (SMEs).⁷⁶ In addition, new employment may have been created at vehicle manufacturers in relation to vehicle design considerations to ensure continued compliance of vehicles to be type approved. As the range of design changes could vary between vehicles it is not possible to estimate the range of this impact.

No evidence was found of a significant impact of the 3R Directive on spare part availability (and, through it, of reduced costs of repairs for consumers).

⁷⁶ See Evaluation of Directive (EC) 2000/53 of 18 September 2000 on end-of-life vehicles SWD(2021) 61 final, section 5.1.

A precise quantification of these benefits that is distinct from the previous estimate of the benefits of the ELV Directive is not possible from the (qualitative) evidence basis for the evaluation of the 3R Directive.

11.4.1.2 Efficiency

Evaluation question 4: What are the regulatory costs related to the 3R Directive and are they affordable for industry and consumers? Has the 3R Directive caused unnecessary regulatory burden or complexity?

Overall conclusion: The regulatory costs of the 3R Directive derive from the increased obligation on vehicle manufacturers to report to Member State authorities at the type approval stage, from the changes to vehicle design necessitated by compliance with 3R provisions, and from the administrative support that Member State authorities need to provide to keep the 3R Directive as part of the type approval process.

The administrative costs for vehicle manufacturers and type-approval authorities are modest compared to other aspects of type approval which are more cost intensive such as safety or pollutant emissions (with more physical tests and engineering development requirements) and which have seen a faster path of regulatory development in the period covered by the evaluation.

The compliance costs of the 3R Directive for vehicle manufacturers are expected to be passed to customers in full. Since the 3R Directive has been fully phased in since 2010 (it applies to all newly registered vehicles under its scope), these costs are not expected to increase in the future in absence of further regulatory intervention.

Regulatory costs of the 3R Directive, regulatory burden and complexity

When asked the question ‘Since its adoption in 2005, do the economic and environmental benefits achieved by the 3R Directive in your view outweigh the cost of its implementation?’, of a total of 31 participating stakeholders, twenty did not provide an answer, however of those that did, the majority (five stakeholders) considered that benefits are high or that costs are low (three stakeholders) or both (one stakeholder). Only two stakeholders stated that benefits are too low and costs too high and one stakeholder that benefits are too low.

The main costs of the 3R Directive for vehicle manufacturers relate to the provision of the necessary supporting information to justify compliance for each type approval of vehicles under scope. Unlike other aspects covered by type approval (vehicle safety, emissions), the demonstration of compliance does not require the performance of physical tests and is instead performed on a documentary basis. Information is provided in the two steps of the 3R type approval, this is i) the preliminary assessment, and ii) the type approval as such. The requirements as to what data must be provided, are listed in Annex I (Requirements), Annex II (Information Document for EC vehicle type approval), and IV (Preliminary Assessment).

The design of 3R provisions is such that the burden on vehicle manufacturers can be partially mitigated when appropriate. For example, the 3R Directive makes use of the concept of a reference vehicle to avoid the need to conduct repeated detailed calculations under the ISO 22628:2002 process. The selection of a reference vehicle takes account of the version within a type that will constitute the greatest challenge regarding reusability,

recyclability and recoverability. The 3R Directive, however, makes clear that all vehicles covered by the type must comply, and that the selection of the reference vehicle should be performed jointly by the manufacturer of the vehicle and the type-approval authority. The exemptions applicable to special purpose vehicles (e.g., motorcaravans, armoured vehicles, ambulances, hearses and others), multi-stage built vehicles belonging to category N1 (provided that the base vehicle complies with the Directive) and vehicles produced in small series have kept the type approval effort proportionate for SMEs. Since the exempted vehicles are still covered by the ELV Directive, this has not measurably hindered the recycling rates at end of life.

In other cases, the information required by the 3R Directive can be reused elsewhere. The preliminary assessment of the manufacturer (according to Article 6(3) of the 3R Directive) requires that the manufacturer prepare a strategy for dismantling, reuse, recycling and recovery⁷⁷. Although the consultation clarified that this strategy and the documents that vehicle manufacturers prepare for the exchange of information using the IDIS platform⁷⁸ are not the same, one vehicle manufacturer declared that they provide to IDIS an adapted version of the strategy prepared to comply with Article 6(3) of the 3R Directive. This indicates that the information needed to prepare the 3R strategy is already available in a structured manner within manufacturers.

Compliance with provisions on coding of plastic parts and parts containing hazardous substances are also checked in the preliminary assessment, thus, not per vehicle type, but only whether manufacturers handle data properly and completely over the value chain. This too has a moderating effect on the administrative burden on both vehicle manufacturers and type-approval authorities.

Box 2 – The ELV Directive and the 3R Directive: together or separate?

During the consultation process for the revision of the ELV Directive, stakeholders were asked about the possibility of merging the ELV and the 3R Directives together under one legal text. No stakeholder clearly indicated their preference for a merge of 3R Directive and ELV Directive. The participating Member States that perform 3R type approvals were not in favour of a merge with the ELV Directive. China was provided as an example where one legal instrument is in place, but the European market would be more diverse, according to stakeholders.

An ACEA position paper refers to the positions of the automotive industry in relation to the merge of 3R Directive and ELV Directive: ACEA “call[s] for the current legal framework to be maintained.” Rather than focusing on recyclability, they would like to

⁷⁷According to the definition in the 3R Directive, strategy’ means a large-scale plan consisting of coordinated actions and technical measures to be taken as regards dismantling, shredding or similar processes, recycling and recovery of materials to ensure that the targeted recyclability and recoverability rates are attainable at the time a vehicle is in its development phase.

⁷⁸This is an industry-led platform for the exchange of manufacturer-compiled information to promote the environmental treatment of End-of-Life-Vehicles, safely and economically (see: IDIS | The International Dismantling Information System (idis2.com)).

see their engagement in the field of emission reductions during the use phase, i.e., strategies focusing on light weight, acknowledged framing it Design for Sustainability.⁷⁹

However, the co-existence of two separate legal acts (ELV Directive and 3R type-approval Directive) brings with it the risk that the provisions that are ‘mirrored’ (e.g., the 3R rates, or the hazardous substance prohibitions) lose coherence if amendments are not made to both pieces of legislation at the same time. The merging of the two existing Directives would ensure this coherence, and it could also simplify the regulatory framework by gathering all requirements into a single act, also contributing to a stronger EU market integration (especially at the end-of-life stage, where there is no equivalent to the harmonisation effect provided by the type-approval framework). Lastly, merging the two Directives would be beneficial to circularity in the automotive sector, helping to bridge the gaps between vehicle design and production and the end-of-life stage.

Evaluation question 5: To what extent has 3R Directive been cost-effective? Are the costs proportionate to the benefits attained?

Overall conclusion: As previously discussed in Evaluation question 4, there is no evidence to suggest that the 3R Directive has resulted in excessive costs for industry, authorities or consumers. At the same time, the evaluation of the effectiveness of the 3R Directive suggests that it has had a positive effect in promoting environmentally friendly design practices in the automotive industry (albeit with limited results in the promotion of reuse). This positive effect was acknowledged by vehicle manufacturers and type-approval authorities alike, although it was not backed up by data.

However, given the difficulty in precisely quantifying the costs and benefits of both the ELV Directive and the 3R Directive, and in performing an allocation of the qualitative benefits between the two pieces of legislation, the cost-effectiveness of the 3R Directive cannot be evaluated in detail. The targeted survey asked ‘since its adoption in 2005, do the economic and environmental benefits achieved by the 3R Directive in your view outweigh the cost of its implementation?’ About 16% of replies stated that the environmental benefits are high, while 10% stated that the costs were low. This indicates that stakeholders broadly shared the view that the 3R Directive has led to environmental advantages at a reasonable cost.

11.4.1.3 Coherence

Evaluation question 6: To what extent is the EU legislation on circularity in the automotive industry coherent?

Overall conclusion: The 3R Directive was found to be internally coherent and coherent with the ELV Directive. The mirrored ‘3R requirements’ in both directives are seen as a strong element that ensures the coherence between the two texts, despite the differences in meaning of the two sets of requirements (potential rates at type approval vs. effective rates at end-of-life).

⁷⁹ACEA “want to point out that, for the necessary new and innovative materials for achieving the ambitious goals of targeted carbon neutrality by 2050, there might not yet be available appropriate recycling technologies for vehicles on an industrial scale.”

The 3R Directive was also found to remain coherent with the type-approval framework even though it is the last directive remaining that is a main legal text of the overall framework (the others being regulations) and despite some legal references needing an update to improve clarity.

Internal coherence of the 3R Directive and coherence with the ELV Directive

It could be argued that the 3R Directive was set up as a market oversight instrument to support the ELV Directive (i.e., waste legislation). However, from the interviews and workshop participants, specifically the EU Member State representatives' workshop, it became clear that the 3R Directive is more often connected to the general type-approval legislation rather than to the ELV Directive, as usually, both are handled in the Member States in ministries of transport or finance. If expected by the regulator that in the future, the 3R Directive is a means to link the design and production of vehicles with their end-of-life stage, and that the 3R Directive shall contribute to the ELV Directive objectives and effectively ensure that vehicles put on the market are more circular, such intention is to be made more explicit in the 3R legal text and to be communicated to stakeholders.

One of the elements that more strongly ensures the internal coherence of the 3R Directive and the coherence of the 3R Directive with the ELV directive is the mirrored '3R requirements' in both Directives⁸⁰. In absence of improvements in the (potential) reusability, recyclability and recoverability of newly type-approved vehicles, it becomes difficult to meet the (effective) recovery, recycling and reuse targets down the line as the vehicles reach their end-of-life stage, although improvements in recycling and end-of-life treatment are also needed to increase those rates (and thereby the circularity of the vehicles in the scope of both directives).

The scopes of ELV Directive and 3R Directive are similar but not identical. Both include M1 vehicles (passenger cars) and N1 vehicles (light-commercial vehicles). The ELV Directive includes three-wheel motor vehicles but excludes motor tricycles, both defined in the type-approval of two- or three-wheel vehicles and quadricycles⁸¹. In terms of the exemptions, small series and multi-stage built vehicles are exempt from the 3R Directive but not from the ELV Directive. Special purpose vehicles are exempt from the 3R Directive too; however, they are in scope of ELV Directive (although exempt from Art. 7 provisions on the reuse, recycling and recovery rates, so that they do not enter the calculations for the overall 3R rates at end-of-life). There is no evidence that these minor differences in scope have had a detrimental effect on the achievement of the goals of either directive, especially considering how limited the exemptions are in terms of relative share of ELVs.

The questions of the evaluation refer to the future possible requirements and the future legislation to cover the hazardous substance requirements. For the moment, coherence in

⁸⁰ The nominal values of the 3R rates are the same (85% for reuse (reusability) and/or recycling (recyclability) and 95% reuse (reusability) and/or recovery (recoverability), although the targets have distinct meanings and carry different consequences for authorities and economic operators (cf. answer to evaluation question 1).

⁸¹ Council Directive 92/61/EEC of 30 June 1992 relating to the type-approval of two or three-wheel motor vehicles (repealed by Directive 2002/24/EC, again repealed by Regulation (EU) No 168/2013 of the European Parliament and of the Council of 15 January 2013 on the approval and market surveillance of two- or three-wheel vehicles and quadricycles).

relation to the substance prohibitions is ensured as far as the legal text of 3R Directive makes a direct reference to ELV Directive Art. 4(2) for the hazardous substances. On the other hand, for the coding of plastic parts, there is no reference to ELV Directive Art. 8(1), but only to Commission Decision 2003/138/EC⁸². Thus, coherence with any changes to ELV Directive Article 8(1), or new part coding standards introduced through other legislation adopted in line with ELV Directive Art. 8 would not be automatically ensured.

The 3R Directive is also seen as coherent with the overall EU type-approval framework, even after the two overhauls that the framework has undergone since the time that the 3R Directive entered into force. Any future modifications to 3R type approvals should at least ensure an update of the legal references (from the old Directive 70/156/EEC to the current Regulation (EU) 2018/858 governing the type approval of and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles). The exemptions of the 3R Directive applicable to certain vehicles (special purpose vehicles, multi-stage built vehicles belonging to category N1 and vehicles produced in small series) are found to be consistent with the normal functioning of the type-approval framework.

Evaluation question 7: To what extent is the 3R Directive externally coherent with other EU legislation and policy developments?

Overall conclusion: In terms of coherence with other EU waste legislation (notably the Waste Framework Directive⁸³) and with other EU legislation aimed at promoting sustainability, such as REACH. The 3R Directive is also coherent with the broader objectives of the EU to promote sustainability and reduce waste, but further efforts are needed to increase circularity in the automotive sector and address the remaining challenges, especially those related to the electrification of road vehicles.

Coherence with the Waste Framework Directive and REACH

The various levels of the waste hierarchy are being addressed in a different manner in the 3R Directive. Waste prevention and reuse are not being promoted through the 3R Directive. Also, the 3R Directive does not provide an incentive to improve recyclability with an increasing ambitious level, especially if the 3R targets are being achieved across most of the EU Member States. It is thus likely that the 3R Directive is not effective in ensuring that vehicles placed on the EU market increase in circularity, which would not be fully coherent with the aims of the Waste Framework Directive or with high-level political goals of the European Green Deal. It is estimated that current trends towards greater electrification of the vehicle fleet, or the increased use of new materials for vehicle construction (which, in turn, are motivated by policy initiatives under the European Green Deal) could contribute to make this situation worse.

⁸²2003/138/EC: Commission Decision of 27 February 2003 establishing component and material coding standards for vehicles pursuant to Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles.

⁸³ Waste Framework Directive, Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312, 22.11.2008, p. 3) as last amended by Directive (EU) 2018/852 of the European Parliament and of the Council of 30 May 2018 (OJ L 150, 14.6.2018, p. 141).

The key for ensuring that the 3R Directive is effectively addressing substance prohibitions is the direct cross-reference to Art. 4(2) in the ELV Directive. It should be possible to add the direct cross-reference to another legislation, e.g., REACH, if deemed necessary in the future. In the case of merging ELV Directive and 3R Directive and should hazardous substance provisions of the ELV Directive be moved to another legislation, (e.g., REACH), it might be relevant that the (dynamic) reference to the legislation where hazardous substance provisions will be regulated in the future is amended to ensure compliance is checked through the 3R approval process. Alternatively, any legislation addressing prohibitions for vehicles in the future would need to address how compliance is to be ensured or how the future 3R type-approval process works in relation to hazardous substance provisions.

Coherence with ISO 22628:2002 and UNECE

Looking at the wording of the targets, the ELV Directive refers to a reusable and/or recyclable and, secondly to a reusable and/or recoverable target. This is a different wording compared to the outcome of calculations according to the ISO 22628:2002 standard which is a “recyclability rate” and “recoverability rate.” However, these differences in framing, also in relation to reuse, are not perceived to result in any problems in the implementation, except for reuse not playing a role in the ISO calculations, as indicated by stakeholders.

From the formulation of the targets of the 3R Directive, this can only be a *potential* or hypothetical recyclability and recoverability, since the various masses of materials included in the calculation are ‘considered recyclable for the purpose of the calculation’. In the ISO 22628:2002 standard, recyclability is a yes or no decision, while in practice, different recycling efficiencies are achieved for different materials. Hence, the rates calculated through the ISO 22628:2002 standard do not represent the final shares of what is effectively recycled. But, from how the ELV Directive requirement is formulated, and given that no further discrepancy between the wordings of Art. 7 of the ELV Directive, 3R Directive and ISO 22628:2002 could be identified, it is concluded that the standard is coherent with the objectives of the 3R Directive.

However, a minor point was identified, where coherence between ISO standard and EU legislation (ELV Directive & 3R Directive) was not ensured: In relation to the assessment of dismantled component parts to be considered reusable or recyclable, (a) accessibility, fastening and dismantling technology shall be assessed in relation to the dismantlability, (b) safety and environmental hazards shall be assessed in relation to reuse, and (c) material composition and proven recycling technology shall be assessed in relation to recyclability (requested in step 2 in the ISO calculation). Interviewees were asked how the classification of component parts into reusable parts and recyclable parts is done. One vehicle manufacturer answered that “the reusability of vehicle components is usually possible for all components unless they are explicitly excluded by law, or they are wearing parts. Which vehicle components are reused in practice depends on the requirements over the life of a vehicle. This cannot be foreseen by the vehicle manufacturer.” This suggests that the assessment of dismantled components to be considered reusable or recyclable according to the three criteria mentioned is of no particular importance for manufacturers in the compilation of the 3R type approval.

The stakeholder consultation also addressed the importance of coherence between the 3R Directive and UNECE Regulation No. 133 (used for international type approvals beyond the EU) in the workshop, explaining that it also made the process more efficient for vehicle manufacturers, i.e., as they did not need to perform the type-approval process multiple times for the same vehicle type in different world regions. The evaluation questions asked whether it is ensured that vehicles placed on the market following a type approval under UNECE Regulation No. 133 also comply with the relevant provisions that are required for vehicles that are type approved based on the 3R Directive, and vice versa.

Minor deviations in the criteria for the selection of the worst-case vehicle were found. Another aspect is, that the definition of recovery in the UNECE Regulation No. 133 differs from that included in the 3R Directive and ELV Directive. The latter refers to a list of recovery processes agreed under the Waste Framework Directive. Hence, the definition in ELV Directive is more detailed than the UNECE Regulation No. 133 definition. However, it was neither mentioned by stakeholders nor were there any other indications that pointed out or concluded that this discrepancy between the definitions was problematic. As the 3R Directive has been the main source for the UNECE regulation, and given that there are only slight differences that are not substantial to the objectives and main provisions, it is assumed that the 3R Directive is coherent with the UNECE Regulation No. 133. A stakeholder reported that his company was applying for type approvals under the UNECE regulation.

11.4.2 11.4.2 How did the EU intervention make a difference and to whom?

Evaluation question 8: What is the added value resulting from having a 3R Directive at EU level?

Overall conclusion: The 3R Directive is deemed to have created EU added value throughout the years it has been in force, with positive impacts in the automotive sector and in the completion of the EU Single Market. The 3R Directive was also successfully turned into an international UNECE Regulation supporting global harmonisation of type approvals.

11.4.2.1 EU added value

The examination of EU added value of the 3R Directive assesses the benefits of developing legislation at EU level, compared to individual action by Member States through the development of their own comparable legislation, or through other combined international efforts, like those of the United Nations Economic Commission for Europe (UNECE). The following analysis is of qualitative nature, having used inputs from stakeholders and previous experience from the type-approval legislation.

When asked ‘In your view, does it make sense to move away from a type-approval Directive on vehicle reusability, recyclability & recoverability to a type-approval regulation on vehicle reusability, recyclability & recoverability?’, 60% of the stakeholders agreed with this thesis. This clear result assumes that the relevant actors acknowledge the added value of regulating 3R on the EU level, by asking for even more

EU intervention. As such, the EU should consider expanding its current 3R Directive into a Regulation, while respecting the principle of subsidiarity in accordance with EU law.

The evaluation of ELV Directive already pointed out the advantages of having these issues regulated at EU level, rather than the Member States' individual national level. Given that the environmental impact of the automotive industry (i.e., pollution, non-recyclable waste, etc.) is affecting all Member States, it was deemed important to prioritise EU legislation supporting the completion of the EU Single Market and to prevent that diverging national regulations emerge.

This is even more so the case for the 3R Directive, considering that the vehicles manufactured in the EU are also sold, transported and disposed of across the Union. Thus, harmonised and coherent regulations concerning the type-approval of vehicles with regard to their reusability, recyclability and recoverability on the EU level are of utter importance for the effective protection of the environment and the functioning of the Single Market.

EU added value of 3R Directive compared to action at national level

During the stakeholder workshop, participants were asked 'How high do you estimate the added value of having EU harmonised rules for vehicles reusability, recyclability and recoverability, compared to what could have been achieved at merely national level?' 50% answered that the added value is significantly higher and 38% stated it is somewhat higher. These results underline that stakeholders recognise the need and the advantages of having coherent regulations on the EU level. This is supported by the increased numbers of manufactured vehicles that are made of recoverable, recyclable and/or reusable materials in Member States that are significant actors in the automotive industry (e.g., France, Germany).

The ELV Directive evaluation had also shown previously that the recorded numbers of ELVs across Member States had also increased after the introduction of the ELV Directive, also confirming that EU level regulations in the domain of sustainability of the automotive sector offer a significant added value compared to individual national actions. As already stated, given the cross-border nature of road transport, vehicle manufacturing and air pollution, EU directives in this sector promote the functioning of a sustainable EU internal market.

The development and governing of reusability, recyclability and recoverability standard for the automotive sector at EU level is key to prevent harm to the functioning of the Internal Market. While local or national initiatives could in theory replace EU action, they would also create considerable obstacles for automotive industry to enter national markets, as numerous standards are expected to arise. This shows that national action poses great risks for the internal market.

EU added value of 3R Directive compared to action at international level

A different approach to action at EU level usually entails action at the international level; i.e., via the UNECE World Forum for Harmonization of Vehicle Regulations. The

UNECE intends to establish “global” harmonisation of certain technical regulations, with mutual recognition of type approvals amongst its agreements’ signatories, which include all 27 EU Member States. UNECE regulations are legally binding for its signatories, who must transpose the UNECE provisions to their national legal framework.

In relation to the type-approval of vehicles with regard to their reusability, recyclability and recoverability, the UNECE adopted a very similar regulation to the 3R Directive, namely UNECE Regulation No. 133 (Uniform provisions concerning the approval of motor vehicles with regard to their reusability, recyclability and recoverability), which entered into force in 2014. Therefore, the EU is a driving force behind various measures taken by the UNECE, especially regarding more environmentally friendly and sustainable actions, including established regulations No. 49 and No. 83, which aligned with the EU’s Euro VI and Euro 6. The adoption of a global 3R a few years after the 3R Directive was put in place, confirms the EU’s role as a source of global standards.

During the stakeholder workshop, participants were asked ‘How high do you estimate the added value of having EU harmonised rules for vehicle reusability, recyclability and recoverability, compared to what could have been achieved at merely national level?’ From 34 stakeholders that answered, 30 agreed that the harmonised rules have a higher or somewhat higher added value than national legislation (others did not know). In another instance, participants were asked a question regarding equivalence with UNECE legislation: ‘For the purpose of obtaining an EU Whole Vehicle Type Approval, a certificate in accordance with UNECE Regulation No. 133 is accepted as alternative to the 3R Directive. How important is it to keep such equivalence with UNECE legislation and why?’ The stakeholders that replied to this statement made clear that there is a need to maintain this equivalence with UNECE legislation, mostly because of the global nature of the automotive industry considering the role of export/import of vehicles. They especially mentioned that there are European countries that are signatories to the UNECE without being EU Member States, making harmonised regulations even more important. While the respondents emphasized the importance of continued global harmonisation, many underlined the need for the EU to lead regarding 3R type approval legislation and ‘disregard any negative influences from the UNECE’, which might slow down progress and effectiveness.

As such, it can be assumed that, in the absence of EU level action, (minimum) standards on type-approval of vehicles regarding their reusability, recyclability and recoverability under the auspices of UNECE would only be promoted by like-minded and similarly developed countries (e.g., EU Member States and third countries) promoting similarly advanced requirements. Nonetheless, the level of stringency adopted would most probably be the lowest common denominator necessary to satisfy UNECE contracting parties that would take more time to adopt and implement the established regulations.

11.4.3 11.4.3 Is the intervention still relevant?

Evaluation question 9: To what extent do the 3R objectives correspond to the current needs?

Overall conclusion: The 3R rates are currently being met by vehicles at type approval without significant problems. At the same time, the corresponding 3R rates at the end-of-life stage are largely being fulfilled by EU Member States, but this could change if the material composition of vehicle changes over time (e.g., through the introduction of new, lightweight materials).

Current relevance of designing vehicles for reusability, recyclability and recoverability

The 3R Directive does not provide an incentive to improve recyclability with an increasing ambitious level, provided the 3R rates are met at type approval (and, albeit indirectly, as long as the 3R targets are being attained across most of the Member States). As for future provisions on circularity, the level of effectiveness will depend on whether the future provisions fine-tune or amend those that are already being covered with lower ambition today, e.g., amendments of the 3R targets or adding new materials to be coded.

As it stands today, the 3R Directive does not sufficiently differentiate between non-recyclable and recyclable materials if technologies are available at the laboratory stage of development and above (i.e., only a low level of development of recycling technologies for the material is required for it to qualify as fully recyclable). In practice, this allows vehicles making use of high volumes of non-recyclable to be placed on the market in some cases, such as carbon-fibre-reinforced plastics (CFRPs) which is increasingly used in vehicles to reduce their weight. For example, BMW placed the first units of the i3 model on the market in 2013, using carbon fibres as a main material for the vehicle body instead of metal to reduce the weight of the vehicle and achieve better efficiency. Based on interviews with waste management operators, capacities for the recycling of this material are still not available for ELV waste management, resulting in a large share of the vehicle weight not being recycled.

Considering that most vehicles sold today do not use CFRPs in significant quantities and yet the 85% reuse and recycling target is not significantly over-achieved, with the trend towards lightweight materials, this could affect the achievability of the 3R targets in the mid-term (as these vehicles are increasingly produced and become progressively more relevant in the ELV waste stream). On the other hand, an increase in use of a non-recyclable material in the vehicle fleet could be sufficient in some cases for recycling capacities to develop over time, having a positive effect on the 3R rates at the end-of-life over time. Should any requirements be introduced in relation to non-recyclables (e.g., obligatory dismantling) it would be beneficial for them to be addressed under 3R Directive to at least ensure that the use and localisation of such materials is communicated to waste operators to ensure the application of appropriate treatment technologies.

Although it has been shown throughout this evaluation that the 3R Directive has been less successful in promoting the reusability of vehicle parts, there is no evidence that the list of parts that are explicitly excluded from reuse has lost relevance.

Evaluation question 10: To what extent can the 3R Directive cover new challenges linked to the transformation of the automotive industry?

Overall conclusion: The transformation of the automotive industry will bring about challenges to the 3R Directive. The increase of vehicles with electrified powertrains on EU roads will pose challenges at their end-of-life (because electric vehicle batteries are difficult to recycle, and there are potential safety risks associated with their disposal, and recycling infrastructure is at present limited) but also at the design and production stages. Compared to their conventional counterparts from about two decades ago, today's electric vehicles contain an increasingly complex mix of materials that includes electronic components and increasing amounts of electronic components that lower the recyclability of new vehicles as currently evaluated under the 3R Directive. In some cases, parts may be software-locked by the vehicle manufacturer for security reasons, which further limits reuse.

On the other hand, many vehicle manufacturers are already making efforts to increase the circularity of products by applying novel design solutions and standardisation of materials or exploring modular solutions to component design that facilitate disassembly and increase vehicle repairability. Other manufacturers are increasingly becoming involved in directly managing the end-of-life phase of their products (with a special focus on electric vehicle batteries and other electric powertrain components, which contain valuable materials). These efforts are currently not rewarded by the 3R Directive, which does not cover circularity aspects beyond the simple calculation of the 3R rates.

During the evaluation of the ELV Directive, more than 50% of the consulted stakeholders noted that the increased use of electrified vehicles will increase waste management costs for ELVs. It is thought that dismantling may temporarily become less profitable as costs for storage, equipment, safety (e.g., against fires from lithium-ion batteries) and transportation may increase. The new Regulation on Batteries is expected to improve circularity in the design of batteries of EVs. The articulation with the ELV Directive and the 3R Directive will be important. In addition to the batteries, ELVs from EVs contain very costly components such as electric motors, which may generate income for the dismantlers. Rare earth elements, which are used for permanent magnets in EVs (average weight of 1-2 kg of permanent magnets per electric vehicle), platinum group metals for catalytic converters (77% use share in automotive catalysts) and precious metals from electric and electronic systems in vehicles are also increasingly found in new vehicles. However, dismantlers are not currently experienced with such components and the markets for them is not yet developed.

The circularity challenges associated to the electrification of vehicles is not limited to the end-of-life stage. Compared to the conventional vehicles that were produced at the start of the evaluation period, today's vehicles are made up of an increasingly complex mix of materials that includes electronic components and increasing amounts of electronic components that could lower the recyclability of new vehicles as currently evaluated under the 3R Directive, potentially to a point where compliance with 3R rates becomes challenging for new types being brought on the EU market.

Also in the context of the evaluation of the ELV Directive, ATFs referred to the phenomenon of software-locked components or assemblies (e.g., window wiper motors,

inverters, navigation systems, and others) which require a proprietary software key to be installed in a new vehicle after removal. This may be an obstacle for reuse as a component removed without the key will not be reusable and the necessary software key does not have to be provided for free. This is understood to particularly affect establishments that work with multiple vehicle models and brands and that do not have contracts with specific OEMs. Vehicle manufacturers on the other side claim that the locks are of importance for the safety of vehicles, anti-theft and data security.

On the other hand, some vehicle manufacturers are already making efforts to introduce more circularity into their products and services. For example, Renault tries to integrate more circularity through using “recycled and recoverable materials” such as recycled textiles in the battery-electric Renault ZOE. They also consider how certain vehicle components could be used for other purposes, such as in the case of second life for batteries.⁸⁴ Renault also refers to reconditioning of parts (or remanufacturing) to allow their use when repairing other vehicles. With a look to the future, BMW has set an aim to build a recycled electric car by 2040, referring not only to its composition from recycled materials but also to its being emission free. Whereas BMW states that its new cars are currently made with close to 30% recycled materials, the new circular-based approach should increase this to 50% recycled content⁸⁵.

11.5 What are the conclusions and lessons learned?

11.5.1 11.5.1 Conclusions

To minimise the environmental impact of vehicles as they reach their end-of-life stage, vehicle manufacturers should take incorporate waste minimisation into vehicle design considerations. The 3R Directive lays down administrative and technical rules to ensure that the parts and materials of vehicles under its scope may be reused, recycled and recovered as much as possible. It makes sure that the reused components do not cause any safety or environmental risks.

The 3R Directive therefore establishes the link between the design and production stages of certain road vehicles and their end-of-life treatment by setting type-approval requirements for these vehicles regarding their reusability, recyclability and recoverability. The 3R Directive applies to new models and models already being produced of vehicles belonging to the M1 (passenger cars), and N1 (light commercial vehicles, i.e., vans) categories. The legislation does not apply to special purpose vehicles (such as armoured cars and ambulances), to vehicles produced in multiple stages or vehicles produced in small series.

According to the 3R Directive, new vehicles may only be sold in the EU if they may be reused and/or recycled to a minimum of 85% by mass or reused and/or recovered to a minimum of 95 % by mass. The reusability, recyclability and recoverability rates (the so-called 3R rates) are calculated using a dedicated international standard (ISO 22628:2002

⁸⁴ <https://group.renault.com/en/news-on-air/news/circular-economy-moving-up-a-gear/>

⁸⁵ [Circular economy: sustainable into year 2040 | BMW.com](#)

Road Vehicles – Recyclability and recoverability – Calculation method) which provides a simplified methodology for the estimation of the recyclability and recoverability of the vehicle as a whole according to the mass and material composition of its constituent parts. For a material to qualify as recyclable under the ISO 22628:2002 calculation, only a low level of development of existing recycling technology is required. Therefore, the ISO 22628:2002 calculation yields optimistic (potential) recyclability rates, which are difficult to be effectively achieved at the end-of-life stage of the vehicles.

Beyond the 3R rates, the 3R Directive requires manufacturers to have strategies in place to properly manage the reusability, recyclability and recoverability requirements of the legislation. If national authorities consider these strategies satisfactory, the manufacturer receives a certificate of compliance, which is valid for at least two years. This is an additional instrument of the 3R Directive meant to ensure circularity of vehicles. Although the consultation process confirmed that the strategies of the vehicles manufacturers are checked and approved by type-approval authorities, in practice this strategy does not go beyond commitments to certain strategic goals of the company and is not specific to the vehicles to be type-approved. The usefulness of the dismantling strategy, and whether its current implementation effectively contributes to the goals of the 3R and ELV Directives is unclear.

The 3R Directive limits the reuse of certain component parts, such as airbags, seat belts and steering locks since they could present safety and environmental risks. Hazardous substance and plastic coding provisions are specifically part of the checks to be performed by the competent body.

Interaction between the 3R Directive and the ELV Directive

The 3R Directive was adopted with the aim to ensure coherence between the type-approval procedures on one side and the obligations contained under the ELV Directive on the other side. The latter contains rules on the collection, treatment and recovery of end-of-life vehicles and their components, as well as restrictions on hazardous substances in new vehicles which mirror the requirements of the former. Although the nominal values of the 3R rates of both directives are the same (85% for reuse (reusability) and/or recycling (recyclability) and 95% reuse (reusability) and/or recovery (recoverability) and sometimes used interchangeably, the targets have distinct meanings and carry different consequences for authorities and economic operators. Whereas the requirements of the 3R Directive are on reusability, recyclability and recoverability (i.e., on circularity potential of vehicles as evaluated at the design and production stages), ELV Directive 3R requirements are on recycling, reuse and recovery rates (i.e., on effective treatment rates at the end-of-life stage). Moreover, the requirements apply to different actors (3R Directive requirements apply to vehicle manufacturers, ELV Directive requirements apply to Member States) and at various levels (the 3R Directive operates at the vehicle type level, and the ELV Directive looks at aggregated annual level for the ‘average vehicle’, i.e., for the flow of end-of-life vehicles, with no recycling rate targets applying specifically to vehicle types or vehicle manufacturers).

Effectiveness

The 3R Directive has been effective in ensuring that the recyclability, reusability and recoverability rates of vehicles under its scope mirror the requirements of the ELV Directive on vehicle recycling, reuse and recovery at end of life. Looking at the historic data on achievement of the 3R rates by EU Member States at end-of-life stage, a positive trend is observed throughout the years of application of both Directives, although it is not possible to isolate the effect of the 3R Directive from these data. The increases in recyclability and recoverability as reported (in aggregate manner) at the end-of-life stage came about in a gradual way. This is to be expected, considering that the effect of 3R Directive provisions on ELV Directive targets is mediated by the useful life of vehicle types and the (variable) rate at which vehicles reach the end of life.

Although the 3R Directive has been effective in relation with the 3R Rates at the type approval stage, during the evaluation it became clear that the recyclability, recoverability and reusability have an uneven treatment in the 3R Directive, which focuses mostly on recyclability and does not directly address reusability. This is to a considerable extent driven by the ISO 22628:2002 standard, which does not specify reusability rates individually. On the other hand, the ISO 22628:2002 standard (and, as a result, the 3R Directive) does not distinguish between treatment technologies with a sufficient degree of granularity; if a treatment type falls under the definition of recycling (which covers technologies at the early stage of development, and therefore with low recycling efficiencies) it will be fully counted towards achieving the reuse and recycling target.

Thus, the 3R Directive provides no prioritisation of technologies that achieve higher recycling qualities or that reduce the losses of certain materials. This could give rise to problems at the end-of-life stage for materials for which there are no available recycling capacities in the EU at the time of type approval, although this is mitigated by the fact that vehicles usually have a long service life in which it can be expected that recycling technology and the availability of recycling capacities improves.

The lack of monitoring provisions in the 3R Directive has led to an absence of dedicated monitoring of compliance with the 3R Directive, although this shortcoming was mitigated by the incorporation of 3R Directive into the type-approval framework, whereby type-approval authorities in each EU Member State are responsible for ensuring that the vehicle types comply with the provisions of the 3R Directive before the type approval can be granted and the type can be placed in the market, including the provisions on hazardous substances and coding of plastic parts.

Efficiency

The administrative costs for vehicle manufacturers and type-approval authorities are modest compared to other aspects of type approval, such as safety or pollutant emissions. The lack of regulatory development of the 3R Directive would indicate that these costs have remained stable throughout the evaluation period.

The main costs of the 3R Directive for vehicle manufacturers relate to the provision of the necessary supporting information to justify compliance for each type approval of

vehicles under scope. In some instances, the compliance costs are mitigated by the design of the 3R Directive (e.g., by using a reference vehicle to limit the number of vehicles for which the 3R rates need to be calculated, or through the exemptions applicable to certain vehicles, or by checking the compliance with provisions on coding of plastic parts and parts containing hazardous substances at the manufacturer level instead of at the vehicle type level).

The compliance costs of the 3R Directive for vehicle manufacturers are expected to be passed to customers in full, with no evidence emerging during the evaluation to suggest that the 3R Directive has resulted in excessive costs for industry, authorities or consumers. At the same time, the evaluation of the effectiveness of the 3R Directive suggests that it has had a positive effect in promoting environmentally friendly design practices in the automotive industry (albeit with limited results in the promotion of reuse). Given the difficulty in precisely quantifying the costs and benefits of both the ELV Directive and the 3R Directive, an in performing an allocation of the qualitative benefits between the two pieces of legislation, the cost-effectiveness of the 3R Directive could not be evaluated in detail, although during the stakeholder consultation shared the view that the 3R Directive had led to environmental advantages at a reasonable cost.

Coherence

The 3R Directive was found to be internally coherent and coherent with the ELV Directive. The mirrored '3R requirements' in both directives are seen as a strong element that ensures the coherence between the two texts. The scopes of the ELV Directive and the 3R Directive are similar but not identical. There is no evidence that these minor differences in scope have had a detrimental effect on the achievement of the goals of either directive, especially considering how limited the exemptions are in terms of relative share of ELVs. The 3R Directive was also found to remain coherent with the type-approval framework even though it is the last directive remaining that is a main legal text of the overall framework (the others being regulations) and despite some legal references needing an update to bring them in line with Regulation (EU) 2018/858.

The evaluation of the 3R Directive did not reveal any major coherence issues with other EU waste legislation (notably the Waste Framework Directive) and with other EU legislation aimed at promoting sustainability, such as REACH. In relation to the Waste Framework Directive, it was found that the various levels of the waste hierarchy are being addressed in a different manner in the 3R Directive, with waste prevention and reuse not being promoted through the 3R Directive. The lesser emphasis on reuse is attributed to the logic of the ISO 22628:2002, which was otherwise found to work coherently within the 3R type approval process. Also, the 3R Directive does not provide an incentive to improve recyclability beyond the current 3R targets, and thereby to increase their circularity. This situation would not be fully coherent with the aims of the Waste Framework Directive or with high-level policy goals of the European Green Deal.

Finally, the 3R Directive and UNECE Regulation No. 133 (used for international 3R type approvals of beyond the EU), were found to be fully coherent, as a consequence of the

latter being based on the former. It was found that changes in 3R legislation in the EU would necessitate changes at the UNECE level to preserve coherence and ensure a high level of harmonisation that is highly valued by the automotive industry.

EU added value

The 3R Directive is deemed to have created EU added value throughout the years it has been in force, with positive impacts in the automotive sector and in the completion of the EU Single Market. These impacts were, however, only possible to be evaluated in a qualitative manner, and without being disentangled from the positive impacts brought about by the ELV Directive. Considering that the vehicles manufactured in the EU are also sold, transported and disposed of across the internal borders of the Union and beyond, the EU added value of the 3R Directive (and, by extension, of the type-approval framework) is particularly clear, and this was recognised by stakeholders. A clear further indication of the EU added value of the 3R Directive is the fact that it was successfully turned (with only very minor adaptations) into an international UNECE Regulation supporting global harmonisation of type approvals, further cementing the EU's regulatory leadership in this domain.

Relevance

The relevance of the 3R Directive will be tested by the ongoing transformation of the automotive industry. This is especially true of the increase of vehicles with electrified powertrains on EU roads will pose challenges at their end-of-life. Compared to their conventional counterparts from about two decades ago, today's electric vehicles contain an increasingly complex mix of materials that includes electronic components and increasing amounts of electronic components that lower the recyclability of new vehicles as currently evaluated under the 3R Directive. The use of materials such as CFRPs may see a further increase, driven by the pursuit of lower vehicle weight and greater energy efficiency. In some cases, parts may be software-locked by the vehicle manufacturer for security reasons, which further limits reuse. Should these trends continue, a decreasing level of recyclability could make type approval increasingly difficult to achieve.

Challenges associated to electrification and broader industry trends affecting the design of new vehicles will become apparent also at the end-of-life stage. For example, electric vehicle batteries are singularly difficult to recycle, and there are potential safety risks associated with their removal from end-of-life vehicles disposal, and recycling infrastructure is at present limited. Whereas this may not pose an immediate problem (electric vehicles do not yet dominate new registrations, and they are still a small share of overall ELVs), the importance of these issues will grow as more electrified vehicles reach the end-of-life stage.

There are also positive signs that point towards increased sustainability and circular thinking, even in absence of regulatory intervention: many vehicle manufacturers are already making efforts to increase the circularity of products by applying novel design solutions and standardisation of materials or exploring modular solutions to component

design that facilitate disassembly and increase vehicle repairability. Other manufacturers are increasingly becoming involved in directly managing the end-of-life phase of their products and closing material loops. Electric vehicle batteries and other electric powertrain components such as permanent magnets from electric motors could be a source of valuable critical raw materials upon recycling.

11.5.2 11.5.2 Lessons learnt

The evaluation of the 3R Directive confirmed that it has been, and remains, a useful piece of legislation whose role cannot be understood without putting it in context with the objectives of the ELV Directive and the functioning of the EU type approval framework, whereby EU Member State authorities national authorities certify that a vehicle type meets all EU safety, environmental and conformity of production requirements before authorising it to be placed on the EU market, and ensure that the relevant requirements continue to be met thereafter through market surveillance activities.

By acting at the design and production stages of the life of vehicles as products, the 3R Directive has supported a broad achievement of the goals of the ELV Directive (especially increasing the recycling and recovery of vehicles at the end-of-life stage, and limiting the use of certain hazardous substances in new vehicles).

The fact that the effect of reusability, recyclability and recoverability measures applied at the design stage of vehicles can only be translated into effective gains in reuse, recycling and recovery once the vehicles reach their end of life in significant numbers (usually with decades-long delays) complicates the evaluation of the 3R Directive, especially in terms of effectiveness. It appears, however, that the design costs to make new vehicle types compliant with 3R rates have remained reasonable throughout the evaluation period, and a tangible increase in the 3R rates at the end-of-life stage is apparent across Member States if one adopts a long-term perspective.

Although it can be concluded from the evidence supporting the evaluation that the 3R Directive has been an effective piece of legislation with clear EU added value, and that it has worked in a coherent manner with related pieces of EU legislation (including the type-approval framework itself, and the UNECE regulation that was developed from it), there were several shortcomings in its implementation. First, it was clear from the evaluation that the focus of the 3R rates calculation method supported by the ISO 22628:2002 standard was on recyclability and recoverability, with a lesser emphasis on reusability. Second, the lack of granularity of the ISO 22628:2002 to qualify the recyclability of materials may have resulted in a lack of support for more efficient recycling technologies. And third, the lack of inclusion of additional circularity aspects (notably, recycled content provisions) and of mechanisms to monitor and reward over-compliance with 3R rates may have resulted in lower overall circularity improvements that could have benefited both the automotive and the recycling industries. The exclusion of heavy-duty vehicles and L-category from the scope of the 3R Directive is consistent with the scope of the ELV Directive, from which the 3R Directive derives. If the scope of

ELV is expanded to these vehicles in the future, a consistent expansion of the scope should apply to 3R type-approval legislation.

On the other hand, industry-led initiatives (e.g., the establishment of dismantling information databases, or the voluntary circularity commitments made by several ‘front-runner’ vehicle manufacturers) indicate that the EU automotive industry is ready to respond proactively to environmental challenges despite an uncertain context of rapid transformations, including a dramatic shift toward electrified powertrains in new passenger cars. Any review of the 3R Directive will need to account for this, and adapt the existing framework to ensure it supports further improvements in circularity and increased collaboration between vehicle manufacturers, recyclers and EU and Member State authorities.

11.6 Evaluation matrix

Table 11.4 – Evaluation matrix: Effectiveness

Evaluation criterion 1: Effectiveness				
Question	Sub-question	Judgement criteria	Indicator	Data sources
EQ1 : To what extent have the objectives of the 3R Directive been met and monitored?	1.1. To what extent has the 3R Directive facilitated meeting the reusability, recyclability and recoverability targets of the ELV Directive?	Gap between the achieved targets on reuse, recycling and recovering of end-of-life vehicles and the targets in the ELV Directive	Achieved targets on reuse, recycling and recovering of end-of-life vehicles, including for different materials	Literature review: evaluation of the ELV Directive, JRC study ⁸⁶ , impact assessment study Öko ⁸⁷
		Degree to which the 3R Directive has contributed to achieving ELV targets	Estimated contribution of 3R Directive to achieving targets on reuse, recycling and recovering of end-of-life vehicles	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics
	1.2. Which obstacles in vehicle design to meeting these targets still remain?	List of obstacles in designing vehicles taking into account reusability, recyclability and recoverability	Obstacles in designing vehicles taking into account reusability, recyclability and recoverability	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics
	1.3. To what extent has the 3R Directive prevented safety and environmental hazards through restrictions on re-use of certain component parts?	Degree to which the safety and environmental hazards arising from reuse of components have been resolved by 3R	Reported safety and environmental hazards from reuse of components both before 3R Directive and since the 3R Directive	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics
	1.4. To what extent are these achievements monitored? Is there insufficient data to ensure full effectiveness?	Extent to which reported/monitored information is available and complete	List of reported/monitored information on achievements 3R Directive	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics

⁸⁶ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC12900.

⁸⁷ Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023.

EQ2: How effective are the 3R provisions in verifying a vehicle's reusability, recyclability and recoverability?	/	Degree to which the type-approval provision are able to verify a vehicle's actual reusability, recyclability and recoverability	Verified vehicle reusability, recyclability and recoverability versus actual reusability, recyclability and recoverability	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics
EQ3: What are other benefits of the 3R Directive for industry, environment and citizens?	/	Degree to which economic, environmental and social indicators improved following the introduction of the 3R Directive	Innovation in vehicle design taking into account reusability, recyclability and recoverability Health and environmental indicators Vehicle prices Indicators of competitiveness and Single Market	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics

Table 11.5– Evaluation matrix: Efficiency

Evaluation criterion 2: Efficiency				
Question	Sub-question	Judgement criteria	Indicator	Data sources
EQ4: What are the regulatory costs related to the 3R Directive and are they affordable for industry and consumers? Has the 3R Directive caused unnecessary regulatory burden or complexity?	4.1. What are the regulatory costs related to the 3R directive and are they affordable for industry and consumers?	Implementation costs high/low in comparison to price vehicles and other costs for industry	Implementation costs for industry	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics Desk research
	4.2. Is there any evidence that the implementation of the 3R Directive has caused unnecessary regulatory burden or complexity?	Extent to which administrative cost and burden can be considered unnecessary	Administrative costs linked to 3R Directive, reported administrative burden or complexity	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics Desk research
EQ5: To what extent has 3R Directive been cost-effective? Are the costs proportionate to the benefits attained?	/	Degree to which benefits of the 3R Directive are proportionate or outweigh the related costs	Implementation cost 3R Directive Benefits 3R Directive	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics Desk research

Table 11.6 – Evaluation matrix: Coherence

Evaluation criterion 3: Coherence				
Question	Sub-question	Judgement criteria	Indicator	Data sources
EQ6: To what extent is the EU legislation on circularity in the automotive industry coherent?	6.1. To what extent is the 3R Directive internally coherent?	Number and relevance on inconsistencies in the 3R Directive	List of inconsistency issues in the 3R Directive	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics Desk research
	6.2. To what extent are the 3R Directive and the ELV Directive coherent?	Number and relevance on inconsistencies between the 3R Directive and the ELV Directive	List of inconsistency issues between the 3R Directive and the ELV Directive	Literature review: evaluations of the ELV Directive and other type-approval legislation Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics
EQ7: To what extent is the 3R Directive externally coherent with other EU legislation and policy developments?	7.1. Are the 3R requirements and the related type-approval process coherent with the overall type-approval framework, with safety type approval and emissions type approval? To what extent is the scope of the 3R Directive coherent?	Number and relevance on inconsistencies between the 3R Directive and the type-approval framework Share of vehicles and vehicle waste covered by the 3R Directive	List of inconsistency issues between the 3R Directive and the type-approval framework List of vehicle categories covered in type-approval legislation Different vehicle categories in number and in kg waste	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics Desk research

	7.2. Are the 3R provisions coherent with the EU waste legislation?	Number and relevance of inconsistencies	List of inconsistency issues	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics Desk research
	7.3. Is the 3R Directive coherent with REACH?	Number and relevance of inconsistencies	List of inconsistency issues	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics Desk research
	7.4. Is the 3R Directive coherent with ISO 22628: 2002 and international regulations such as UNECE Regulation No. 133?	Number and relevance of inconsistencies	List of inconsistency issues	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics Desk research
	7.5. Is the 3R Directive coherent with other EU legislation?	Number and relevance of inconsistencies	List of inconsistency issues	Literature review: impact assessment study Öko Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics Desk research

Table 11.7 – Evaluation matrix: EU added value

Evaluation criterion 4: EU added value				
Question	Sub-question	Judgement criteria	Indicator	Data sources
EQ8: What is the added value resulting from having a 3R Directive at EU level?	8.1. What is the added value of 3R Directive compared to what could have been achieved at merely national level?	Weighing (dis)advantages of having rules on vehicle design and production taking into account their reusability, recyclability and recoverability at Member State level	(Dis)advantages of having rules on 3R vehicle design and production at Member State level	Literature review: evaluations of the ELV Directive and other type-approval legislation Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics
		Weighing (in)consistency between the needs and challenges of the 3R Directive the needs of the internal market	The needs and challenges of the 3R Directive and the needs of the internal market	Literature review: evaluations of the ELV Directive and other type-approval legislation Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics
	8.2 What is the added value of 3R Directive compared to what could have been achieved at international level?	Weighing (dis)advantages of having rules on vehicle design and production taking into account their reusability, recyclability and recoverability at international level	(Dis)advantages of having rules on 3R vehicle design and production at international level	Literature review: evaluations of the ELV Directive and other type-approval legislation Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics
	8.3 Do the needs addressed by 3R Directive continue to require harmonisation action at EU level?	Degree to which withdrawing the existing EU intervention would lead to negative consequences	Negative consequences of withdrawing the 3R Directive	Literature review: evaluations of the ELV Directive and other type-approval legislation Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics

Table 11.8 – Evaluation matrix: Relevance

Evaluation criterion 5: Relevance				
Question	Sub-question	Judgement criteria	Indicator	Data sources
EQ9: To what extent do the 3R objectives correspond to the current needs?	9.1 To what extent does designing vehicles taking into account reusability, recyclability and recoverability correspond to the current needs and EU ambitions?	Gap between ambitions in targets for vehicle reusability, recyclability and recoverability (do not) and the current needs and EU ambition	List of current needs for circular automotive industry and vehicle design for circularity; List of ambitions of wider EU initiatives (e.g. CEAP, EU Green Deal and Industrial policy)	Literature review: evaluations of the ELV Directive and other evaluations (Waste Shipment Regulation, REACH, ROHS) Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics
	9.2 Is the current list of non-reusable component parts still fit to prevent from today's safety or environmental hazards?	Degree to which the list of components covers all safety and environmental hazards from reuse of component parts of relevance today	Reported concerns regarding reuse of certain (new) components	Literature review: evaluations of other type-approval legislation Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics
EQ10: To what extent can the 3R Directive cover new challenges linked to the transformation of the automotive industry?	10.1 To what extent can the 3R Directive cover technological developments in the automotive industry (e.g. the growing share of electric vehicles)?	Degree to which the objectives of the 3R Directive can continue to be met taking into account technological development.	List of technological developments in the automotive vehicles, especially for vehicles in the scope, affecting today's reusability, recyclability and recoverability practices (incl. growing share electric and hybrid vehicles, increased use of lightweight	Literature review: evaluations of the ELV Directive and other type-approval legislation Stakeholder input from e.g. MS and EU officials, (re)manufacturers, recyclers, NGOs, academics

			materials in vehicles like plastics, carbon-fibres, fibre-reinforced (plastics) materials; electronic components, which contain strategic and/or critical raw materials (CRMs))	

11.7 Overview of benefits and costs

Table 11.1. Overview of benefits and costs identified in the evaluation

	Citizens/Consumers		Businesses ⁸⁸		Administrations ⁸⁹		Environmental costs	
	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
[Cost or Benefit description]:								
Administrative costs	recurrent	Compliance costs of businesses are expected to be passed on to consumers. Because the cost of a type approval is spread over all the vehicles in the type, this has a small impact on final vehicle prices.	Costs for OEMs that submit an application for type approval: Fees for applying for type approval varies depending on certificate type (0-600€) ⁹⁰	Based on input of a single OEM, processing an application or type approval takes between 0.5-2 FTE and they prepare around 30 applications per annum. Assuming that an OEM processes 30 3RTAs per annum suggests that the burden of compliance is between 15-60 FTE per OEM. It is noted that as 3RTA is internationally compliant, not all submissions will take place in the	Costs for type approval authorities from checking and approving applications for 3R Type approval: estimated at "< 0.25 years FTE per 3R Type approval and at 1.5-2.5 years FTE in total per annum per MS.	One authority estimated the costs for the process at "< 0.25 years FTE per each 3R type approval. From inputs of MS who perform 3R Type approvals it is concluded that 6-9 3R Type approvals are performed per annum. Though the data is not exhaustive, it can be assumed that only between 5-10 MS perform 3R type approvals.		

⁸⁸ This includes impacts for OEMs on the one side and for Type approval service providers who provide support in the preparation of documentation for type approval (the latter can be considered similar to certification bodies). One type approval service provider gave information as part of an interview with a Member State (MS) type approval authority. Others did not participate. Input was furthermore provided to consultation efforts in the form of answers to survey questions: OEMs were interviewed, 1 OEM provided answers to the survey confidentially and an association also provided general input in writing, however not answering the survey questions.

⁸⁹ Data is based on input from 5 MS Type approval Authorities that participated in stakeholder consultation activities based on a survey of questions. One MS was interviewed, three provided the filled-out survey, 1 provided short input per email, relating to the survey but only to a few of the aspects addressed therein.

⁹⁰ Based on a survey of MS Type approval authorities, it is not clear whether these fees apply only to 3R Type approvals or have a different scope – one MS specified only one fee while another gave different fees but said not to have done and 3R ones: Some MS have not performed any TAs since Directive 2005/64/EC came into force (e.g., Latvia, Finland) but do report on Regular TAs for second stage of N vehicles. Some perform 3R Type approvals regularly.

					EU and not all models will be marketed in the EU, i.e., the sum cannot be allocated in total to the Directive.				
Implementation costs	recurrent			Costs for Type approval service providers: Costs of increasing knowhow of vehicle composition and related likelihood of complying with the 3R Targets: Partial costs: Organisation and participation in visits at ATFs to observe the dismantling process.	One Type approval service provider stated that they perform visits at ATFs to see how the dismantling is performed in practice, feeding into their knowledge, however this was necessarily of the vehicle models they type approved and it could be understood that a visit is not performed every year.				
Adjustment costs								Costs related to resource efficiency: in cases where large amounts of “non-recyclable materials” such as reinforced plastics are contained in the vehicle and assumed to be recyclable due to a $TRL \geq 4$, such materials	

								will probably be shredded and mixed with other fractions, possibly contamination other fractions and increasing recycling costs.	
Benefits	one-off	Benefit of type approval for consumers: as the 3R Type approval applies throughout the EU and as it is linked to the international UN ECE Regulation 133 which is very similar, consumers have the benefit of being to purchase or sell second hand vehicles between borders without the need to recertify the type approval of the vehicle ⁹¹							
Benefits	recurrent			Benefits for OEMs: as the 3R Type approval applies throughout the EU and					

⁹¹ This applies to the base vehicle which is affected by the 3R Type approval. In the case of second stage type approvals this may differ as the vehicle may change at different stages of its lifetime, however this is understood to be out of scope of this review.

				is also compliant internationally, OEMs have the benefit of harmonisation as they only need to perform a single type approval for new models they intend to place on the market, which then applies in all countries where that model is marketed. Benefits for Type approval service providers: these establishments are hired by the OEMs to certify and thus support the preparation of type approval applications. Data was not made available on the revenue for such services; however, it would be expected to incur for every type approval performed by the company. [benefits not quantifiable]					
Indirect	recurrent					Benefits for MS: where	Basis for assumption		

benefits						type approved vehicles are placed on the market of an MS in which it was not type approved, that MS has benefit of cars being placed on the market that are considered to comply with ELV requirement, without having had any administrative costs to ensure the compliance . [benefits not quantifiable]	: The 3R Type approval is harmonised not just for the EU but also internationally.		

ANNEX 12: OVERVIEW OF PROJECTS AND RESEARCH

Since 2000, under the Horizon 2020 and LIFE, the EU has funded around 100 of different projects which have contributed to higher scale of knowledge, expertise in advancement of relevant ELV treatment operations, material recovery, reduced use of rare earth materials and manufacturing/recycling costs. The subsections below provide the overview of the key ongoing and completed projects and research in the field.

12.1 Under Horizon 2020 programme:

1. Circular Process for Eco-Designed Bulky Products and Internal Car Parts (2017-2021)

ECOBULK⁹² aims at demonstrating and implementing a new Circular Economy model for bulky composite products in automotive, furniture and building component industrial sectors, with high potential of cross-sectoral replicability and transferability to other industrial sectors, to promote greater re-use, upgrade, refurbishment and recycling of these products. ECOBULK is a large-scale demonstration project that develops different pilot activities and demonstrations at different levels. The initial planning for manufacturing, demonstration and validation of the newly designed circular products have already started in ECOBULK by generating a master plan for the demonstration activities. This preliminary demo plans total 7 EU-countries, 11 demonstrators and in 21 individual demonstrations all over the Europe during years 2019-2021 within the three product sectors automotive, furniture (indoor/outdoor) and building and construction.

2. Removing hazardous substances to increase recycling rates of WEEE, ELV and CDW plastics (2019-2022)

The EU-funded NONTOX project⁹³ targets two waste streams: end-of-life vehicles (ELV) and construction and demolition waste (CDW). It will develop technologies to remove hazardous substances from these two waste streams. The project investigates the thermochemical conversion of non-target plastics and side streams to increase system efficiency by increasing the range of final products and applications. The project aims to develop an economically competitive recycling process that can produce safe and high-quality secondary plastic materials from contaminated plastic waste.

3. New industrial sorting systems based on laser spectroscopy (LIBS), magnetic induction, and machine vision for recycling of non-ferrous metals (2014)

SMEs and research organisations in the EU-funded SHREDDERSORT project⁹⁴ have developed and demonstrated a new industrial sorting system to separate non-ferrous shredder scrap into cast aluminium (Al), wrought Al, and non-Al categories. Compared to the unsorted material, the sorted categories are better suited for recycling into secondary metals, have a higher market value, and will reduce the use of raw materials.

⁹² <https://cordis.europa.eu/project/id/730456>

⁹³ <https://cordis.europa.eu/project/id/820895>

⁹⁴ <https://cordis.europa.eu/article/id/128556-new-industrial-sorting-systems-based-on-laser-spectroscopy-lbbs-magnetic-induction-and-machin>

4. Controlled Closed Loop Recycling for Life-Cycle Optimised Industrial Production (2005-2007)

The Conclore project⁹⁵ aimed to develop a viable, low-emission system for manufacturing 100 %-recyclable single-component car interior products. Materials can be recovered at the end of the vehicle's useful life and be recycled into another product — in any sector. By focusing on modifications to the production of automotive parts, the concept involved reintegration of recycled polymer material with quality equal to that of virgin material.

5. Automotive Residue Valorization (2016)

The AUTOREVAL project⁹⁶ aimed at the total elimination of landfill disposal, as regards car-fluff, with the related environmental impact and transportation costs. In the context of this project a new kind of innovative industrial plant was to be developed, which should be able to process and convert ASR (Automotive Shredder Residue or car fluff) and ELT (End of Life Tyres) rubber, into fuel products, reducing the environmental impact and making more efficient the entire automotive sector. In this way, materials transformed into fuels will be used as energy source by the players of the sector, contributing in this way to the development of a circular economy that embraces the whole vehicles life.

6. Advanced Reluctance Motors for Electric Vehicle Applications (2016)

To enable a large scale adoption of EVs, a new generation of electric drive systems is needed to reduce dependency on rare earth materials, while improving energy efficiency, power density and reducing manufacturing/recycling costs. The ARMEVA⁹⁷ project developed a new rare-earth-free generation of advanced reluctance motors.

7. Robust recycling technology that separates different plastic types from a mix of plastic waste to produce a plastic material directly marketable to manufacturers (2017-2018)

The technology developed within the TRIBOSORT project⁹⁸ allows to 1) recycle all ultimate scrap residues from ELV and WEEE, 2) separate its valuable plastic components with a purity of 95% minimum, 3) provide an industrial scale solution with a production capacity of 1.5t/h 4) produce a final recycled plastic material directly marketable to manufacturers, 5) provide a Recycle certificate along with our final products.

8. X-ray sensor for the recognition of polymer type, additive and fillers in black and coloured plastics for recycling and analysis (2019-2020)

The black plastics, which represent 30-50% of plastic scraps in Waste Electric and Electronic Equipment (WEEE) and End-of-Life Vehicles (ELV), end up as residue and are disposed in landfills, buried or exported outside EU, because the existing plastic sorting technologies are not able to sort black plastics based on the type of polymer and to identify the presence of additives such as Brominated Flame Retardants (BFR) and pollutants which are forbidden by

⁹⁵ <https://cordis.europa.eu/article/id/86900-simpler-structures-for-improved-auto-recycling>

⁹⁶ <https://cordis.europa.eu/project/id/717514>

⁹⁷ <https://cordis.europa.eu/project/id/605195>

⁹⁸ <https://cordis.europa.eu/project/id/790321>

EU directives on recycling. The SELEX project⁹⁹ exploits for the first time a combination of X-ray solutions allowing: 1) to discriminate polymers used in the plastic matrix both for coloured and black plastics; 2) to provide quantitative information about presence of fillers, additives and pollutants present in the polymer matrix, including BFR.

9. Supporting the Electric Vehicle REVOLUTION through maximising EV Range and End-of-Life Vehicle Recovery through optimisation of recycled plastics and advanced light materials (2021-2023)

The REVOLUTION project¹⁰⁰ aims at overcoming the challenges hindering the use of recycled materials, but more broadly, restricting the widespread adoption of circular economy principles in the automotive industry. REVOLUTION will use machine learning and artificial intelligence to optimise the input of recycled materials and injection moulding process to deliver high-quality parts.

10. Advanced Light materials for sustainable Electrical Vehicles by Integration of eco-design and circular economy Strategies

The LEVIS¹⁰¹ project developed multi-material structural parts using thermoplastic-based carbon fibre reinforced plastics/metal hybrid materials integrated with a structural health monitoring system. The aim was to achieve a significant weight reduction while keeping the mechanical in-service performance of the targeted parts. As such, new sustainable materials and suitable manufacturing and assembly procedures as well as advanced simulation methodologies/workflows and innovative sensing/monitoring technologies were developed.

11. Leading the TRansion of the European Automotive Supply chain towards a circular futurE (2021-2024)

The fact that the car industry has little involvement in CRM recovery from end-of-life vehicles (ELVs) led to the development of the idea of the TREASURE project¹⁰². The TREASURE project will develop a scenario analysis and simulation tool to assess the positive and negative implications of circular economy practices and principles in car manufacturing to facilitate the adoption of CRM recovery and circular economy in this sector.

12. Advanced and sustainable recycling processes and value chains for plastic-based multi-materials (2018-2022)

The MultiCycle project aimed¹⁰³ to introduce an advanced and sustainable recycling process as well as the value chains for plastic-based multi-materials. This process will be demonstrated in fibre reinforced thermoplastic composites for the automotive sector from which plastics constitute around 16% of End-of-Life Vehicles weight, i.e. ca. 1 million tons/year in EU.

⁹⁹ [X-ray sensor for the recognition of polymer type, additive and fillers in black and coloured plastics for recycling and analysis | SELEX Project | Fact Sheet | H2020 | CORDIS | European Commission \(europa.eu\)](#)

¹⁰⁰ <https://cordis.europa.eu/project/id/101006631>

¹⁰¹ <https://cordis.europa.eu/project/id/101006888>

¹⁰² <https://cordis.europa.eu/project/id/101003587>

¹⁰³ <https://cordis.europa.eu/project/id/820695>

13. Optimising quality of information in Raw Materials data collection across Europe (2017-2019)

The ORAMA project¹⁰⁴ focuses on optimising data collection for primary and secondary raw materials in Member States. For End-of-Life Vehicles the focus is on developing 'INSPIRE-alike' protocols. ORAMA will demonstrate how to create more robust Material Systems Analysis studies and reliable Sankey diagrams for stocks and flows of specific raw materials.

12.2 Under LIFE programme:

1. A novel and efficient sorting process for post-shredder ELVs to meet and overcome ELV directive targets (2014-2017)

The LIFE CARWASTE project¹⁰⁵ aims to contribute to the effective life-cycle management of cars through an innovative process to exploit currently landfilled waste material produced at end-of-life. More specifically, it plans to develop and demonstrate an innovative technology and process to facilitate the re-use of 'fluff' materials in cement and steel plants.

2. Aim to realise 95% ELV-recycling in the Netherlands by means of post shredder technology (2011-2015)

The PST project's¹⁰⁶ main objective was to reach an ELV recycling rate of 95% by the end of 2014 and thus allow the Netherlands to comply with the ELV Directive. It planned to do this by demonstrating and optimising a PST plant using the VW-SiCon process in the Dutch province of Gelderland. The PST project beneficiary ARN Recycling reported an End-of-Life Vehicles (ELV) recycling rate of 83.7% for material recycling and a total of 96.1% for recycling and energy recovery for 2012; and 86.1% and 96.0%, respectively, for 2014.

3. Industrial Platform Demonstrator to achieve 95% recycling of the "end-of-life vehicle" (2011-2015)

The objective of the LIFE project ICARRE 95¹⁰⁷ was to demonstrate how to recycle 95% of End-of-Life Vehicles (ELVs) at a regional scale (up to 30 000 ELVs per year) and to create a model that can be applied and exported to other sites and countries in France and Europe. To reach its objective, the project concentrated its efforts on plastics, foams, glass, textiles and catalytic converters. The project aimed to outline an effective process for dismantling recovered car and to develop a cradle-to-cradle process for recycling the targeted components.

4. High performance devulcanized masterbatches for End-of-Life Tire reuse in high-volume technical compounding applications (2020-2024)

The LIFE GREEN VULCAN project¹⁰⁸ aims at increasing the reuse rate of rubber waste with an innovative and environmentally-friendly devulcanisation technology. The project

¹⁰⁴ <https://cordis.europa.eu/project/id/776517>

¹⁰⁵ <https://webgate.ec.europa.eu/life/publicWebsite/project/details/3968>

¹⁰⁶ <https://webgate.ec.europa.eu/life/publicWebsite/project/details/3397>

¹⁰⁷ <https://webgate.ec.europa.eu/life/publicWebsite/project/details/3343>

¹⁰⁸ <https://webgate.ec.europa.eu/life/publicWebsite/project/details/5357>

contributes to the implementation of the End-of-Life Vehicles Directive by enabling increased recycling rates.

5. ELV DEPOLLUTION BAY -equipped island for the management of materials and components for end of life vehicles (2017-2019)

The main objective of the LIFE De-BAY¹⁰⁹ project was to lower the environmental impact of ELVs by developing more efficient recovery systems and techniques for small and medium-sized dismantlers. This technology would be validated and demonstrated within fully-equipped and integrated depollution islands at two pilot dismantling sites. The aim was to enable the recovery of larger amounts of vehicle materials and components (e.g. plastics, glass and filters) and up to 99% of all ELV fluids by weight, in a much faster and more efficient way than is possible using current tools and systems. The main environmental benefits demonstrated by the project were the increased/improved recovery of spent fuels and other fluids from ELVs, and the reduction of hazardous materials and not-recoverable wastes sent to landfills. On a yearly basis, for example: +50 000 l/year more petrol recovered, +12 000 l/year engine oil, +5 000 l/year brake fluids, and +1 700 kg/year air conditioning refrigerants.

6. Recycling of textile fibres from end-of-life tyres for production of new asphalts and plastic compounds (2015-2018)

The project REFIBRE-LIFE¹¹⁰ aimed to overcome the two main existing barriers limiting ELT fibre recycling. Its overall objective was that 100% of the ELT fibre material is transformed into a useful secondary raw material within a ‘circular economy’ approach. The project’s objectives were, among others, to construct and validate an innovative industrial pilot plant to treat, clean and process ELT fibres, making them recyclable and re-usable and produce new materials (plastic compounds and asphalts) that have been modified with the fibre.

7. Boosting circular economy of plastics from end-of-life vehicles through recycling into high added-value applications(2018-2022)

The LIFE CIRC-ELV project¹¹¹ aims to boost plastic recycling rates in the automotive sector by recycling polypropylene in end-of-life cars and reusing it in new products. Substituting virgin plastics with the recycled kind would contribute to the EU circular economy package. It would also support the Waste Framework Directive and ELV Directive by closing the manufacturing loop for plastics used in car manufacturing and tackle the depletion of fossil resources from which they are currently derived.

8. Low energy chemo-thermal recycling of carbon fibre composites, a central step to a circular economy for CFRP products (2022-2025)

The current manufacturing methods for CFRP parts produce large quantities of scrap. This material is made up of in-production scrap, end-of-life components (e.g. automotive parts,

¹⁰⁹ <https://webgate.ec.europa.eu/life/publicWebsite/project/details/4685>

¹¹⁰ <https://webgate.ec.europa.eu/life/publicWebsite/project/details/4241>

¹¹¹ <https://webgate.ec.europa.eu/life/publicWebsite/project/details/4918>

aircraft wings, wind turbine blades, sporting and consumer goods) and full-scale test articles. The LIFE CFCycle project¹¹² aims to implement and evaluate a low-energy approach for recycling carbon fibre reinforced polymers (rCF). This will be achieved by a low-temperature and low-pressure chemical recycling process known as chemolysis. The objective is to recycle at least 2 000 tonnes CFRP scrap per year from automotive parts, aircraft wings and wind turbo blade to establish a supply chain for CFRP scrap and to demonstrate the suitability of the recycled material in at least three applications. The project contributes to the implementation of the End-of-Life Vehicle (ELV) Directive, which requires that 85% of each vehicle manufactured after January 2015 must be re-used or recovered.

12.3 Under other programs:

1. Selective recovery of non-ferrous metal automotive shredder by combined electromagnetic tensor spectroscopy and laser-induced plasma spectroscopy (2014-2016)

The SHREDDERSORT project¹¹³ aims at developing a new dry sorting technology for non-ferrous automotive shredder. First, shredder will be separated into different metals, based on their conductivity. To this end, a new electromagnetic sensing technique combined with a vision system will be used.

2. Future Availability of Secondary Raw Materials (2022-2026)

The FutuRaM project¹¹⁴ will address, among others, the waste stream of End-of-Life Vehicles. It seeks to (1) develop knowledge on the availability and recoverability of secondary raw materials (SRMs) within the European Union (EU), with a special focus on critical raw materials (CRMs), to enable fact-based decision making for their exploitation in the EU and third countries, and (2) disseminate this information via a systematic and transparent Secondary Raw Materials Knowledge Base (SRM-KB).

¹¹² <https://webgate.ec.europa.eu/life/publicWebsite/project/details/5682>

¹¹³ <https://cordis.europa.eu/project/id/603676>

¹¹⁴ <https://cordis.europa.eu/project/id/101058522>

ANNEX 13: SME TEST FOR THE PREFERRED OPTION

As indicated in Annex 4 of this impact assessment, the preferred option would impact large companies involved in the manufacturing of vehicles as well as the steel and plastics industries. As it would also impact SMEs, this Annex provides an analysis (based on the methodology for “SME test” laid out in the Commission Better Regulation Guidelines¹¹⁵), on:

1. the types of SMEs affected by the measures contained in the preferred option;
2. how they have been consulted in the development of this impact assessment;
3. what the expected impacts on these SMEs are;
4. how possible negative impacts on these SMEs have been minimised.

13.1 Step (1) – Identification of affected businesses¹¹⁶

The categories of SMEs affected by the proposed measures have been identified based on their activities (dismantling; shredding/recycling; repair and garage shops; export of used vehicles).

- **Dismantlers:** there are approximately 12 000 “authorised treatment facilities” (ATFs) in the EU, which are on the frontline for the dismantling of ELVs. Most of them are SMEs. Some others are integrated in larger companies which also carry out shredding activities. A number of them also have contractual links with vehicle manufacturers, while others are completely independent. They receive ELVs from their last owners, carry out their depollution and remove the most valuable parts and components. They make most of their business in the commercialisation of these parts removed (to be reused) and the sale of depolluted ELVs to shredders. Many of them also deal with used vehicles that they purchase and sell inside or outside the EU. They are directly affected by the provisions of the ELV Directive on collection, treatment and depollution, as well as on recycling/re-use and recovery targets. While they have to abide by the EU requirements, they face competition (both to receive ELV but also when selling spare parts) from the informal sector which collect ELVs and dismantle them in less environmentally sound manner (and without an authorisation to do so).
- **Shredding/recycling companies:** there are a few hundred¹¹⁷ companies in the EU active in the sorting, shredding and processing of ELVs and waste fractions resulting from ELVs. Some of them are linked to large waste management companies while others are SMEs. They buy depolluted ELVs from ATFs, shred them, sort the resulting waste, sell the resulting sorted and shredded materials to industries using secondary materials as

¹¹⁵See tool #23 in https://commission.europa.eu/law/law-making-process/planning-and-proposing-law/better-regulation/better-regulation-guidelines-and-toolbox/better-regulation-toolbox_en

¹¹⁶ See as well as Annex 4.

¹¹⁷ See the supporting study for the impact assessment, which refers to data collected in 2014 according to which 350 shredders are established in the EU. According to Eurostat, there are shredders equipped for ELVs in all EU Member States except Luxembourg and Malta.

feedstock in their production processes, and send residual waste to landfills or for incineration with energy recovery. Such companies are not evenly equipped with modern technologies, some of them having invested in “post-shredding technologies” allowing to better sort and decontaminate materials mixed during the shredding process, while others rely on more basic technology. They have traditionally been focusing on the commercialisation of ferrous and non-ferrous scrap, which are by far the most profitable waste fractions from ELVs. A large share of this metal scrap is exported outside the EU. Some shredding companies have however been investing in plastics recycling and in improved technologies for metal recovery and have called for the establishment of recycled content obligations for these materials in new vehicles to support their activities.

- **Repair shops and garages:** The sector of the maintenance and repair of motor vehicles in the EU is composed of around 450 000 companies which are mostly micro SMEs with fewer than 10 employees¹¹⁸. They would be mainly affected by measures impacting the purchase and selling of used parts and components. They are indeed important actors in the market of spare parts: this is the case both for new spare parts, which they buy from vehicle manufacturers or spare part suppliers, and used spare parts stemming from ATFs or other garages. Measures dedicated to support reuse of remanufactured and used parts would enlarge the supply of used parts to these stakeholders, but could also generate additional burden for them compared to the baseline scenario, especially if the measures imply obligations.
- **Companies involved in the export of used vehicles:** most companies exporting used vehicles outside the EU are SMEs. This is the case of some garages or ATFs for which the purchase/sale of used vehicles is just one part of their regular business activities. There are also companies which exercise exclusively these activities, buying used cars from garages, insurance companies or individual owners, and organising their export to non-EU countries.

13.2 Step (2) consultation of SME stakeholders

The review process for the ELV Directive started in 2018 and included extensive consultation of the stakeholders affected by this legislation, especially SMEs. The first consultations took place in the context of the evaluation of the ELV Directive¹¹⁹. They were followed by consultations carried out as part of the present impact assessment (Open Public Consultation on the Impact Assessment for joint review of the ELV Directive and 3R type-approval Directive¹²⁰, specific consultation for 3R type-approval aspects, additional targeted consultations and bilateral discussions with different groups of stakeholders). The review of the ELV Directive was also covered by an opinion from the “Fit for future platform¹²¹” which reflected views from stakeholders. Particular attention was paid to reach out to SMEs during

¹¹⁸ Annual detailed enterprise statistics for trade (NACE Rev. 2 G) [SBS_NA_DT_R2__custom_4698656]

¹¹⁹ [End-of-life vehicles: evaluation of the ELV Directive published \(europa.eu\)](https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-End-of-life-vehicles-revision-of-EU-rules_en)

¹²⁰ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-End-of-life-vehicles-revision-of-EU-rules_en

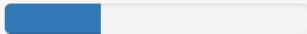
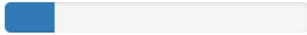
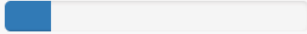
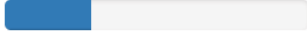
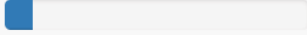
¹²¹ <https://cor.europa.eu/en/our-work/Pages/Fit-for-Future-opinion-on-End-of-life-vehicles-and-3R-type-approval.aspx>

these consultations, either through their umbrella federations at EU or national levels, or directly.

The analysis of the OPC for the impact assessment carried out from July to October 2021 illustrates how SMEs took part in the consultation process. Among the 208 stakeholders which contributed to this consultation, 62.5% were SMEs or organisations representing the interests of SMEs (130 responses), covering a wide geographical scope.

Among others, these stakeholders included for example the European association for national associations of automotive recyclers in Europe (EGARA¹²²); the Association of ATFs in Catalonia (AETRAC¹²³); the French Private Companies Association for Waste Management (FNADE¹²⁴); the French federation of companies working on services linked to automotive sector, including repair (Mobilians¹²⁵); the French Federation of Craft Businesses in the automotive sector and in mobility services (FNA¹²⁶); Gremi de Recuperació de Catalunya¹²⁷; a Finnish ATF (Suomen Autopurkamoliitto r.y)¹²⁸; a Czech metal waste processor (DEMONTA Trade SE¹²⁹); the German association of recycling companies (Bundesvereinigung Deutscher Stahlrecycling- und Entsorgungsunternehmen e.V.¹³⁰).

Organisation size

		Answers	Ratio
Micro (1 to 9 employees)		65	31.25 %
Small (10 to 49 employees)		34	16.35 %
Medium (50 to 249 employees)		31	14.90 %
Large (250 or more)		59	28.37 %
No Answer		19	9.13 %

In terms of sectoral representation, vehicle manufacturers, importers, suppliers (50), together with waste management operators (dismantlers, ATFs – 47, recyclers, shredder operators – 45) represented the major groups of stakeholders.

¹²² <https://egaranet.org/>

¹²³ <https://aetrac.org/>

¹²⁴ <https://www.fnade.org/fr>

¹²⁵ <https://www.mobilians.fr/>

¹²⁶ <https://fna.fr/>

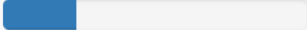
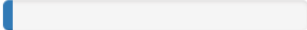
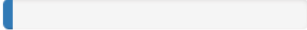
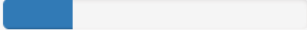
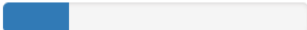
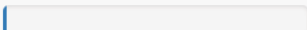
¹²⁷ <https://www.gremirecuperacio.org/sobre-nosotros/>

¹²⁸ <https://www.autopurkamoliitto.fi/>

¹²⁹ <https://www.demontagroup.cz/>

¹³⁰ <https://www.bdsbv.org/der-verband/>

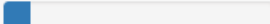
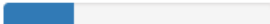
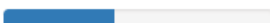
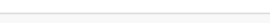
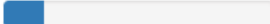
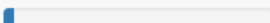
If you represent the private sector (Company or business organisation), please specify your area of interest / activity You can select more than one box:([ID14])

		Answers	Ratio
Vehicle producer/ manufacturer/ suppliers/ importer([ID17])		50	24.04 %
Car dealer([ID18])		6	2.88 %
Repair shop([ID19])		10	4.81 %
Insurance company([ID20])		6	2.88 %
Dismantling sector, Authorised Treatment Facility([ID21])		47	22.60 %
Recycling sector incl. shredder and PST operators([ID22])		45	21.63 %
Import / export of used vehicles([ID23])		2	0.96 %
Other([ID24])		94	45.19 %

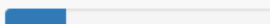
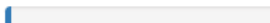
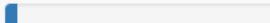
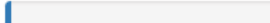
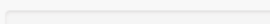
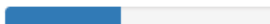
13.2.1 13.2.1 SMEs views relating to measures to increase the re-use of vehicle parts:

The OPC included a specific question, addressed to the professional audience, on which measures would contribute to increase the reuse of vehicles parts, from **189 responses totally received, 130 came from SMEs mostly representing the ELV dismantling sector. 84 of them supported the view that the introduction of an obligation for repair shops to offer used spare parts (together with new spare parts) to their customers would contribute to increase the reuse of vehicle parts.** 75 of them were of the opinion that car manufacturers should be obliged to enable ATFs to unlock parts with digital keys so that these parts could be reused after dismantling. Additionally, 66 of the respondents representing the SMEs agreed that the manufacturers should be obliged to provide the dismantling centres information about the parts. 54 of the participants in this category supported the measure to remove certain parts of ELVs before shredding with the aim to support reuse.

26. In your view which of the following measures would contribute to increase the reuse of vehicle parts? More than one answer can be indicated.

		Answers	Ratio
Implementation of a separate reuse target by weight of the reused part compared to the weight of the vehicle.		13	10.00 %
Implementation of separate reuse targets for specific vehicle components such as tyres, combustion engines, gears, bumpers etc.		34	26.15 %
Obligation for repair shops to offer customers used spare parts as an alternative to new ones (see the example of France above).		84	64.62 %
Obligation for ATFs to remove certain parts of ELVs before shredding to help increase reuse (if yes, see next question).		54	41.54 %
Obligation for car manufacturers to enable (e.g. the ATFs) unlocking parts so that they can be reused and dismantled.		75	57.69 %
Obligation for car manufacturers to provide the dismantling centres (ATFs) information about which parts can be used as identical parts in other models of the manufacturer or even other brands.		66	50.77 %
Establishing rules that the origin of a spare part must be demonstrated and can be tracked.		55	42.31 %
No change of the current situation.		3	2.31 %
Other		25	19.23 %
I do not know / no opinion		20	15.38 %
No Answer		5	3.85 %

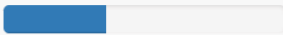
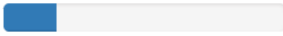
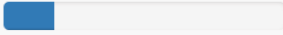
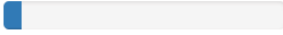
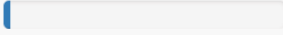
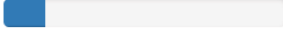
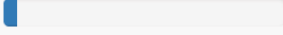
If you represent the private sector (Company or business organisation), please specify your area of interest / activity You can select more than one box:

		Answers	Ratio
Vehicle producer/ manufacturer/ suppliers/ importer		29	22.31 %
Car dealer		3	2.31 %
Repair shop		6	4.62 %
Insurance company		3	2.31 %
Dismantling sector, Authorised Treatment Facility		39	30.00 %
Recycling sector incl. shredder and PST operators		26	20.00 %
Import / export of used vehicles		0	0.00 %
Other		55	42.31 %

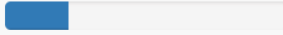
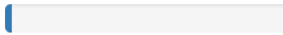
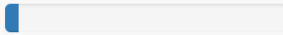
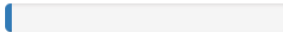
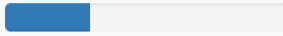
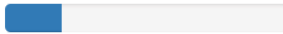
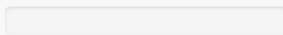
13.2.2 13.2.2 Recycled content target for plastics

Out of 130 responses from SMEs, 71 strongly agreed or agreed with setting a recycled content target for plastics. 30 of these SMEs belonged to dismantling sector or ATFs, while 15 represented the recycling sector. Only 11 of SMEs in these sectors opposed to setting a mandatory target on use of recycled plastic in new vehicles. Taking the total number of SMEs, 36 (or 27.8 %) of them did not agree, while 28 (or 21.5%) remained neutral.

31. Do you agree with including in the ELV Directive a recycled plastics content target for new vehicles?
([ID282])

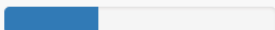
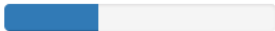
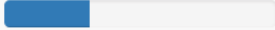
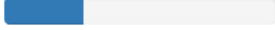
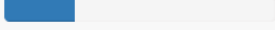
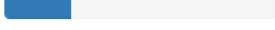
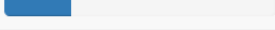
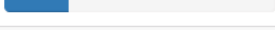
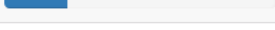
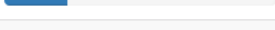
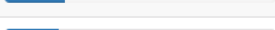
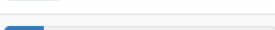
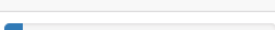
		Answers	Ratio
Strongly agree([ID301])		47	36.15 %
Agree([ID305])		24	18.46 %
Neutral([ID307])		23	17.69 %
Disagree([ID339])		8	6.15 %
Strongly disagree([ID340])		3	2.31 %
I do not know / no opinion([ID341])		19	14.62 %
No Answer		6	4.62 %

If you represent the private sector (Company or business organisation), please specify your area of interest / activity You can select more than one box:([ID14])

		Answers	Ratio
Vehicle producer/ manufacturer/ suppliers/ importer([ID17])		29	22.31 %
Car dealer([ID18])		3	2.31 %
Repair shop([ID19])		6	4.62 %
Insurance company([ID20])		3	2.31 %
Dismantling sector, Authorised Treatment Facility([ID21])		39	30.00 %
Recycling sector incl. shredder and PST operators([ID22])		26	20.00 %
Import / export of used vehicles([ID23])		0	0.00 %
Other([ID24])		55	42.31 %

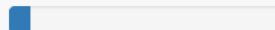
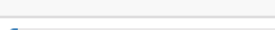
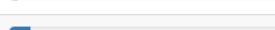
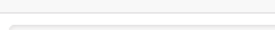
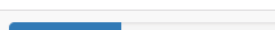
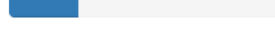
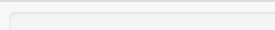
When asked to indicate **other materials for which recycled content targets should be considered**, most of the SMEs representing dismantling, ATFs, vehicle producers, manufacturers, suppliers and recycling sector chose **glass, platinum group metals, REEs, aluminium alloys, other CRMs and steel alloys and magnesium** as the most potential candidates.

35. Please indicate other materials for which recycled content targets should be considered and explain shortly why (multiple materials can be indicated). (ID366)

		Answers	Ratio
Glass (ID370)		45	34.62 %
Platinum group metals (PGMs) (ID374)		45	34.62 %
Rare earth elements (REEs) (ID373)		41	31.54 %
Aluminium alloys (ID372)		38	29.23 %
Other Critical Raw Materials (ID378)		34	26.15 %
Steel alloys (ID371)		32	24.62 %
Magnesium (ID376)		32	24.62 %
Copper alloys (ID379)		31	23.85 %
Niobium (ID377)		30	23.08 %
I do not know / no opinion (ID381)		30	23.08 %
Gallium (ID375)		29	22.31 %
Other (ID382)		26	20.00 %
None (ID380)		19	14.62 %
No Answer		9	6.92 %

From the SMEs cluster, the distribution of the responses to this question is provided below:

If you represent the private sector (Company or business organisation), please specify your area of interest / activity You can select more than one box: (ID14)

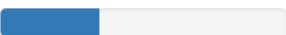
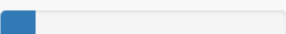
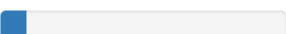
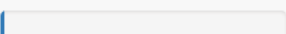
		Answers	Ratio
Vehicle producer/ manufacturer/ suppliers/ importer (ID17)		5	7.81 %
Car dealer (ID18)		2	3.13 %
Repair shop (ID19)		5	7.81 %
Insurance company (ID20)		0	0.00 %
Dismantling sector, Authorised Treatment Facility (ID21)		26	40.63 %
Recycling sector incl. shredder and PST operators (ID22)		16	25.00 %
Import / export of used vehicles (ID23)		0	0.00 %
Other (ID24)		25	39.06 %

13.2.3 13.2.3 Material specific recycling targets

When inquired about establishing a material-specific targets, on the overall, the SMEs were supportive, 83 of them agreed as it would increase the separate recycling, while 70 also noted

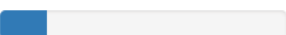
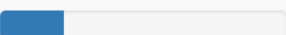
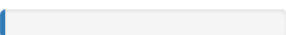
the increase of the quality of recycling. Although 70 participants admitted that the establishment of the material specific targets would increase costs, 45 also acknowledged that setting such targets would increase the revenues from the sale of recycled materials.

6. In your opinion, the establishment of material-specific recycling targets in EU law would (more than one answer can be indicated):

		Answers	Ratio
Increase the separate recycling of materials addressed by such targets		83	63.85 %
Increase the quality of recycling of materials addressed by such targets		70	53.85 %
Increase recycling costs		70	53.85 %
Increase revenues from sale of recycled materials		45	34.62 %
Other		16	12.31 %
I do not know / no opinion		12	9.23 %
No Answer		2	1.54 %

In this context, 28 ELV management operators also agreed that such regulatory approach on recycling targets would have a positive impact on innovation development. SMEs specified that the major impacts are expected in increasing i) innovative eco-design of products; ii) high-quality recycling; and iii) innovative recycling opportunities and processes.

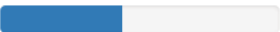
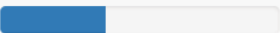
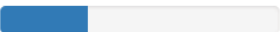
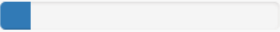
28. Would material-specific recycling targets have an impact on innovation?

		Answers	Ratio
Yes		32	59.26 %
No		9	16.67 %
I don not know / no opinion		12	22.22 %
No Answer		1	1.85 %

13.2.4 13.2.4 Export related requirements for the used vehicles

70 % of all the participants of the OPC represented SMEs and were in favour of new EU-wide export related measures for used vehicles. Assessing the individual responses received, 64 of SME stakeholders agreed with idea to introduce a requirement to provide a valid roadworthiness certificate as a mandatory condition to authorise the export of a used vehicle to a non-EU country. This response was followed by the support to better enforce the existing ban on export of ELVs (57), while 49 suggested to focus on illegal export of ELVs by improving the traceability of vehicles and introducing mandatory criteria to distinguish waste vehicles from used vehicles.

10. Which of the following options is in your view the most adequate to overcome the problem of 'illegal exports' of ELVs to non-EU countries, as well as the problem posed by the export of used vehicles which are not considered as waste? (more than one reply is possible)

		Answers	Ratio
Enact new conditions for the export of used vehicles, so that export is only possible upon presentation of a valid roadworthiness certificate		64	49.23 %
Enact new conditions for the export of used vehicles (as presented in the suggestions above) and better enforce the ban on export of ELVs		57	43.85 %
Not enact any new conditions for the export of used vehicles, but rather focus on illegal export of ELVs, through enhanced enforcement efforts, better traceability and making the criteria for distinguishing them from used vehicles binding under EU law		49	37.69 %
Enact new conditions for the export of used vehicles, so that export is only possible for vehicles which comply with certain environmental criteria (for example, air pollutants or greenhouse gas emission limits)		41	31.54 %
I do not know / no opinion.		14	10.77 %

Taking the overall scope of respondents, the main responses were received from dismantling ATF, recycling sector and vehicle producers, manufacturers, suppliers and importers. 8 car dealers and representatives specialising in import/export of used vehicles responded to this question; 3 of them identified themselves as SMEs.

13.3 Step (3) assessment of the impact on SMEs

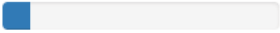
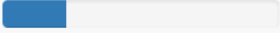
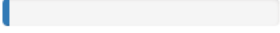
13.3.1 13.3.1 EPR related measures

Stakeholders were asked to provide their opinion whether it is necessary to compensate the authorised treatment facilities (ATFs) for their dismantling efforts that, under the current conditions, are not economically viable, in order to ensure a high quality of recycling.

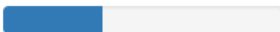
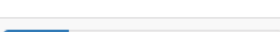
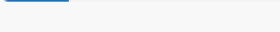
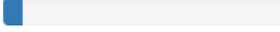
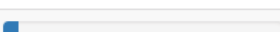
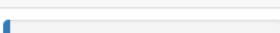
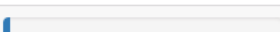
Overall, more than 64% of stakeholders representing SMEs agreed that it is necessary to compensate the costs incurred by the ATFs. The dismantling and recycling sector alone was represented by 65 SMEs. 40 of them were in favour, while 9 of them indicated as I don't know/ no opinion. **Out of 18 individual respondents who identified themselves as vehicle producers, suppliers or importers, 8 individuals disagreed with such an approach.**

From the SMEs cluster, the distribution of the responses to this question is provided below:

41. Please indicate whether you agree with the following statement: To ensure that a high quality of recycling is achieved, it is necessary to compensate the authorised treatment facilities (ATFs) for their dismantling efforts that, under the current conditions, are not economically viable.

		Answers	Ratio
Yes		70	64.22 %
No		11	10.09 %
I do not know/no opinion		25	22.94 %
No Answer		3	2.75 %

If you represent the private sector (Company or business organisation), please specify your area of interest / activity You can select more than one box:

		Answers	Ratio
Other		55	50.46 %
Dismantling sector, Authorised Treatment Facility		39	35.78 %
Recycling sector incl. shredder and PST operators		26	23.85 %
Vehicle producer/ manufacturer/ suppliers/ importer		8	7.34 %
Repair shop		6	5.50 %
Car dealer		3	2.75 %
Insurance company		3	2.75 %
Import / export of used vehicles		0	0.00 %

13.3.2 13.3.2 Impacts on companies involved in the dismantling and recycling sector:

The economic viability of SMEs in the **dismantling sector** is already fragile. Under the baseline scenario, they will face considerable challenges within a 10- to 15-year horizon, due to the consequences of the shift to electric vehicles. The dismantling of EVs will indeed require an evolution of their business model, notably investments for new technologies and infrastructure.

For SMEs in the dismantling sector, the measures in the preferred option consisting in increasing the number of parts and components to be removed prior to the shredding phase will generate important extra costs. These costs would be partly offset by additional revenues, notably linked to the sales of used spare parts, which will be considerably encouraged through measures designed to improve the market for such parts. In the same vein, valuable components removed prior to shredding (parts containing plastics, aluminium, CRMs) and sent for high quality recycling will command higher prices than when these components are sent to shredders. Taking advantage of the digitalisation process will be critical in empowering the smaller and often family-run companies to reach out to new market players by connecting to online platforms and distant

marketplaces at both local and international levels. In addition, the ‘pull-effect’ from the mandatory target on recycled content for plastics are expected to boost the competitiveness of dismantlers, as they would become the primary supply spots of the high-demand high-quality secondary materials. The measures designed to address the problems of “missing vehicles” will also have a considerable effect for the dismantling sector, as this will result in an important extra volume of ELVs of up to 3.2 million units delivered to ATFs in 2035, and thereby a considerable increase in their turnover. For the extra costs linked to the proposed measures which cannot be offset through market conditions, the measures proposed on EPR will be key to ensure that vehicle manufacturers provide the necessary financial support to dismantlers so that they maintain their competitiveness and face down unfair competition from the informal sector.

Based on the elements presented above, it is clear that an important number of factors will influence the competitiveness of SMEs in the dismantling sector. The proposed measures, especially to increase the collection of ELVs, will lead to an important additional economic activity and increased turnover. According to the modelling from the main impact assessment, it would also lead to the creation of about 8,000 jobs in 2035 compared to the baseline related to implementation of the recycled content, quality of recycling and collection related measures. The expected increase in the demand for spare parts, improvements in their distribution and the fluctuations of prices of secondary materials (i.e., spare parts for re-use and materials destined for recycling) will be essential elements to determine the profitability of ATFs. While it remains challenging to provide an accurate projection of the costs and revenues for SMEs from the measures contained in the preferred option, it is estimated that they would be able to increase their competitiveness, with a higher turnover and additional employees, and an overall increased net revenue of 2 million EUR in 2035.

For SMEs involved in the **sorting, shredding and recycling** of ELV waste, the most impactful measures are those:

- (i) on better collection of ELVs, which would mean that additional ELVs would be supplied to shredding and recycling plants;
- (ii) on recycled content, which should ensure an increased market share for recycled plastics [and steel] through ensuring a steady supply from these recyclates to industries processing them into new products, and boost their competitiveness;
- (iii) designed to increase the quality of recyclates and improve the treatment of waste, especially the requirements for selective treatment of a list of parts and components (as described in Measure 13b) and new requirements on the ban on the landfilling for automobile shredders residues and on mixing of ELV scrap with WEEE and other scraps during shredding and post-shredding technologies. These measures would require investments, notably for the companies which are currently not operating modern shredding and post shredding technologies.

Overall, the proposed measures would have a substantial impact on SMEs active in this sector, with a large increase in turnover and also new investment needs. And in that case again, the measures proposed on EPR are meant to ensure that extra costs which cannot

be offset under normal market conditions should be borne by vehicle manufacturers to support the recycling sector. As for SMEs in the dismantling sector, the overall economic impact on shredding and recycling companies will be highly dependent on the prices of recyclates, which cannot be predicted with certainty. Taking these uncertainties into consideration and based on the model used for this impact assessment, the overall economic impact for the shredding sector has been assessed as representing a net cost of 190 million € in 2035 compared to the baseline, while it would be of 265 million € net revenues for the recycling sector. As indicated above, the extra costs for the shredding sector would be compensated by contributions from the vehicle manufacturers through EPR schemes, so that the competitiveness of the shredding sector would not be affected. The social impact would translate in the creation of 6 000 jobs for the whole sorting, shredding and recycling sector.

Overall, the proposed measures should support the competitiveness of **SMEs in the dismantling and recycling sector** through new market opportunities. It is however likely that a number of SMEs might not be able or willing to adapt their business models or invest in the technologies necessary to meet the new requirements. In addition, the measures proposed on the design/production of vehicles, as well as those on EPR, could also encourage vehicle manufacturers to play a greater role in management of ELV waste. This could take the form of contractual arrangements with existing actors in the waste management, or of a more direct intervention through direct investments in this field. As a result, it is likely that the proposed measures could lead to a concentration of actors in the dismantling and recycling sectors and a reduction in the number of SMEs in this field. It should be underlined that this trend for concentration is expected to happen under the baseline scenario, as some vehicle manufacturers intend to exercise a higher control over the recovery of materials contained in electric vehicles, due to their value and relevance for their industry. The proposed measures under the preferred option could exacerbate this trend but it is expected that a concentration of the sector would take place in any event under the baseline scenario.

Impact on companies in the maintenance and repair of vehicles: For the SMEs in this sector, the most impactful measure assessed as part of this report is the measure requiring them to offer used spare parts together with new spare parts to their customers (as is currently the case in France). Adopting this measure would be up to EU Member States. This would represent an additional burden compared to the baseline. This will be the case especially for the companies which are not currently used to proposing used spare parts to their customers, as they would have to carry out an additional task. In practice, this new measure would translate in spending a certain amount of time to search for used spare parts. There are many online platforms offering used spare parts for sale, thus facilitating search for the appropriate one.

Impact on companies involved in the export of used vehicles: They will be affected by the measures designed to ensure a better control on the interdiction to export ELVs outside the OECD, as well as by the new measures governing the export of used vehicles (only authorised upon presentation of a roadworthiness certificate). The companies specialised in the export of used cars will be the most impacted. They would incur costs linked to the obligation for them to carry out roadworthiness tests for vehicles which are currently exported after the certificate has expired. In addition, they are likely to see a

decrease in revenues linked to a reduction in the export of used vehicles which do not meet the conditions to obtain a roadworthiness certificate. They would then have to sell these vehicles as ELVs to ATFs in the EU, at a much lower price than what they could have obtained for exporting them. The overall net economic impacts for this sector have been assessed to reach a loss of 510 million EUR costs by 2035 compared to the baseline scenario.

13.4 Step (4) minimising negative impacts on SMEs

The negative impacts of the preferred option have been minimised through (i) a careful design and adaptation of the measures to ensure that their cost remains proportional to the expected benefits and are not excessive for SMEs and (ii) the introduction of mechanisms of compensation by vehicle manufacturers for possible extra costs linked to the proposed measures, which could be not offset under normal conditions by SMEs (through the establishment of “extended producer responsibility” schemes).

- **Companies in the dismantling/recycling sector:** The measures impacting companies in the dismantling and recycling sector have been devised in a way to reflect the different situations in the Member States, their degree of technological development, the need to remain technology-neutral and avoid excessive costs. This is in particular the case for the obligations to ensure an improved treatment of ELV and their related scrap: one of the most important measures in that regard is the obligation for dismantlers and shredding companies to operate a selective treatment of a list of parts and components contained in ELV. The definition of the items contained in this list has taken into consideration the associated costs and benefits linked to their selective dismantling. As a result, the preferred option did not retain the suggestions made during the consultation process to include a number of components (as reflected in Measure 14c, which does not form part of the preferred option), in view of the high costs linked to their dismantling compared to the environmental and economic benefits. The preferred measure in that regard is Measure 14b, which includes a shorter list. In addition, the obligation for selective treatment is less stringent than the suggestion made during the consultation process that the items contained in the list should all be removed manually by dismantlers before the shredding stage. This remains an option, but the selective treatment can also be operated by shredding companies if they provide evidence that the quality of the scrap resulting from shredding will be of similar quality than for components removed prior to shredding. This was an important demand by the shredding operators.

The costs linked to the new requirements for the SMEs in the dismantling and recycling sector are also mitigated through (i) measures designed to stimulate the market for recyclates and re-use of spare parts and (ii) financial contribution by vehicle manufacturers to offset compliance costs which cannot be absorbed under normal market conditions (through EPR schemes).

The measures designed to improve the market for recyclates are in the first place the requirements on the mandatory use of recycled plastics (and potentially steel), which will

ensure that a steady supply of recycled plastic and steel from ELV scrap is channelled towards the production of new vehicles. These measures correspond to a longstanding request by the dismantling and recycling industry and have proven to be very effective in boosting the recycling of plastics when they were first implemented at the EU level for bottles made of Polyethylene terephthalate (PET). The measures designed to boost the market for the re-use and remanufacturing of spare parts described in Measure 14b will on the other hand provide a larger access for ATFs to the market of spare parts and help them better compete with informal actors.

The measure foreseeing the establishment of EPR schemes will in addition ensure that the dismantlers and recyclers can benefit from financial support channelled by the vehicle manufacturers to offset compliance costs. In this case, this means that SMEs in the dismantling and recycling sector will not have to face along the extra-costs of measures designed to improve the collection and treatment of ELV waste but would be able to rely on the financial contribution of large companies (vehicle manufacturers). While calling for the establishment of such schemes, the dismantling and recycling sector has also emphasised that EPR schemes should not be used by the vehicle manufacturers to impose their practices and business models towards them. They have insisted in particular on the need that they should be adequately represented in the governing bodies of Producer Responsibility Organisations and that there is an oversight by public authorities on the functioning of the EPR schemes. These concerns have been taken into account in the preferred option, which includes explicitly these points.

- **companies in the maintenance and repair of vehicles:** In view of the relatively limited input received by SMEs in this sector in the consultation, the very small size of many of companies and the concern that a mandatory obligation could place an unnecessary burden on them, the preferred option did not retain the measure making it mandatory at EU level for these companies to offer used spare parts together with new spare parts to their customers. Rather, it provides that Member States should put in place a set of measures to promote the market and acceptance for used spare parts. This could include an obligation on garages to provide offers for used spare parts (as described above), but this would remain at the discretion of the Member States and not be an EU wide obligation.
- **Companies involved in the export of used vehicles:** the measure on the export of used vehicle has been devised in a way which does not constitute a blanket ban. During the consultation process, suggestions were made to ban the export from the EU to third countries of all used vehicles which would be over a certain age or not complying with Euro emissions. This would have led to a prohibition of export for a wide range of vehicles, even those which are still roadworthy, without the possibility for exporters to overcome it. This suggestion has not been retained in the preferred package, which foresees rather than the export is conditioned upon the presentation of a valid roadworthiness certificate. Exporters could then be able to continue exporting used vehicles for which the certificate has expired, on the condition that they ensure that the vehicle continues to be roadworthy and obtain the required certificate before export.

While this would represent a cost, it is deemed proportionate to the aim of the measure, which is to avoid the export of non-roadworthy vehicles outside the EU, and consistent with the obligations applying to vehicles on the EU road which cannot be driven without such certificate.

13.4.1 13.4.1 EU-wide measures to mitigate impacts for SMEs

The impact assessment has taken into account that the attainment of higher quality treatment of ELV, the uptake of recycled materials in new vehicles, a wider re-use of materials and the design of more circular vehicles can only succeed if the European companies are ready to engage in new circular business models and are equipped to do so. This requires new technologies, investments and reforms that unlock the full potential of such investments. This is the case for SMEs in automotive and recycling sectors, which need to be modernised, extend their capacity in meeting upgraded treatment requirements, customers' needs and keep up with the digitalisation of the processes.

The EU has put in place in the last years an unprecedented level of public financial support for investments which are specifically geared towards the green transition. This represents considerable opportunities for all actors in the waste sector, which are mostly SMEs, and the industries processing waste to accelerate the transition to the circular economy. It includes funding available under the Multiannual Financial Framework for the period 2021-2027, especially the **European Structural and Investment Funds**¹³¹. In addition, the **Recovery and Resilience Facility (RRF)**¹³², including **REPowerEU**¹³³, which is the key instrument at the heart of the €807 billion **NextGenerationEU**¹³⁴, supports reforms and investments (with more than €11 billion until 2026) in 21 Member States for innovative and advanced solutions for separate collection, sorting, reuse and recycling, as well as fostering the development and adoption of circular economy innovations.

Circular economy is also embedded in the matrix of the **Horizon Europe**¹³⁵ programme on research, notably its partnership on circularity¹³⁶. It is one of the pillars of the **Programme for the environment and climate action (LIFE) 2021–2027**¹³⁷, the only EU funding instrument entirely dedicated to environmental and climate objectives, with an allocation of €5 billion for the period 2021-2027. Thanks to these programmes, the EU supports more than 200 000 businesses every year. EU Funding is available for all types of companies of any size and sector including entrepreneurs, start-ups, micro companies, small and medium-sized enterprises. More information on projects under these programmes which are particularly targeting the design and recycling of ELVs is provided in Annex 9 of this report.

¹³¹ https://ec.europa.eu/regional_policy/index.cfm/en/funding/accessing-funds/

¹³² https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en

¹³³ https://commission.europa.eu/publications/guidance-recovery-and-resilience-plans-context-repowerEU_en

¹³⁴ https://ec.europa.eu/info/strategy/recovery-plan-europe_en

¹³⁵ https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en

¹³⁶ https://ec.europa.eu/commission/presscorner/detail/en/ip_21_1122

¹³⁷ Regulation (EU) 2021/783 of the European Parliament and of the Council of 29 April 2021 establishing a Programme for the Environment and Climate Action (LIFE), and repealing Regulation (EU) No 1293/2013 (OJ L 172, 17.5.2021, p. 53–78).

The European Investment Bank is also a key player in supporting the transition to a circular economy and has recently stepped up its engagement in this field¹³⁸. **The European Investment Fund**¹³⁹ provides specific support to European SMEs in the form of business loans, microfinance, guarantees and venture capital. **The InvestEU programme** also supports circular economy approaches, including in SMEs, by mobilising public and private investment through an EU budget guarantee¹⁴⁰.

Finally, there are a number of different platforms established to coordinate and streamline the support for the SMEs at the EU level. For instance, the Enterprise Europe Network (EEN)¹⁴¹ helps businesses innovate and grow on an international scale. It is the world's largest support network for SMEs with international ambitions. It brings together experts from member organisations that are renowned for their excellence in business support, including chambers of commerce and industry, regional development organisations, universities and research institutes and innovation agencies. Such cooperation mechanism supports the SMEs in dealing with different challenges in running their businesses across different sectors.

¹³⁸ See "The EIB Circular Economy Guide Supporting the circular transition", published in 2020 and available at: https://www.eib.org/attachments/thematic/circular_economy_guide_en.pdf

¹³⁹ <https://www.eif.org/>

¹⁴⁰ https://investeu.europa.eu/what-investeu-programme/investeu-fund_en

¹⁴¹ <https://een.ec.europa.eu/about-enterprise-europe-network>

ANNEX 14: IMPACTS OF THE PROPOSED MEASURES FOR THE AUTOMOTIVE INDUSTRY IN THE INTERNATIONAL CONTEXT

14.1 Main findings

The European automotive industry has been continuously growing since 1980. Thanks to the technological progress resulting in the emerge of more fuel-efficient and electric vehicles¹⁴², this growth has further enhanced. **Today Europe is the second biggest vehicle manufacturer in the world¹⁴³**, whereas 12.1 million vehicles produced in the EU accounts for 15.3% of the total motor vehicle production worldwide. Passenger cars represent 82 % of all the vehicles produced in the EU¹⁴⁴. Although compared to 2020, manufacturing of passenger cars dropped by 7.7 % in 2021, **the EU maintained its global competitiveness by delivering 9.9 million cars¹⁴⁵**.

Based on ACEA statistics, every year the European automobile industry exports 5 747 063 motor vehicles¹⁴⁶, with a positive trade balance of 2 182 321 units. In 2021, over 3 million passenger cars were imported to the EU¹⁴⁷. According to JRC estimates in the study on the recycled content for plastics¹⁴⁸, the import of new vehicles manufactured in non-EU countries presents 30% of the total number of vehicles traded in the EU, while the export of the EU manufactured vehicles to third countries is 46%. The number of manufactured vehicles would increase by 1.3 times in the EU, which can be translated into 19.3 million vehicles in 2030 and accordingly 19.5 million – in 2035 (vs. 14.9 and 15.0 million of the EU sales)¹⁴⁹.

¹⁴²

<https://www.mckinsey.com/~media/mckinsey/industries/automotive%20and%20assembly/our%20insights/a%20long%20term%20vision%20for%20the%20european%20automotive%20industry/race-2050-a-vision-for-the-european-automotive-industry.pdf>

¹⁴³ <https://www.acea.auto/figure/world-motor-vehicle-production/>

¹⁴⁴ <https://www.acea.auto/figure/eu-motor-vehicle-production-by-type/>

¹⁴⁵ <https://www.acea.auto/figure/eu-passenger-car-production/>

¹⁴⁶ <https://www.acea.auto/figure/eu-motor-vehicle-trade-by-vehicle-type-in-units/>

¹⁴⁷ In 2021, the EU imported 458,769 passenger cars from Turkey, followed by China (435,080) and Japan (401,276). More information available at: <https://www.acea.auto/figure/eu-motor-vehicle-imports-main-countries-of-origin-in-units/>

¹⁴⁸ Maury, T., Tazi, N., Torres De Matos, C., Nessi, S., Antonopoulos, I., Pierri, E., Baldassarre, B., Garbarino, E., Gaudillat, P. and Mathieux, F., Towards recycled plastic content targets in new passenger cars, EUR 31047 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-76-51784-9 (online), doi:10.2838/834615 (online), JRC129008.

¹⁴⁹ *Ibid.*

Table 14.1 Overview of the main countries of origin of passenger car imports in the EU (in units), ACEA, 2021.

	2016	2017	2018	2019	2020	2021
World	3,659,905	3,865,048	3,963,023	3,973,903	3,057,873	3,097,550
Turkey	569,756	718,163	714,895	701,111	494,081	458,769
China	60,954	99,854	133,280	133,465	169,803	435,080
Japan	489,473	552,017	581,385	674,336	484,358	401,276
United Kingdom	1,170,174	901,298	841,402	700,371	507,383	393,410
South Korea	294,623	411,952	435,814	441,870	318,493	377,404
United States	253,205	239,786	256,411	349,089	387,720	308,506
Morocco	179,959	222,965	266,276	280,731	240,488	270,977
Mexico	133,601	228,668	262,147	218,077	170,600	178,267
South Africa	148,521	140,966	172,407	213,198	124,892	93,483
Switzerland	60,965	64,113	65,877	58,514	48,052	53,966

To enter the EU market, manufacturers must adhere to a variety of legal requirements:

- i) all imported vehicles to the EU must be type-approved. This process involves demonstrating that the vehicles meet the essential safety and environmental requirements of the EU. Certificate of compliance, granted during the type-approval process, shall include the appropriate documentation and describe the strategy recommended by the manufacturer to ensure dismantling, reuse of component parts, recycling and recovery of materials¹⁵⁰;
- ii) vehicles must be designed in way that meets the EU safety standards established in Vehicle General Safety Regulation¹⁵¹, such as the electronic stability control, lane departure warning, advanced emergency braking systems;
- iii) Vehicles shall be labelled¹⁵² and to include the information on the fuel efficiency and emissions. This information helps consumers in taking decisions before purchasing cars and encourage the manufacturers to reduce the fuel consumption in new cars.

¹⁵⁰ Article 6(5) of the current 3R type-approval Directive.

¹⁵¹ <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32019R2144>

¹⁵² https://climate.ec.europa.eu/eu-action/transport-emissions/road-transport-reducing-co2-emissions-vehicles/car-labelling_en

All manufacturers placing their vehicles on the EU market shall comply with the EU specific rules on the fuel efficiency and Euro emissions standards. The expected impacts of the new legislation are comparable to those analysed under the impact assessment of the Euro7 proposal¹⁵³ which introduces the emission compliance requirements for all motor vehicles put on the EU market, i.e., manufactured and imported to the EU. Based on the compiled evidence, the assessment reveals, most of EU trade partners for the vehicle production, namely the United States, United Kingdom, China, Japan, South Korea, and Switzerland, are developing more stringent standards or are already following the Euro standards. It is in particular relevant for countries, participating in the EU single market as a part of EFTA agreement. It was also revealed that the manufacturers are able to adjust the vehicles' emission control systems to the markets that do not require compliance with the Euro emission standards, e.g. China or the United States.

Similar reasoning can be applied for assessing the impacts across the global producers regarding the proposed design-related requirements for vehicles that would be placed on the EU market. In this context, it is important to take into account that it is a common practice upon which the vehicle manufacturers worldwide adapt to specific market requirements by designing and producing vehicles that meet the requirements to those markets. Manufacturers align to the markets by offering a range of models fitted to the preferences of the customers. This may include different engine types, trim levels, and other aspects.

Overall, manufacturers adapt to EU requirements by using a variety of strategies and technologies to design vehicles that are compliant with the regulations and that meet the preferences and needs of customers in that market. Manufacturers also often adapt to specific requirements by localizing their production in that market. According to the European Automobile Manufacturers' Association (ACEA), currently 301 automobile factories operate across Europe, producing passenger cars, light commercial vehicles, heavy-duty vehicles, buses, engines and batteries, with 194 of these plants being situated within the EU itself¹⁵⁴.

14.1.1 14.1.1 Decarbonisation efforts by vehicle manufacturers

Although there are no global or the EU wide recycled content requirements for vehicles, many manufacturers have already taken efforts to include higher shares of secondary materials and thus to decarbonise their production lines. Substitution of primary materials with the recycled content reduce the carbon footprint and also brings significant cost savings to the producers. These are examples of car manufacturers already integrating recycled content: an average of just under 30 % of BMW Group vehicles are currently made from recycled and reused materials. It is intended to gradually expand this figure to 50 %¹⁵⁵. BMW Group has set itself the target of increasing the proportion of secondary materials in the thermoplastics used in new vehicles from currently around 20 % to an average of 40 % by 2030¹⁵⁶. PEUGEOT 508 has an average of 31% recycled and natural materials in the vehicle; Stellantis¹⁵⁷ plans to boost recycled material content in vehicles by 35%¹⁵⁸. Toyota aims to

¹⁵³ Proposal for a Regulation on type-approval of motor vehicles with respect to their emissions and battery durability (Euro 7) COM(2022) 586 final

¹⁵⁴ <https://www.acea.auto/figure/interactive-map-automobile-assembly-and-production-plants-in-europe/>

¹⁵⁵ <https://www.bmw.com/en/magazine/sustainability/circularity-at-bmw.html>

¹⁵⁶ <https://www.press.bmwgroup.com/global/article/detail/T0403390EN/revolution-in-the-car-industry:-parts-made-from-recycled-fishing-nets?language=en>

¹⁵⁷ Stellantis N.V. is a multinational automotive manufacturing corporation formed in 2021 on the basis of a 50–50 cross-border merger between the Italian-American conglomerate Fiat Chrysler Automobiles and the French PSA Group.

increase the use of recycled plastics by more than three times compared to current levels by 2030 – and fully switch to leather-free interiors by that time¹⁵⁹. In 2021, Ford used post-consumer nylon in a battery box and 50% of post-consumer PP, ocean plastics and nanocellulose PU foam in various applications. Ford Motor expects that by 2035, half of its plastics will come from recycled or renewable materials, and that the company will be completely carbon-neutral by 2050¹⁶⁰. Volvo, the Swedish manufacturer, set the ambition by 2025 to reach 25 % of its used plastics to be bio-based or from recycled materials, and 25% of steel with 40% aluminium coming from recycled sources¹⁶¹. To have a common industry-supported definition and approach for measuring recycled content of automotive products, a group of vehicle manufacturers, such as Ford Motor Company, General Motors, Honda Development & Manufacturing of America, LLC (HDMA), Stellantis, Toyota Motor North America, and their suppliers has recently adopted guidance¹⁶².

These facts shows that the automobile industry is already taking initiatives in finding solutions that would lead to a more efficient and cost-saving production process of vehicles, by foreseeing optimal use of secondary materials, particularly steel. As these actions are voluntary, they are not currently supported or incentivised by law. Introduction of mandatory recycled content targets would send a clear signal to the automotive sector and credibility to the market players in terms of providing a balanced supply and demand of the secondary materials in a long term.

In addition to voluntary actions at the company level, different countries, where the vehicle manufacturers are established, implement national policies in order to accelerate decarbonisation of the steel industry. These include the following examples:

- China which is responsible for producing well over half of the world's steel in 2020 has announced it will be putting a price on steel emissions, possibly as soon as 2023¹⁶³. They further announced as part of the 14th Five-Year-Plan (2021-2025) that it will be prioritising the creation of a circular economy¹⁶⁴, seeking to increase the use of scrap steel to 320 million tonnes by 2025, an increase of around 30% relative to estimates for 2020. This follows India – the world's second largest steel producer in 2020 – releasing their own Steel Scrap Recycling Policy¹⁶⁵, aiming to promote a circular economy in the steel sector by facilitating steel recycling across the product life cycle.
- The EU is in the process of developing a carbon border adjustment mechanism¹⁶⁶ for steel, while the United States¹⁶⁷ has announced that it is considering the same. These

¹⁵⁸ <https://www.reuters.com/business/autos-transportation/stellantis-set-boost-recycled-material-content-vehicles-2022-10-11/>

¹⁵⁹ <https://www.toyota-europe.com/sustainability/circularity#:~:text=Recycling%20of%20Plastics,free%20interiors%20by%20that%20time.>

¹⁶⁰ <https://corporate.ford.com/articles/sustainability/recycling-plastic-water-bottles.html>

¹⁶¹ <https://www.volvocars.com/intl/v/sustainability/circular-economy>

¹⁶² <https://waste-management-world.com/artikel/automotive-industry-develops-new-guidance-for-measuring-recycled-content-of-automotive-products/>

¹⁶³ <https://www.asiafinancial.com/china-carbon-market-expansion-delayed-caijing>

¹⁶⁴ http://english.www.gov.cn/policies/policywatch/202107/08/content_WS60e639b0c6d0df57f98dc92b.html

¹⁶⁵ <https://pib.gov.in/newsite/PrintRelease.aspx?relid=194359>

¹⁶⁶ https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_3661

¹⁶⁷ [https://ustr.gov/sites/default/files/files/reports/2021/2021 Trade Agenda/Online PDF 2021 Trade Policy Agenda and 2020 Annual Report.pdf](https://ustr.gov/sites/default/files/files/reports/2021/2021%20Trade%20Agenda/Online%20PDF%202021%20Trade%20Policy%20Agenda%20and%202020%20Annual%20Report.pdf)

policies would apply tariffs on imported emissions-intensive goods from jurisdictions with weak or absent emissions policy in an effort to limit carbon leakage and incentivise stronger emissions measures overseas.

- France¹⁶⁸ and Japan¹⁶⁹ recently released roadmaps for decarbonising the iron and steel sector, setting out specific targets and laying out concrete steps for their steel sectors, with the national plan calling for emission reductions of 31% by 2030.
- Germany, which is the biggest vehicle manufacturer of the EU, announced earmarking 7 billion EUR¹⁷⁰ for green hydrogen. It also includes EUR 55 million for steel production run by hydrogen.

These already now ongoing practices are expected to affect the driving forces of the market for secondary metals, and accordingly to balance the supply-demand of low-carbon steel. It is an important factor for the automotive industry which is the major “client” for steel sector operating at the local, regional and global scale.

14.1.2 14.1.2 Automotive global supply chain

The automotive industry is functioning on global supply chain for several reasons:

- (a) Access to production materials. Manufacturing of vehicles requires a range of different materials (ferrous, non-ferrous metals, plastics, etc.). By having a global supply chain, producers can access these materials from different parts of the world. By outsourcing certain parts of the production process to countries, vehicle producers reduce the overall cost of production and increase profits.
- (b) Competitiveness advantage. A well-functioning global supply chain provides the vehicle manufacturers with advantage to be able to quicker respond to changing market demands and trends.
- (c) Expertise. Certain automotive components or processes may be better managed by suppliers who hold the specialized expertise. For this reason, a global supply chain gives the vehicle manufacturers the access to a wider pool of suppliers and their specialized knowledge.

Taking in to account the above aspects, the global supply chain plays a central role for the smooth functioning of the automotive industry. In this context, the implementation of the foreseen design requirements builds on this model. The future Regulation aims to respect these principles and does not disrupt but rather to improve the business working model.

Introduction of recycled content targets for plastics would allow the manufacturers exporting vehicles to the EU to maintain their competitiveness within the global supply chain. It would not restrict the vehicle manufacturing companies – established both at the EU and in third countries – to source their recycled plastics or steel from outside the EU if they can verify that that this content used in their production is indeed recycled materials based on the specification criteria (e.g. minimum % share of closed-loop). Being within a global supply

¹⁶⁸ https://www.conseil-national-industrie.gouv.fr/files_cni/files/csf/mines-metallurgie/plan_siderurgie_france.pdf

¹⁶⁹ https://www.meti.go.jp/english/press/2021/1027_002.html

¹⁷⁰ <https://www.iea.org/policies/11561-package-for-the-future-hydrogen-strategy>

chain, manufacturers are in a position find the best quality materials for their production needs. The global supply chain allows manufacturers to source materials from the most cost-effective and efficient sources, regardless of geographical location. As a result, with a possibility to source recycled content from outside the EU, manufacturers enjoy broader access to a pool of suppliers specialising in the concrete areas.

Therefore, introduction of the new design-related requirements for vehicles takes into account the fact that the global nature of the supply chain is an important aspect of the automotive industry. Along these lines, it is therefore, important to set the same legal requirements for both the EU manufacturers of vehicles and importers for the following reasons:

- Legal clarity. Common requirements simplify the process of importing and selling vehicles in the EU, reducing costs and administrative burdens for companies operating in the market.
- Fair competition. By setting up the same requirements for both the EU manufacturers and importers, a level playing field is ensured.
- Market stability. Consistent and uniform legal requirements ensure stability and predictability in the EU automotive market. This attracts investment, foster growth in the industry.
- Consumer protection. Same level of requirements ensures that all vehicles made available on the EU market meet the same requirements.

Today, many countries where the automobile industry is established, regulate end-of-life treatment. In South Korea, end of life treatment of vehicles has been managed by the Act on Resource Circulation of Electrical & Electronics and ELVs since 2008, which is similar to the EU WEEE and ELV Directives¹⁷¹. It regulates the restricted use and prohibition of toxic substances (e.g., cadmium, hexavalent chromium, lead, and mercury) in vehicles and promotes their recycling by establishing a resource-circulation system of ELVs. It set a mandatory target recycling rate of 95% including 10% energy recovery as a maximum in the beginning of 2015. In Japan, legislation on ELV recycling was implemented in 2005 based on the shared EPR concept. Automobile manufacturers including importers take responsibility for the collection and recycling of ELVs¹⁷². The Circular Economy Promotion Law¹⁷³ in China was designed to reduce waste and promote sustainability. The provisions and targets for recycling and waste reduction, as well as regulations for the management of waste, apply to the automotive industry and the vehicles it produces¹⁷⁴. Overall, these regulations set recycling requirements mainly focussing on the recovery of metals, plastic, and other materials from end-of-life vehicles for re-use.

Since the late 2000s, China has adopted the circular economy as a national priority and defined vehicle remanufacturing as a strategic sector. Remanufacturing uses approximately

¹⁷¹ Jang, Y.-C.; Choi, K.; Jeong, J.-h.; Kim, H.; Kim, J.-G. Recycling and Material-Flow Analysis of End-of-Life Vehicles towards Resource Circulation in South Korea. *Sustainability* 2022, 14, 1270. <https://doi.org/10.3390/su14031270>.

¹⁷² https://mdpi-res.com/d_attachment/sustainability/sustainability-14-01270/article_deploy/sustainability-14-01270.pdf?version=1643006861

¹⁷³ <https://leap.unep.org/countries/cn/national-legislation/circular-economy-promotion-law-peoples-republic-china>

¹⁷⁴ The dismantlement or reutilization of waste motor vehicles shall be conducted in accordance with the relevant laws and administrative regulations (Article 38) https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/China_CircularEconomyLawEnglish.pdf

60% less energy and 70% fewer materials than making new products. Vehicle remanufacturing in particular has a huge market potential in China, with its existing stock of 365 million vehicles, and an automotive repair and maintenance market worth 157 billion USD annually¹⁷⁵. There are also other exemplary business cases towards support for the market of used and remanufactured spare parts. Renault Group established an ambitious policy designed to boost the remanufacturing of vehicles parts and components, thereby reducing the use of virgin materials. This approach has led to generate revenues of nearly 120 million EUR in 2019 alone from remanufacturing activities. By 2025, Renault expects to generate 200 million EUR through its recently planned recycling business¹⁷⁶. Volvo currently remanufactures 36 different component groups, including engines, gearboxes, turbo compressors and clutches. In 2021, Volvocars International saved over 4,000 tonnes of CO₂ by remanufacturing over 37,000 parts¹⁷⁷.

Similar to the situation in recycled content, manufacturers already integrate different elements of circularity into the manufacturing policies. A number of companies publish this information on their websites in a form of strategies, annual sustainability reports¹⁷⁸ or general overviews¹⁷⁹. Among other information, these documents include the overview on the innovations, investment into R&D, long term climate neutrality objectives, social and corporate responsibility in sourcing materials, measures taken to increase resource efficiency¹⁸⁰ and decrease cost of production. Therefore, new requirement for the manufacturers to prepare and implement circularity strategies for vehicles would complement the current practices by defining common criteria for content and presentation.

14.1.3 14.1.3 Factors for the development of the European automotive industry

Europe is the birthplace of the automobile and has a long history of developing breakthrough innovations¹⁸¹. Representing 27 percent of the region's total R&D investments, the automotive industry is Europe's largest R&D investor. In 2021, Automotive R&D investment (EU) was equal to 58.8 billion Eur. Moreover, Europe has the right talent and human capital to continue successful automotive innovations and has a number of globally leading universities along the ACES trends: 13 out of 17 universities globally leading in the area of electrification are based in Europe; also 4 out of 17 in autonomous driving and 8 out of 19 in connectivity.

¹⁷⁵ <https://ellenmacarthurfoundation.org/circular-examples/advancing-vehicle-remanufacturing-in-china-the-role-of-policy>

¹⁷⁶ More information available at: <https://ellenmacarthurfoundation.org/circular-examples/groupe-renault>, <https://www.reuters.com/markets/europe/renault-expects-11-billion-revenue-new-recycling-business-2021-11-30>

¹⁷⁷ <https://www.volvocars.com/intl/v/sustainability/circular-economy>

¹⁷⁸ E.g. Nissan: <https://www.nissan-global.com/EN/SUSTAINABILITY/LIBRARY/SR/2022/>, Hyundai: <https://www.hyundai.com/eu/about-hyundai/sustainability/sustainability.html>; Stellantis: https://www.stellantis.com/content/dam/stellantis-corporate/sustainability/csr-disclosure/fca/fca_2020_sustainability_report.pdf; Ford: <https://www.ford.co.uk/experience-ford/sustainability>

¹⁷⁹ Examples: BMW <https://www.bmwgroup.com/en/sustainability.html>; Kia: <https://www.kia.com/eu/about-kia/sustainability/>

¹⁸⁰ E.g. Toyota Europe <https://www.toyota-europe.com/sustainability/circularity>

¹⁸¹ More information available at: <https://www.mckinsey.com/~media/mckinsey/industries/automotive%20and%20assembly/our%20insights/a%20long%20term%20vision%20for%20the%20european%20automotive%20industry/race-2050-a-vision-for-the-european-automotive-industry.pdf>

The EU contributes to this development by providing a number of different funding opportunities for both public and private sector, through Horizon 2020, LIFE programmes. More information on the projects is provided in Annex 11 of the IA.

14.2 Conclusion

From the legal point of view, future requirements would apply equally both to European producers and to importers and would be consistent with the EU's international obligations on the trade relationships and the WTO, considering that the requirements are non-discriminatory and justified for reasons linked to environmental protection. The new legislation will in due course be notified under the TBT Agreement.

Moreover, the EU manufacturers would not be put in the more advantageous position, as the majority of the manufacturers, representing the most popular brands of the imported vehicles to the EU, already integrate business practices to optimise the functioning of their production lines and the increase the efficiency in material use. These aspects are comparable to the measures proposed under the preferred option of this impact assessment.

Therefore, the design related requirements to be foreseen under the future legislation would be complementary to the current set of the EU rules and would apply in a proportionate and non-discriminatory manner for both importers and those manufacturers established in the EU. Such regulatory approach would therefore not affect the international competitiveness of the EU or third parties.

ANNEX 15: CONTRIBUTION OF THE REVISION OF THE ELV AND 3R TYPE-APPROVAL DIRECTIVES TO THE CIRCULARITY OF CRITICAL RAW MATERIALS (CRM)

The Commission proposal for a Critical Raw Materials Act adopted in March 2023 contains a series of measures linked inter-alia to the development of Critical Raw Materials (CRMs) value chains in the EU, and to the diversification of supply and partnership to reduce supply risks. It contains measures designed to increase the circularity of products containing CRMs and the recycling capacity for these products in the EU. Considering that new vehicles contain substantial quantities of CRMs (see sections 15.1 and 15.4.1 below), and that at the same time end-of-life vehicles represent an important source of secondary raw materials, the joint revision of the ELV and Type Approval Directives represents a key opportunity to improve the recovery of CRMs used by the automotive industry, hence already contributing to the objectives of the CRM Act. Furthermore, the extension of the scope of the EU legislation on ELV and 3R type-approval to new vehicles such as lorries, buses and two-wheelers broadens the EU capability to recover higher quantities of CRMs from vehicles, which represents an additional boosting contribution to the CRM Act circularity objectives.

This annex summarises key information and data related to proposed measures for circularity of CRMs in the preferred package, including: 15.1) Relevant information (EU import reliance, market share, main and expected future use) on CRMs in vehicles and relevant components containing these CRMs; 15.2) expected 2035 and 2040 impacts of these measures for the circularity of the relevant CRMs 15.3) suggestions for follow-up review clauses on CRM circularity measures, and 15.4) additional contribution of the potential ELV and Type-Approval directives extension of scope to a higher circularity of CRM. The data presented in this Annex have been compiled by the Commission Joint Research Centre, and is a part of a study to be published later in 2023¹⁸².

15.1 Relevant information on CRMs in vehicles and relevant components

There are **more than 60 materials** used in ICEVs (internal combustion engine vehicles) and EVs (electric vehicles), although only a dozen of materials represents up to 95% of the total weight of the vehicles. From a CRMs perspective, most of the value of an ELV is not in the most abundant materials and CRM content differs significantly between ICEVs and EVs¹⁸³. ICEVs mainly contain cerium (Ce), lanthanum (La), palladium (Pd), platinum (Pt) and rhodium (Rh) in the catalytic converter, whereas EVs contain **many CRMs in the electric power train**: namely neodymium (Nd), praseodymium (Pr) and dysprosium (Dy) in the **REPMs (rare-earth permanent magnets)** of the e-motor, lithium (Li), cobalt (Co), manganese (Mn), and nickel (Ni) in the battery (batteries types and materials are covered by

¹⁸² Nacef Tazi, Martina Orefice, Charles Marmy, Yifaat Baron, Maria Ljunggren, Patrick Wäger, Fabrice Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821

¹⁸³ Amund N. Løvik, Charles Marmy, Maria Ljunggren, Duncan Kushnir, Jaco Huisman, Silvia Bobba, Thibaut Maury, Theodor Ciuta, Elisa Garbossa, Fabrice Mathieux, Patrick Wäger, Material composition trends in vehicles: critical raw materials and other relevant metals. Preparing a dataset on secondary raw materials for the Raw Materials Information System, EUR 30916 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-45213-3, doi:10.2760/351825, JRC126564.

the adopted Battery Regulation). A trend valid for both ICEVs and EVs is the higher and **higher amount of electrics and electronics**¹⁸⁴, which corresponds to a higher content of silver (Ag), gold (Au), Dy, Nd and Pd. The possible future deployment of fuel cells vehicles might also require large amounts of Pd and Pt for the appropriate catalyst.

Larger requests of copper¹⁸⁵ (Cu) and other base metals such as aluminium (Al) are occurring due to the transition from ICEVs towards EVs. Moreover, **metals alloys often contain CRMs**: 4xxx and 5xxx Al-alloys contain respectively silicon metal (Si) and magnesium (Mg), beside to other metals as Cu and Mn while steel laminations (also named electrosteel or Si-steel) contain up to 3.5 wt.% of Si, and high-strength steel is relevant for the content of niobium (Nb). Similarly, Mg alloys are made-up also of Al and Mn and, in general, the automotive sector corresponds to 50% of the Mg demand in Europe¹⁸⁶. In Table 15.1 Table 15.1 a summary on import reliance, current use in the automotive sector and market share for the automotive or all the EU sectors and future demand of some critical and precious metals are reported. Through the parameters in Table 15.1 Table 15.1, an analysis of the relevancy of CRMs in ELV is provided together with failures in the EU strategic autonomy and in circularity of the same materials, which might be mitigated by one or more measures. The parameters were already defined in the methodology for establishing the EU list of CRMs¹⁸⁷ and the data, in particular, were extracted from the Raw Material Information System - [RMIS dataset](#)¹⁸⁸. A circularity failure is observed when the circularity of a CRM contained in key components is not maximized, e.g. because of technical limitations or because of market reasons (e.g. limited demand of secondary raw materials). In the criticality assessment, the parameter on the market share provides insight on the importance of a material for the EU economy, in particular in terms of end-use applications. It is significantly important to know the current and expected market share of the automotive industry for given CRMs to suggest a product or specific waste policy measures.

¹⁸⁴ Bobba, S., Carrara, S., Huisman, J., Mathieux, F., & Pavel, C. (2020). Critical Raw Materials for Strategic Technologies and Sectors in the EU - a Foresight Study, doi:10.2873/58081

¹⁸⁵ On 2023 CRM list

¹⁸⁶ European Commission, study on the EU's list of Critical Raw Materials (2020), Factsheets on Critical Raw Materials.

¹⁸⁷ European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Pennington, D., Tzimas, E., Baranzelli, C., et al., *Methodology for establishing the EU list of critical raw materials : guidelines*, Publications Office, 2017, <https://data.europa.eu/doi/10.2873/769526>

¹⁸⁸ <https://rmis.jrc.ec.europa.eu/>

Table 15.1 Summary of key features of relevant CRMs contained in vehicles

List of materials	EU import reliance	Current use in the automotive sector	Market share of the automotive industry (CRM, 2020)	Expected future use in the automotive sector	Why the EU should act to mitigate current circularity failure** ?
Rare earth elements (REEs) - Nd, Pr and Dy	100%	Permanent magnets (PMs) for electric (drive and not drive) motors	No specific data for the automotive sector. 100*% end use for PMs in different sectors (automotive, wind energy...)	Nd demand expected to increase by 11 fold by 2032; PM e-drive motors share in the EU fleet expected to be 77% in 2040;	Environmental concerns of REEs mining, processing and smelting; no EU recycling of REE, but they are lost in ferrous fractions or into landfill; building up know-how in REEs recycling will also thrive know-how of REEs processing value chain at EU level
Silicon metal	63%	Mainly in steel laminations of the e-drive motors. It is also used in Al-alloys.	No specific data for the automotive sector. 38*% use in (steel laminations and electronics, both for different sectors.	Exponential increase of steel lamination in e-drive motors due to EU fleet electrification.	Currently lost in the recycling of Si-steel as common steel
Ga	31%	Mainly in integrated circuits, sensors	No specific data for the automotive sector. 70*% use for manufacturing integrated circuits, sensors and LEDs for different sectors.	Increase of Ga due to more electronic components and to electrification of EU fleet	Lack of information of Ga use in vehicles; current practices lead to no EU recycling from ELVs.
Pd	93% of primary Pd	Mainly in autocatalysts, but also in electronics and printed circuits boards and semiconductors.	87% in autocatalysts and 4%* in electronics (general)	Increase of Pd due to more electronic components and to electrification of EU fleet	Current sorting and recycling practices lead to losses of this material; underuse of urban mine potential to generate Secondary Raw Materials (SRM)
Precious metals (Au and Ag)	Unknown for Au, 40% of primary Ag	Au mainly used in electronics as contact material, also for wires for integrated circuits or transistors. Ag used in electronics car applications and solders.	8% use of Ag in the automotive sector. 11%* use of Au in electronic applications.	Increase the use of Ag in vehicles due to the need of higher electrical properties, durability and oxide resistance	Not CRMs but current sorting and recycling practices prevent the full recovery of precious metals from controllers units; underuse of ELV potential to generate SRM;

Source: JRC elaboration, based on RMIS dataset. <https://rmis.jrc.ec.europa.eu/> *EU end-use sector, not specifically related to automotive sector **It is considered that a CRM or a CRM based component is characterised by a circularity failures if circularity principles are hindered, due either to technical challenges of market failures (no demand of recycled materials).

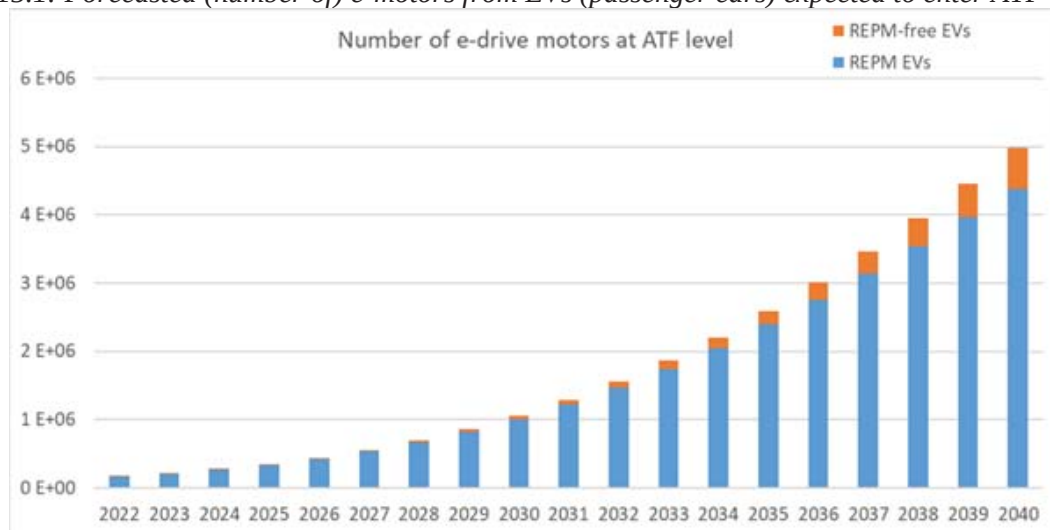
While platinum group metals (PGM) in catalytic converters are already recovered due to their high market values, **Pd from car electronics and controllers** are not targeted in the current sorting and recycling processes. **Precious metals (Au and Ag)** in the same vehicle controllers can also be targeted together with Pd, as their recovery potentials from ELV are not maximised.

REEs from ELVs are not recycled at all. REEs are present in several components of both ICEVs and EVs: for instance, glass windows and catalytic converters do have La and Ce (albeit not recovered); electronics, actuators and small motors do have REPMs even if they belong to specific ICEVs segments as found from indirect evidence of shredded ICEVs. However, undoubtedly, the largest consumption of **REPMs** is **in the e-drive train motors**. **Si-steel in steel laminations** can also be targeted together with REEs in e-drive motors. It has been reported that the current and expected 2035-2040 EU passenger car fleet would rely mainly on REPM e-drive motors, containing the highest concentration of REEs (Nd, Dy and Pr) in vehicles. A second type of e-motors does not have REPMs but a Cu induction coil (labelled in the JRC report as REPM-free e-motors). This later expected market share would be less than 23% in the forecasted period of 2035-2040. REEs have a very high future supply risk and are crucial to e-motor as well as other EU strategic sectors. At the same time, their expected increased use in the coming years make them a priority target to be legislated. As electric motors are developing in all sectors, there is also currently an untapped potential related to re-use opportunities of electric motors coming from end-of-life vehicles. Finally, it is supposed that vehicles also have significant amounts of **gallium Ga, in integrated circuits, sensors and microchips**, but little to no data are available for these two materials.

REEs in REPMs and **Si-steel in steel laminations**, both in **e-drive motor**, are used here as examples to illustrate current **circularity failures**. The baseline scenario for e-motors is, once reaching an Authorised Treatment Facility (ATF) that they are not disassembled from the car hulk prior to shredding, and therefore leading to REPM and Si-steel loss, while copper contaminates some ferrous and non-ferrous metals fractions.

Figure 15.1 reports the forecasted amounts (in number per year) of e-motors collected at ATF level.

Figure 15.1: Forecasted (number of) e-motors from EVs (passenger cars) expected to enter ATF in the EU



Source: JRC 2023¹⁸⁹. It is assumed here an average of one e-drive motor per EV.

REPM e-motors contain circa 1.2 kg of REPMs, up to 5 kg of Cu and up to 23 kg of Si-steel. REPM-free e-motors do not contain REEs but still contain similar amount of Si-steel and up to 10 kg of Cu. As the know-how of REEs recycling and the lack of recycling infrastructures in Europe currently prevent from recovering REEs from REPM, the potential quantities above would be diluted (downcycled) in the ferrous and non-ferrous fractions or send to landfill if no relevant measures would mitigate such circularity failures.

15.2 Expected 2035 and 2040 impacts of the measures for the circularity of the relevant CRMs and other materials contained in the preferred option¹⁹⁰

The measures aiming at improving circularity of CRMs and other relevant materials are reminded in this section and are assessed against three dimensions:

- Impact on material flows and on production of Secondary Raw Materials (SRM)
- Environmental based assessment
- Socio-economic assessment.

Impacts on innovation as well as administrative burdens are also captured in this analysis of impacts. While the full assessment is available in the JRC report¹⁹¹, initial selected expected impacts are reported below.

15.2.1 Measure 1: Mandatory removal of e-drive motor by authorised treatment facilities:

Linked to the option PO3A, M13a in Annex 7.2.3

The scope of this measure only targets EVs (PHEV+HEV+BEV).

The assessed measure on e-drive motors is thus targeting circa. 2.5 million ELV reaching EU ATFs in 2035, and circa. 5 million ELV at ATF level in 2040. Of those motors, it is also forecasted that 2.3 million and 4.3 millions permanent magnets e-motors from ELV would be separately collected from ATFs in 2035 and 2040. The SRM production estimated is presented in Table 15.9Table 15.9.

¹⁸⁹ Nacef Tazi, Martina Orefice, Charles Marmy, Yifaat Baron, Maria Ljunggren, Patrick Wäger, Fabrice Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821.

¹⁹⁰ Steel, copper, aluminium

¹⁹¹ Nacef Tazi, Martina Orefice, Charles Marmy, Yifaat Baron, Maria Ljunggren, Patrick Wäger, Fabrice Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821

Table 15.9: 2035 and 2040 SRM production from measure 1. Units in kt.

Material (kt)	2035	2040
REPM materials (REEs, Fe, Co, ...)	0.35	1.4
Si-steel*	7.1	31.2
Copper	8.1	19.1
Aluminium	23.8	52.7

Source: JRC, 2023. *it is considered here the recovery of silicon steel as a separate flow. However, further assessment is ongoing to assess this recovery's feasibility.

For SRM from REPM recycling, the potential corresponding flows available for recycling due to this measure are up to 2 kt in 2035 and 4.2 kt in 2040. Since the assumed 2035 and 2040 recycling rate for magnets would be respectively 18% and 35%, the output flows (e.g. REEs, Fe, Co) produced would be up to 0.35 kt in 2035 and up to 1.4 kt in 2040. Such flows would in principle cover, in closed loop perspective, 3% to 12% of the expected e-drive motors 2035-2040 EU demand scenarios (for passenger cars), with contributions to the reduction of supply disruptions and to the EU strategic autonomy.

This measure would also increase reuse flows. The potential of reuse of permanent magnet is relevant for e-drive motors as well as other markets and can also contribute to remanufacturing strategies, implying the creation of further incentives for reuse and the development of second-hand products and markets. In this sense, the content of Dy, which increase the resistance to demagnetization, will be a significant parameter in the REPM composition.

The assessment of environmental impacts of changing the End of Life (EoL) handling of e-drive motors is based on a review of life cycle assessments (LCA) on e-drive motors and NdFeB magnets. Based on a first analysis, this measure would lead to a reduction of climate change impacts thanks to separate removal and recycling of the e-drive motor, instead of shredding it with the car hulk. The potential incorporation of secondary REOs to replace primary REOs into new products would significantly lower the environmental impacts and hazardous (connected to generation of radioactive waste) from primary mining. The reduction of resource scarcity is also significant.

From socio-economic dimension, this measure would lead to a further job creation at ATF level and would lead to an increased turn over at ATF and recyclers level thanks to the expected surplus of SRM flows from e-drive motors removal.

The cost of removal of e-motors, revenues at ATF level as well as those returned that incur from their recycling or reuse were assessed. Initial results estimate a 10 minutes removal time of e-motor for recycling purposes at ATF level, and 20 minutes non-destructive removal time for reuse purposes. The assessment was based on a labour cost of 35€ per hour, 8 working hours a day and 200 days of work per annum representing a single job. 19€ and 129€ of additional logistic costs for the ATF per e-motor in case of removal (for recycling) and disassembly (for reuse) were therefore calculated. Such costs cover logistics not related to the removal actions, like costs of storage of removed motors or their inclusion in a sales platform in the case of reuse and may have

some overlap with the costs estimated for removal. Revenues for recyclers were based on the same sources as the ones used in the ELV impact assessment main support study¹⁹².

Thus, the partial socio-economic impacts would be:

- Overall, costs for ATF operators can be allocated to two main entries (see Table 15.10Table 15.10): i.e., removal activities and its accompanying logistic costs. It is assumed that the costs for removal operations would be up to 15 M€ in 2035 and up to 29 M€ in 2040. The ATF logistic costs (transport, storage...) would be up to 50 M€ in 2035 and up to 96 M€ in 2040. The difference of costs between the assessed years is also linked to the significant increase of EVs reaching EoL over the years. Collected e-motor flows from ATF would in principle be diverted to reuse or recycling purposes. Overall, the main challenge towards the feasibility of this measure relies on the development of magnet recycling infrastructure as well as market opportunities for e-motor materials (including REPM but also electric steel). Furthermore, the development of markets for reused e-motor would lead to higher environmental savings compared to recycling routes, the latter may create economical pressure to favour reuse of e-motors rather than recycling where the motors are still intact (meaning that recycling and its benefits could still take place at a later point in time).
- Revenues are distributed over ATFs (see Table 15.10Table 15.10) and recyclers (see Table 15.11Table 15.11). Thanks to this measure, it is estimated an overall ATF additional revenue up to 98 M€ in 2035 and 214 M€ in 2040, respectively. The additional revenues at recyclers' level are expected to be respectively circa. 68 M€ in 2035 and up to 181 M€ in 2040. Here also, the higher increase of revenues is also due to the higher share of EVs reaching EoL over the assessed years. Recyclers' revenues consider here the recycling of REPM materials, assuming the establishment of future recycling facilities. In a conservative scenario, where no magnet recycling is considered, revenues will decrease to 56 M€ for recyclers in 2035 and 130 M€ for recyclers in 2040. Revenues are considered as conservative as the separate treatment of e-motor might generate additional revenues thanks to the production of other metals flows such as secondary Si-steel or secondary copper.
- Looking only at the costs expected for ATFs and the end-of-life HEV, PHEV and BEV being collected for treatment, it is estimated that the cost of the measure per vehicle for the ATF would be around 25€ over the assessed years. The benefits for the ATF are currently lower than expected costs and so would not cover the burden of implementation. Though the expected revenues to recyclers would help set off gradually the burden in 2035 and completely in 2040, the cost calculations are initial and some form of compensation (through the EPR) or allocation of revenues (through an increase in the cost recyclers are willing to pay ATFs) would be needed for ATFs to retain economic feasibility. This assessment only considers the EVs fleet since they contain e-motors. In case of all ELV flow considered, it is estimated that the cost of the measure per vehicle (all drive trains considered) for the ATF would be around 7€ in 2035 and 12€ in 2040.

¹⁹² Baron, Y.; Kosińska-Terrade, I.; Loew, C.; Köhler, A.; Moch, K.; Sutter, J.; Graulich, K.; Adjei, F.; Mehlhart, G.: Study to support the impact assessment for the review of Directive 2000/53/EC on End-of-Life Vehicles by Oeko-Institut, June 2023

Table 15.10: ATF economic assessment

	2035	2040
ATF dismantling costs	15 M€	29 M€
ATF logistic costs	50 M€	96 M€
cost per vehicle reaching ATF [only EVs reaching ATFs]	25 €	25 €
cost per vehicle reaching ATF [all vehicles reaching ATFs]	7 €	12 €
ATF revenues	98 M€	214 M€

Table 15.11: Recyclers economic assessment

	2035	2040
Recyclers revenues w/ magnets	68 M€	181 M€
Recyclers revenues w/o magnets*	56 M€	130 M€

*Considering revenues from recycling electrosteel as steel in general.

- Jobs to be created at ATF level would be up to 270 in 2035 and 520 in 2040, should the e-motor measure be applied. Removal of e-motors can also be performed in (semi-) automated process, leading to a decrease of destructive removal time to less than 1 minute. The use of (semi-) automated processes might decrease the forecasted jobs to be created at ATF level, but will require an investment in equipment. Impacts are not expected to change in cases where the e-motor would be disassembled for reuse purposes, instead of recycling routes, as at present equipment only shortens the time needed for destructive removal. Employment at recyclers' level is not assessed because of lack of data. The latter is dependent on the future development of EU recycling facilities to recover Nd and magnet materials.

Overall conclusions stemming from this partial socio-economic impact assessment describe the benefits and some main challenges towards higher efficiency of this measure to fulfil its objective of improving REE circularity. As compared to the baseline, this measure leads to a higher job creation and additional revenues for both ATFs and recyclers. The reuse of e-motors could generate even further revenues for ATFs and may motivate ATFs to perform non-destructive reuse should the demand for second hand motors develop. Additional costs are generated due to the separate sorting and recovery of e-motors. The level of benefits and thus also of their ration to costs is highly dependent on whether robust REE recycling processes and market will develop by 2040. Clearly, this measure contribute to setting-up such an infrastructure and market in the EU. Overall, more benefits than burdens are stemming from this measure, when compared to the baseline option when e-motors are shredded with the car hulk. EPR might support the additional burden at ATF level in order to ease the implementation of this measure in the early times where the total revenues related to this measure do no suffice for the practice to be economically feasible. Another opportunistic benefit related to the removal of e-drive motors from passenger cars would be linked to the optimisation of costs related also to the collection and removal of batteries from ELVs. As the Battery Regulation would require 100% collection of EVs batteries, treatment and removal costs might be allocated to batteries and near-by components such as e-drive motors or inverters, leading to a decreased ATF burdens related to the removal of e-drive motors.

This measure would also have a positive impact on innovation and R&D development in EU. The available e-drive motors flows would thrive research, innovation and the development of new recycling technologies to increase the recovery of SRM from these flows. It is unlikely that such measure would hinder advances in performance and new technology approaches.

15.2.2 15.2.2 Measure 2: Design provisions for e-drive motors:

Linked to the option PO1B, M7 design requirements in A7.2.1

This measure would be applied for new types put on the EU market and would enhance the eco-design of e-drive motors in future vehicles. The core of the measure is defining design constraints on the OEM to provide clear and succinct instruction on the disassembly operations. Such instructions should include a list of interfering components and parts to be taken out to reach the e-drive motor, the different tools required as well as the number of fastening techniques to unlock and extract the e-drive motor. This measure also ensures that the design of the vehicle and joining, fastening or sealing techniques do not prevent disassembly operations. While this measure would not markedly influence the potential SRM production from e-drive motors recycling, nor their environmental impacts, the estimated reporting and design costs might be slightly impacted.

The assessed measure would require OEM investments in the reporting of instructions and reports to be provided to ATF to ease the disassembly of the e-drive motor. Besides, in order to ensure eco-design provisions and possibly optimise disassembly operations at ATF level to extract the e-drive motor, R&D costs would be generated at OEM level to enable technologies and processes. Such costs are aligned with the five strategic R&D areas identified by the European Council for Automotive R&D¹⁹³. However, it is expected that these R&D costs allocated to the ease of disassembly design of the e-drive motors would be distributed over the next decade and are also aligned with most of the OEMs perspective towards the development of sustainable vehicles and improved mobility, see for example the BMW I vision circular¹⁹⁴, or Renault Re-factory¹⁹⁵. This measure is not foreseen to hinder innovation and the development of new technologies.

From ATF perspective, the measure aims to facilitate disassembly operations of the e-drive motor when present in the ELV. It is then expected a decrease in removal and disassembly times as well as the optimisation of ATF costs.

15.2.3 15.2.3 Measure 3: Mandatory removal of selected embedded electronic components (EEC) group by authorised treatment facilities:

Linked to the option PO3B – M13b, A7.2.3

The JRC analysis¹⁹⁶ is building mostly on methodologies and results from the recent project EVA II¹⁹⁷, conducted by Empa for the (Swiss) federal office of the environment (FOEN). This measure would apply to selected electronic components embedded in vehicles. The key characteristic of

¹⁹³ <https://www.eucar.be/strategic-pill%E2%80%8Bbars/>

¹⁹⁴ <https://www.press.bmwgroup.com/global/article/detail/T0341253EN/the-bmw-i-vision-circular?language=en>

¹⁹⁵ <https://www.renaultgroup.com/en/news-on-air/news/station-flins-re-factorys-incubator-opens-its-doors/>

¹⁹⁶ Nacef Tazi, Martina Orefice, Charles Marmy, Yifaat Baron, Maria Ljunggren, Patrick Wäger, Fabrice Mathieux, Initial analysis of selected measures to improve the circularity of Critical Raw Materials and other materials in passenger cars, EUR 31468 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-01625-1, doi: 10.2760/207541, JRC132821

¹⁹⁷ Marmy, C., Capelli, M., Boni, H., Bartolome, N., & Marseiler, U. (2023). *Projekt EVA II - Synthese –Schlussbericht*

those components is that they require electricity to function, either from an external source through a cable, or with the help of an internal battery. These components were shortlisted by the JRC from four main categories: Controllers, Headlights, Actuators and Cables. Such components contain base and strategic metals (steel, Al and Cu), plastics but also precious metals and CRM such as Palladium (Pd) and Gallium (Ga). Pd content is expected to increase due to more electronic components and due to the electrification of the EU fleet.

Those metals are mostly lost at the end-of-life if the components are not removed from ELVs prior to their recycling, because car recycling processes are currently optimized to recover base metals such as Fe, Al or Cu. In order to improve the performance of the recovery of CRM and precious metals from vehicles, the measure requires the removal of selected electronic components embedded in vehicles in order to recycle them separately in e-waste recycling facilities, which are optimized for precious metals recovery. Electronic components recycling infrastructure is already well established in Europe. Initial JRC analysis shortlisted the following components to be dismantled prior to shredding:

- Inverter (for EVs);
- Control module/valve box of automatic transmission;
- Infotainment control unit (sound, navigation and multimedia).

The JRC analysis reports the analysis of impacts of embedded electronic components; see Table 21 of the JRC report for potential secondary raw material produced from each assessed category, see table 22 of the JRC report on the environmental impacts of the recycling of each assessed category, see figure 9 of the JRC report on the cost distribution over waste management operators, assessed per category of EEC). Afterwards, the shortlisting rationale is introduced and the potential additional benefits at EU level of the three components are presented in Table 15..

As also stated in the additional opportunistic benefits linked to the removal and collection of EVs batteries (covered by the Battery Regulation), near-by components would be more accessible after such removal, leading to a decreased allocated ATF costs related to their treatment and removal. The inverter (for EVs) is positively affected by this synergy and its related removal costs would decrease thanks to the removal of EVs battery.

Table 15.5: Potential additional benefits of the shortlisted components, calculated at EU level

	2035	2040
Secondary Cu, in t	3,397	3,628
Secondary precious metals (Au and Ag), in t	15.1	16.1
Secondary Pd, in t	0.6	0.7
Estimated separate recycling costs of the three components, per car, in € (based on EVA II project)	5.9	5.9
Estimated net additional environmental benefits of the three components, per fleet, in t CO_{2eq}	68,956	73,651

15.2.4 Measure 4: Request of information from OEMs on specific CRMs contained in vehicles, and their labelling:

Linked to the option PO1A – M3 – A7.2.1

The measure on declaration of CRMs has already been applied previously in the context of eco-design regulations, in particular on requirements for servers and data storage products¹⁹⁸: this regulation requests (in Annex II, section 3.3) manufacturers to declare compulsory information on CRMs content (mainly Cobalt and Neodymium) at component level. This measure was introduced to address the lack of information on present CRMs in the targeted products and to provide relevant information for recyclers to decide to disassemble such components materials and invest in recovery infrastructure, and for policy makers to take further measures in the future building on solid knowledge.

Considering the previous experience on servers and data storage products, a similar measure can be applied to REEs at REPM level of e-drive motors and Ga in size fixed controller category in order to address the same lack of information. The assessment of the impacts of this measure presented in this section is largely based on the assessment presented in the Impact Assessment of the Eco-design regulation proposal for enterprise servers.

It was stated in the SWD on servers and data storage products that¹⁹⁹, once separated, Nd scrap can be further processed to recover the CRM. Due to the different types and sizes of e-drive motor technologies available in the EU market, a mandatory information requirement at this component level could inform on the presence, location and the exact amount of the targeted CRMs that the e-drive motor contains, and this would encourage the separation at early stages of disassembly in the authorised treatment facilities. Similar mandatory information requirement could be applied to Ga content at controllers' level larger than 10 cm² and sensors. A previous JRC study had mentioned

¹⁹⁸ <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1553786820621&uri=CELEX%3A32019R0424>

¹⁹⁹ [https://ec.europa.eu/transparency/documents-register/api/files/SWD\(2019\)106_0/de0000000060780?rendition=false](https://ec.europa.eu/transparency/documents-register/api/files/SWD(2019)106_0/de0000000060780?rendition=false)

the lack of information on the use of this CRM in vehicles, in particular Ga²⁰⁰. Additionally to the initial assessment on information on weight and location of REEs in e-drive motors, further requested information on number of permanent magnets, their coating and whether gluing was used in their assembly within the rotor could significantly increase the dismantler and recycler knowledge to adapt the necessary operations to efficiently extract the permanent magnets from the e-drive motor.

The available standards on material efficiency, including those developed under CEN/CLC/JTC 10²⁰¹ (e.g. EN 45558 - General method to declare the use of CRMs in energy-related products) could also be used to ease the enforcement of this requirement at e-drive motor level.

Labelling parts or products with specific material content (to ease its depollution or sorting) would in principle incentivise the dismantling and separate collection of the e-drive motor at authorised treatment facilities.

As for expected economic impacts, no costs for transposition into national legislation is foreseen since the form of the envisaged legislation is an EU regulation (linked to 3R type-approval). The estimated compliance costs for OEMs would be mainly concentrated in reporting and documentation delivery from supplier to OEMs. Since the automotive industry is already equipped with material and component communication channels (e.g. IMDS, IDIS), costs of compliance are estimated to be limited. From EoL value chain perspective, additional costs could be related to the search of relevant information in documentation but in principle these would largely be compensated by additional revenues from the sales of CRMs. The estimated overall additional costs for ATFs and recyclers are then supposed to be low to medium. This measure adapted to the e-drive motors would increase ATFs and recyclers knowledge on this component and it is likely to increase recycling, reuse, and remanufacturing actions as well as relevant investment in recovery infrastructure.

It is estimated that limited additional direct socio-economic and environmental benefits would be generated from the implementation of this measure 4 (linked to M3). However, it is expected that the quality of treatment and of output flows of secondary raw materials (hence of value) that will be generated by measures 1 (linked to M13a) and 2 (linked to M7) on e-drive motors and the measure 3 (linked to M13b) on selected EEC components is likely to be enhanced thanks to this measure on CRM information request. It is also unlikely that this requirement would impact negatively job creation. This measure is not intended to hinder innovation and the development of new technologies.

15.3 Suggestions for follow-up review clauses on CRM measures for vehicles

The measures presented in this report could in the future be complemented by others, to be potentially mentioned in review clauses. Follow-up (potentially more ambitious) measures might tackle further circularity failures by addressing other CRMs and components (e.g. Ga or Ti) when more data are available, or by introducing new targets (e.g. recycled content or recycling

²⁰⁰ Amund N. Løvik, Charles Marmy, Maria Ljunggren, Duncan Kushnir, Jaco Huisman, Silvia Bobba, Thibaut Maury, Theodor Ciuta, Elisa Garbossa, Fabrice Mathieux, Patrick Wäger, Material composition trends in vehicles: critical raw materials and other relevant metals. Preparing a dataset on secondary raw materials for the Raw Materials Information System, EUR 30916 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-45213-3, doi:10.2760/351825, JRC126564.

²⁰¹

https://standards.cencenelec.eu/dyn/www/f?p=205:7:0:::FSP_ORG_ID:2240017&cs=18A65BEA4289B745403E9407952618CE3

efficiency for REEs or Mg) when initial recycling infrastructures will be operational in the EU. These pre-requisites would be necessary to trigger CRM recycling and thrive investments as well as innovation in the automotive sector.

15.4 Additional contribution of the potential extension of scope to circularity of CRMs

As mentioned in the main SWD document, the ELV and Type-Approval directives apply to passenger and light commercial vehicles; M1 and N1, respectively. It was stated that 85% of the EU vehicles fleet falls within the current scope of the ELV/Type-Approval directives. The remaining is therefore not covered and represents circa. 52 million vehicles that include trucks (lorries), busses, two- and three- wheelers, estimated in the core document to account 4.13 million tons of materials. In the context of ensuring higher circularity of vehicles and ensuring alignment with the circularity objectives of the CRM Act, the present section provides additional information, from a CRM perspective, to support the possibility of including additional vehicles within the scope of the ELV/Type-Approval; namely lorries, buses and motorcycles (two- or three wheelers).

15.4.1 Evidence on CRM content in lorries, buses and motorcycles:

Newest environmental standards and constraints for heavy-duty vehicles (EU 2019/1242) and EURO 6/7 standards will require the integration of additional technology devices in vehicles to ensure alignment with 2025 and 2030 targets²⁰². These controllers included in vehicles would lead to the increase of specific CRMs in vehicles. For instance, controllers would be included for exhaust gas control, leading to more Cu or Pd/Pt in vehicles. The electrification or hybridization of the power train to reduce CO₂ emissions would also increase contents of Cu, Si-steel, REPM and others CRMs in these vehicles. While an average passenger BEV is equipped with one e-drive motor of 45 kg and an average peak of 100 kW, an electric truck drivetrain could afford multiple e-drive motors and reach for instance a peak power of 490 kW²⁰³. This would lead to the significant increase of numbers and mass of e-drive motors in the truck drivetrain. Volvo FH electric drivetrain is for example equipped with 2 to 3 electric motors, the Tesla Semi is also propelled using three e-drive motors, similar to those used in Tesla model 3. The introduction of electric lorries, buses and motorcycles will also increase CRM content in batteries, especially lithium, nickel and cobalt²⁰⁴. It is also estimated that PGM average content in lorries will raise by 30%, with palladium covering the major share of PGM used in automotive applications (compared to platinum and rhodium²⁰⁵). Pd content in a class 7/8 heavy duty truck catalyst can be up to 60g^{206,207}. Assuming same Pd content for buses, and considering EoL vehicles from these two categories, the untapped potential of Pd in EoL vehicles from these two vehicle categories is presented below in Table 15.6.

Table 15.6: Untapped recovery potential of Pd from lorries and buses catalysts, calculated at EU level

²⁰² Colpier, L, Chazalotte, B, Gaudeau, O, Cor, O, Etude recyclage poids lourds, rapport final-mise à jour, Ademe, 2021

²⁰³ <https://www.volvotrucks.com/en-en/trucks/trucks/volvo-fh/volvo-fh-electric.html>

²⁰⁴ IEA (2021), *The Role of Critical Minerals in Clean Energy Transitions*, IEA, Paris <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>.

²⁰⁵ Johnson Matthey, PGM market report, May 2022.

²⁰⁶ Based on an LNG Heavy Duty Truck, World Platinum Investment Council-WPIC. Platinum quarterly presentation. Q4 2019, March 2020.

²⁰⁷ Compared to an average of 3.9g to 5.6 g per passenger car autocatalyst. WPIC, April 2021

	2035	2040	2035	2040
Vehicle category	Number of vehicles reaching EoL		Pd content (ton)	
Lorries	289,992	310,292	17.4	18.6
Buses	32,972	35,057	2	2.1

Source: EoL data from IA main study, Pd content from World Platinum Investment Council (March, 2020)

Pd is widely used in catalytic converters and to a lesser extent in vehicle electronics. The automotive industry (all vehicle categories) is the largest consumer of Pd, covering more than 80% of supply annually.

In order to ensure higher performances, OEMs are also relying on REPM motors for heavy vehicles, leading to the use of Rare Earth elements and Si-steel laminates in the engine. Based on IDTechEx benchmark on electric motors used in vehicles, most of e-lorries (all types of truck), e-buses and electric two-wheelers are propelled with permanent magnet motors, relying heavily on laminated Si-steel and also rare earth materials, see Table 15.7.

Table 15.7: Motor types in vehicles (e-lorries, e-buses and electric two-wheelers) and main CRMs used

Vehicle	Motor type	Main CRMs used
Electric two-wheelers (EU brands)	Permanent magnet synchronous motor - PMSM, with a typical weight of 19 kg	Laminated Si-steel and REE in magnets
Electric two-wheelers (non EU brands)	Brushless DC motor - BLDC, with a typical weight from 4 kg to 15 kg	Laminated Si-steel and REE in magnets
Electric lorries	More than 93% are based on PMSM and permanent magnet assisted reluctance motor - PMAR motors	Laminated Si-steel and REE in magnets
Electric buses	More than 99% of full and plug-in hybrid buses are PMSM	Laminated Si-steel and REE in magnets

Source: IDTechEx, 2021

Consequently, more CRMs are expected to be used in electric motors for hybrid and electric trucks, buses and motorcycles. This includes REE materials (Neodymium and Dysprosium) but also Si-steel, Terbium, Niobium and also Cobalt. The fleet electrification would also generate an increase of electric and electronic devices (e.g. inverter), leading to the increase of copper, precious metals (gold and silver) and PGM, as stated in the JRC report.

Besides, electric infrastructure would lead to higher CRMs demand, with a slightly higher demand for truck infrastructure, compared to passenger vehicles ones. Infrastructure includes charging

station, post and connexions to the grid, as modelled by Raghavan et al.²⁰⁸. Other scenarios illustrated by the latter reference also describe higher metal demands for hydrogen fuel cell electric cars and trucks implying significant demand for PGMs.

Thus, these vehicles categories contain relevant CRMs in their drivetrain, electric and electronic devices, with an even higher content for trucks and buses due to the increase of their overall weight and the multiplication of e-drive motors used to reach higher performances. These vehicles also contain significant shares of steel and aluminium in their bill of materials.

15.4.2 15.4.2 Challenges on CRM recovery from the extended scope, including export and mismanagement:

As stated in the main document (see section 2.4 Problem area 4), these vehicles do not currently abide by specific legal requirements on their design or end-of-life phases, leading in principle to the loss of important share of secondary raw materials, including CRMs. Main circularity failures are related to:

- Design phase: circularity or design for recycling are not necessarily integrated as a requirement in the design of these vehicles. In addition, lack of information of CRM content and location in these vehicles could prevent EU dismantlers and recyclers to properly recover these materials from collected vehicles.
- Collection phase: the main challenge is related to the absence of structured and professional end of life value chain to properly collect and manage end of life vehicles such as truck, buses²⁰⁹. Main EU authorised treatment facilities (ATFs) are generally designed to collect and treat M1 and N1 vehicle categories. They do not treat two- and three- wheelers neither. This failure compromises circularity and guaranteed environmentally sound management of waste stemming from these vehicles. This failure is also worsened by the export trends of end of life trucks and buses from EU to third part countries, leading to the loss of significant amount of materials from Europe (estimated to be up to 4.13 million in 2019). Current ATF facilities are certainly not prepared to appropriately treat these vehicles and recover CRMs. Collection of e-motorbikes is currently not established and will benefit from the collections targets for Light Means of Transport (LMT) proposed by the battery regulation.
- Recovery phase: the absence of reuse and/or recycling incentives of these vehicles prevent the proper reuse and recycling of parts and materials, including CRMs. These vehicles are also likely to be mainly exported outside Europe at their end of life.

15.4.3 15.4.3 Expected impacts of initial CRM measures for passenger cars in case of the proposed extension to new vehicles (lorries/buses/2-wheelers):

A wider scope covering new vehicles such as lorries, buses and motorcycles will mathematically increase the fleet size targeted by the ELV/3RTA directives, and mathematically increase number and mass of CRM-rich components potentially targeted. This could in principle lead to the development or creation of new business models in EU internal markets, but also reduce environmental hazards stemming from these EoL vehicles.

²⁰⁸ Raghavan, S. S., Nordelöf, A., Ljunggren, M., & Arvidsson, R. (2023). Metal requirements for road-based electromobility transitions in Sweden. *Resources, Conservation and Recycling*, 190, 106777

²⁰⁹ Colpier, L., Chazalotte, B., Gaudeau, O., Cor, O, Etude recyclage poids lourds, rapport final-mise à jour, Ademe, 2021

From a CRM perspective, the extension of vehicle scope to lorries, buses and motorcycles would enhance the transition to a circular economy and improve the performances of measures (see above) already assessed for passenger vehicles, which are:

- **Measure 1:** mandatory removal of e-drive motors by authorised treatment facilities, linked to the option **PO3A, M13a:**

This measure can be strongly impacted by the scope extension, as the number of e-drive motors covered would significantly increase, leading in principle to a linear increase of impacts assessed for passenger vehicles e-drive motors.

As the majority of motor types of the new scope are based on several permanent magnet motors with REPM, it is expected an increase of secondary raw materials (REPM materials, Si-steel, copper and aluminium) production from this measure. The increase of e-drive motor's flow size could also in principle increase reuse flows. Both recycling and reuse flows are expected to contribute to the reduction of supply disruptions and to the EU strategic autonomy.

From a socio-economic perspective, a scope extension would increase the number of motors targeted, leading to similar impacts assessed for passenger vehicles, but with a higher extent.

Assuming:

- that the extension of scope would increase the number of vehicles collected by 15%,
- that trucks and lorries contain significant number of REPM motors,

It can be then assumed that at least 17.5% (=15%/85%) of additional REPM motors and additional mass of CRMs would be collected and treated (*JRC rough estimates*).

Additionally, a positive synergy is foreseen with batteries removal obligations described in the Battery Regulation. This would lead to a cost optimisation at ATF level of batteries near-by components, hence reducing e-drive motors removal costs.

- **Measure 2:** design provisions for e-drive motors, linked to the option **PO1B, M7:**

The new scope to be covered by eco-design requirement would increase dismantlers and recyclers capacity to effectively manage e-drive motors from the extended scope. A better design that facilitates disassembly operations of e-drive motors will decrease removal and disassembly times as well as the optimisation of ATF costs, leading to even further optimised impacts of the measure 1 (PO3A, M13a).

- **Measure 3:** mandatory removal of selected small parts by authorised treatment facilities, linked to the option **PO3B, M13b:**

Similarly to measure 1, and based on the expected electrification of the new scope, an increased flow of copper, PGM and precious metals are expected to be recovered, especially from lorries and buses. Thus, a very positive contribution is also foreseen in case of scope extension. The inverter removal from EVs would also in principle benefit from removal obligations of batteries described in the Battery Regulation, hence reducing its removal costs at ATF level from the extended scope.

- **Measure 4:** request of information from OEMs on specific CRMs contained in targeted vehicles, and their labelling, linked to the option **PO1A, M3**:

As most of motor types included in the scope extension are REPM materials, providing information on location, content and characteristics of REEs in e-drive motors would significantly increase dismantlers and recyclers information and support their decision on rare earth permanent magnet proper end of life management.

An increase of scope's size would have the same expected impacts as assessed for passenger vehicles, both for REE in e-drive motors and Ga in controllers.

15.4.4 Additional Expected impacts of the proposed extension the current legislation to new vehicles (lorries/buses/2-wheelers) to the recovery of CRM and the implementation of the CRM Act objectives:

Additional measures assessed in the main document could also support further recovery of CRM in case of scope extension to lorries, buses and motorcycles. Main additional benefits are linked to:

- Requirements for manufacturers to provide additional information to dismantlers/recyclers on recycling/dismantling (**M28**):

Similarly to the analysis of impacts of measure 4 for passenger cars (linked to M3), this measure is strongly linked to the improved circular design of vehicles under the scope of the ELV/3RTA directives. It is expected an improved dismantler and recycler knowledge on CRM based parts, their location, CRM content characteristics and the relevant information to properly dismantle and recycle CRM from wastes stemming from these vehicles. This measure is also in strong synergy with M30a, should these vehicles need to be properly treated in authorised treatment facilities.

- Mandatory treatment of End of Life vehicles in authorised treatment facilities (**M30a**):

The implementation of EURO 6 rules should in principle decrease the export of lorries and buses to third part countries, leading to the increase of wastes stemming from these vehicles in the EU. This would develop new business models related to the end of life management of these vehicles to properly collect and treat them. It is unsure if the current authorised treatment facilities would be able to collect and treat large sized vehicles such as lorries and trucks, as they are more designed for the treatment of M1 and N1 vehicles. It is expected in short terms a higher additional investments at ATF level to ensure their capacity to receive and treat lorries and buses. If new types of ATF are to be created, they will have to fully consider the novel CRM components of these types of vehicles. However, the expected impacts of this scope extension will lead to higher material recovery from wastes stemming from these vehicles as well as the increase of CRM flows available for recycling. It is also expected an additional jobs created at waste management operators level and also an increase of their revenues related to the management of materials stemming from this new scope. Similarly to measure 1 for passenger cars (linked to M13a), a positive cost-revenue ratio is foreseen in the medium-long terms, as new business model related to this scope extension should emerge.

The CRM Act is clearly supporting actions on CRM recovery to be included in the revision of the ELV/3RTA directives, based on its current scope (limited to M1 and N1 vehicles). In overall

terms, a scope extension to lorries, buses and motorcycle would lead to a higher circularity of CRMs contained in these vehicles. It would also ensure the implementation of CRM Act objectives related to the design and recycling of CRM from all vehicle categories. These vehicles, if properly treated in authorised treatment facilities including through mandatory separate dismantling and recovery of selected CRM-rich parts prior to shredding and supported by an increased knowledge of CRM content would in principle contribute to reach the CRM Act 15% recycling targets aimed. It should also in principle support reuse flows and the creation of secondary markets for (CRM) parts in the EU.

The scope extension of the ELV/3RTA directive would then be inclusive and encourage the setting-up of up-to-date treatment and recovery facilities for these vehicles and contribute to the development of CRM value chains in Europe.