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COMMISSION STAFF WORKING PAPER
IMPACT ASSESSMENT
Accompanying the document

Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Regulations (EC) No 715/2007 and (EC) No 595/2009 as regards the reduction of pollutant emissions from road vehicles

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Introduction

This impact assessment accompanies a legislative proposal that would, if adopted by the Council and European Parliament, introduce a number of complementary provisions to the Euro 5/6 and Euro VI emission standards[1]. The focus of the initiative under consideration is on six specific areas where market and regulatory failures hinder addressing the overarching challenges situated within the context of the EU's air quality and climate change policy and the Better Regulation Agenda.

It is considered that this impact assessment concerns a 'narrow' legislative action.

1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

1.1. Identification

Lead DG: Enterprise and Industry

Other involved DGs: ENV, ENER, CLIMA, MOVE, JRC, SG

Agenda Planning/WP Reference: 2012/ENTR/019

1.2. Organisation and timing

Preparatory work started with the commissioning of an external study on the "Effects of a gear-shift indicator and a fuel economy meter on fuel consumption" which was completed in December 2010.

The impact assessment steering group was composed of representatives of DG ENV, ENER, CLIMA, MOVE, SG and the JRC and met three times. Meetings took place on 19 July 2011, 6 January 2012 and 13 January 2012.

1.3. Consultation and expertise

In developing the proposal the Commission services have both drawn on external expertise and consulted stakeholders in a number of ways:

The present report builds inter alia on the findings of an external study by the Dutch research organisation TNO that assessed the effects of a gear-shift indicator and a fuel economy meter on fuel consumption that was carried out during 2010. The study can be found in Annex 4.

Vehicle manufacturers have been contacted for some further data on financial costs and benefits as well as the environmental impact.

The most relevant stakeholders (contracting parties to the UN/ECE Agreement, relevant ministries and authorities from Member States, suppliers of vehicles,

[1] Arabic numerals designate light duty (LD) vehicle emission standards and Roman numerals heavy duty (HD) vehicle emission standards.

suppliers of parts, consumers, type approval authorities, NGOs, etc) participate in the meetings of the UN/ECE and the Commission's Motor Vehicle Working Group. Individual components of the initiative have been discussed in these fora and stakeholders provided expertise and inputs on various topics related to the current initiative.

Building on this work, a **public consultation** was carried out:

– The consultation period started on 1 September 2011 and ended on 28 October 2011 (8 weeks);

– To ensure transparency, a consultation paper was published in the automotive industries section of the DG ENTR website[2] and a consultation notice was sent to a broad list of stakeholders by email. The mailing list used for this purpose was the one for the MVEG (motor vehicle emissions group) which brings together a broad range of automotive stakeholders, including environmental NGOs and associations of suppliers which represent SMEs.

– The entire consultation process was carried out in accordance with the Commission's minimum standards as outlined in COM(2002)704.

At the end of the consultation period 15 contributions were received. Despite the limited number of responses, the consultation reached a broad range of stakeholders (6 public authorities, 6 industry stakeholders, 2 environmental NGOs, 1 private citizen) and diverse views were expressed. As consultations on highly technical issues, such as emission standards, tend to yield a much lower number of contributions than broader and more accessible policy issues, the result of the consultation is considered as sufficiently representative for the potentially affected stakeholders. A short consultation summary is in Annex 2 to this report.

1.4. Scrutiny by the Commission Impact Assessment Board

The Impact Assessment Board of the European Commission assessed a draft version of the present impact assessment and issued its opinion on 17/02/2012. The Impact Assessment Board made several recommendations and, in the light of the latter, the final impact assessment report:

– Provides a strengthened evidence base of the problem definition and a more detailed baseline scenario;

– Presents a more detailed analysis of the various options, with particular focus on the assessment of SME and competitiveness issues;

– Clarifies the future monitoring and evaluation arrangements.

[2] http://ec.europa.eu/enterprise/sectors/automotive/documents/consultations/2011-emission-standards/index_en.htm

2. CONTEXT

Common European emission standards define acceptable limits for toxic exhaust emissions of all new motor vehicles sold in the EU. At present, they cover nitrogen oxides (NOx), hydrocarbons (HC), carbon monoxide (CO) and particulate matter (PM) emissions. These standards have been defined in a series of European Union Directives, setting specific limits at different levels for different motor vehicle types. Successive "Euro" emission standards for light duty vehicles were initiated in the EU starting in 1993, the most recent ones being Euro 5 and Euro 6. Light duty vehicles are defined as having a reference mass below 2,610 kg (2,840kg in some special cases) regardless of the purpose of the vehicle. These are typically passenger cars and light commercial vehicles, such as delivery vans. The work on reducing emissions is also in progress for heavy duty vehicles with the Euro VI standard. Heavy duty vehicles are defined as having a reference mass above 2,610 kg (2840 kg in some cases) and typically include larger vans, trucks and buses. The Euro standards are formulated according to a split-level approach, which means that essential aspects are contained in a main instrument that is agreed via the ordinary legislative procedure by Council and European Parliament, while non-essential technical aspects are regulated by means of delegated or implementing legislation prepared by the Commission. The corresponding two main instruments are:

– Regulation (EC) 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6).

– Regulation (EC) 595/2009 of 18 June 2009 on type-approval of motor vehicles and engines with respect to emissions from heavy duty vehicles (Euro VI).

3. PROBLEM DEFINITION

3.1. The problem that requires action

Air pollution

Air pollution, both indoors and outdoors, is a major environmental risk to human health. Numerous studies have highlighted the negative impact of atmospheric pollutants on human health and the environment. The World Health Organisation (WHO)[3] estimates that urban outdoor air pollution alone causes 1.3 million deaths worldwide per year. Although air quality in the European Union has improved over the past decade, there are still significant air quality problems, especially in urban areas and in densely populated regions. Two pollutants, ground-level ozone (O_3) and fine particulate matter ($PM_{2.5}$), are now generally recognised as the most problematic ones in Europe. Long-term and peak exposure can lead to a variety of health effects, ranging from minor effects on the respiratory system to premature mortality. Elevated ozone concentrations alone are associated with 21 000 premature deaths per year in the European Union[4]. According to the WHO, exposure to particulate matter

[3] WHO 2011, Air quality and health, Factsheet No 313, updated September 2011

[4] WHO 2008, Health risks of ozone from long-range transboundary air pollution.

decreases the life expectancy of every person in Europe by an average of almost 1 year[5]. High particulate matter and ozone concentrations are also among the most persistent air quality problems in urban areas across the EU and have proven very difficult to reduce.

Exhaust emissions from light duty (LD) and heavy duty (HD) vehicles contribute to air pollution. This is particularly problematic in urban areas where the motor vehicle and population density is the highest. The European Environment Agency (EEA) states that road transport was accountable for 42% of NOx[6] emissions in the EU27 in 2009 and overall NOx emissions were still above the emissions ceiling to be reached in 2010[7]. Alongside its direct health effects, NO_2, a component of NOx, is also the main source of nitrate aerosols, which form an important fraction of particulate matter and, in the presence of ultraviolet light, of ozone[8]. Through this mechanism, NO_2 emissions aggravate O_3 and $PM_{2.5}$ pollution problems.

Global warming

Increased greenhouse gas (GHG) emissions are contributing to climate change and accelerate this process. Transport accounts for roughly 24% of the European Union's GHG emissions with carbon dioxide (CO_2) being the main component of transport emissions (99%). Road transport is, in turn, the largest contributor to CO_2 emissions from the transport sector (around 71% in 2008), thus accounting for more than 17% of the EU-27's total GHG emissions[9]. As such, Europe must tackle transport emissions if it is to achieve significant reductions in its overall GHG emissions.

Specific problem areas

Within the overall context of air pollution, global warming and regulatory simplification, six specific problem areas have been identified where market and regulatory failures hinder addressing the overarching challenges described in the above paragraphs:

(1) Potential to reduce fuel consumption through efficient driving behaviour insufficiently exploited

The potential to reduce fuel consumption, and therefore pollutant and greenhouse gas emissions, through efficient driving behaviour, so-called "eco-driving", is insufficiently exploited. This is mainly due to a lack of information/awareness of drivers about how to drive efficiently. The technical support for eco-driving is focused on two types of in-vehicle systems: fuel consumption meters (FCM) and gear shift indicators (GSI). A FCM is a display presenting instantaneous fuel

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5 http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/air-quality/facts-and-figures

6 NOx is a generic term for nitric oxide (NO) and nitrogen dioxide (NO_2).

7 EEA 2011, EU27 air pollutant emissions – factsheet [see Annex 3]

8 WHO 2011, Air quality and health, Factsheet No 313, updated September 2011

9 DG MOVE 2011, EU transport in figures: Statistical Pocketbook.

consumption, average fuel consumption, fuel consumption when idling or total fuel consumed. A GSI indicates the optimal gear in case this is different to the selected gear, and what the driver should do (shift up or down) to minimise fuel consumption. Its purpose is to give the driver of a vehicle with a manual gearbox a visual warning when a gear change is necessary. GSI have already been made mandatory in new passenger cars of category M1 which are fitted with a manual gearbox[10], but not in any other type of motor vehicle such as light commercial vehicles, trucks or buses. In contrast to that, no legal requirement exists to fit FCM in any category of motor vehicle at present. However, due to the high prevalence of automatic gearboxes and typically higher engine operating loads in heavy duty vehicles, the actual savings potential of FCM and GSI is expected to be considerably lower than in the light duty segment. Studies[11] into the effects of FCM and GSI in light duty vehicles show that the potential of eco-driving can be better exploited when using both systems at the same time. FCM and GSIcan be installed at relatively small costs for the vehicle manufacturer but are currently often unavailable or sold as part of options packages, which impedes their widespread use. Furthermore, where available, these devices are often implemented in ways that are not well suited to support eco-driving (e.g. no permanent visibility, no instantaneous information on fuel consumption). The reasons for this include a lack of consumer awareness of the benefits in terms of potential fuel savings. Another reason lies in the fact that consumers have the tendency to not fully take into account future benefits in their purchasing decision, a concept known as consumer myopia ('nearsightedness').

(2) Scope of ammonia (NH3) emission limits threaten to drive HD natural gas vehicles out of the market

In modern heavy duty vehicles a chemical reagent is used for NOx abatement from compression ignition engines (i.e. diesel engines). This process, called selective catalytic reduction (SCR), relies on the injection of a certain amount of the reagent into the catalyst, which is then converted into ammonia (NH_3), the compound which removes nitrogen oxides from the exhaust gas. The amount of reagent injected must be proportional to the amount of pollutants to be removed. Too little reagent will result in insufficient NOx abatement and too much reagent leads to ammonia emissions (so called ammonia slip). To avoid this risk of ammonia slip from diesel fuelled vehicles, which goes along with the use of SCR, an ammonia limit value has been introduced in Euro VI emissions legislation[12]. However, this ammonia limit value has been introduced for all heavy duty vehicles, regardless of the engine type and will become binding as of 31/12/2012. As the formation of a small amount of ammonia[13] can also occur in the engine combustion process of positive ignition engines (i.e. petrol of natural gas engines) which do not require SCR technology to comply with NOx limits, the entry into force of a NH_3 limit would put vehicles in

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10 Article 11 of Regulation (EC) 661/2009 requires all vehicles of category M1 to be equipped with gear shift indicators. This requirement becomes effective for all new car models as of 2012 and for all new cars as of 2014.

11 TNO 2010, Effects of a gear-shift indicator and a fuel economy meter on fuel consumption.

12 Regulation (EC) 595/2009

13 As described in section 7.2, IVECO estimate that the mass of ammonia typically emitted could reach 36mg/kWh.

this very small segment of the heavy duty market at a severe disadvantage. In particular, this would require positive ignition vehicles to be fitted with a technically complex NH_3 clean-up system that would still have to be developed. This would likely drive up the cost of vehicles such as compressed natural gas (CNG) fuelled transit buses considerably, which would encourage their replacement with otherwise more polluting diesel vehicles which is undesirable from an environmental perspective.

(3) Upper mass limit of LD Euro 6 regulation necessitates two type approvals for some vehicle platforms

Currently there is a strict reference mass limit defining whether vehicles have to be approved for their emissions according to light or heavy duty legislation (currently Euro 5 or Euro V). Euro 5 applies to "light duty" vehicles of category M1, M2, N1 and N2 with a reference mass not exceeding 2610 kg (under certain conditions this limit can be extended to 2840 kg). Vehicles above this borderline have to be approved according to heavy duty emissions legislation (Euro V). Depending on the type of bodywork fitted on the vehicle, different variants of the same vehicle type can therefore be located on different sides of the borderline, as one variant may be below the mass limit and another one above. It needs to be stressed that the current possibility to extend the limit to 2840 kg under certain conditions does not solve this situation, as some variants can go considerably above this limit. The consequence is that the same vehicle type will need a double emissions certification which forces double testing. This means, for example, that two different engine versions would need to be developed and tuned to comply with different requirements. This creates considerable costs for the manufacturer, without delivering any obvious environmental benefits. The issue has been repeatedly raised by industry stakeholders who highlighted the associated compliance costs and has also been discussed in the framework of the Technical Committee – Motor Vehicles (TCMV).

(4) Euro 6 LD Low temperature emission limits not adjusted to technical progress

The emissions of modern passenger cars (and light commercial vehicles) are reduced by after-treatment (e.g. catalysts or selective catalytic reduction (SCR) systems for NOx control of diesel vehicles) or internal engine measures (e.g. exhaust gas recovery, so-called EGR). Since aftertreatment systems require a certain temperature (typically above 250^{o} C) to work at full efficiency and the application of internal engine measures is challenging at cold conditions, emissions are significantly higher at low temperatures. Therefore, separate low temperature emission limits have been introduced in European emission legislation. However, the current Euro 5 limits for hydrocarbon (HC) and carbon monoxide (CO) are carried over from Euro 3 and no longer reflect the technical progress made in engine- and emission control technology. In addition, no Euro 6 NOx emission limits at low temperatures are defined yet. HC are known to have a significantly detrimental impact on health and Member States encounter air quality problems related to NOx.

(5) Euro 6 LD emission regulation specifies a limit value for total emissions of nitrogen oxides (NOx), but no separate limit value for nitrogen dioxide (NO_2)

Nitrogen oxides (NOx) emitted by motor vehicles are a by-product of the combustion process in an engine, consisting of nitrogen oxide (NO) and nitrogen dioxide (NO_2). Both components are toxic gases that have important negative impacts on human health and the environment. However, direct NO_2 emissions are considered particularly problematic as it is a highly reactive oxidant. Direct NO_2 emissions mostly affect air quality in areas in the vicinity of busy roads and therefore have the most significant health impacts in inner-city areas, the so-called urban hotspots. The percentage of each varies, but typically NO_2 might make up 5-10% of the total NOx exhaust emissions of a motor vehicle. Modern diesel engines may, however, bring this share up substantially, strongly depending on the particulate reduction systems used. Continuously regenerating filter systems in particular can tilt the balance towards NO_2 as they rely on NO_2 to burn off the soot filtered from the exhaust stream. However, the relatively low concentration of NO_2 in diesel exhaust gas is normally insufficient to support this process of filter regeneration. For this reason, an oxidation catalyst is commonly applied ahead of the particulate filter, which provides additional NO_2 formed from NO and excess oxygen. Balancing NO_2 production with NO_2 consumption by the particulate filter therefore plays a critical role for preventing a potential increase in NO_2 emissions. To ensure that the use of this technology does not result in an increase in direct NO_2 emissions, specific NO_2 emission limits are already foreseen for heavy duty vehicles in the Euro VI legislation. However, the current Euro 6 light duty vehicle emissions regulation only specifies a limit value for total emissions of nitrogen oxides NOx, but no separate limit value for NO_2.

(6) Euro 6 LD THC emission limits cause problems for CNG vehicle manufacturers

The current Euro 6 light duty emission limits for total hydrocarbons (THC) include the methane and non-methane hydrocarbon (NMHC) emissions. In general, the direct effect of methane emissions is not considered dangerous for health or the environment and they have only been regulated since 2005/6, when the Euro 5/6 co-decision proposal was negotiated. The main reason for the inclusion of methane is the fact that it is a strong greenhouse gas. However, in the light of automotive CO_2 Regulation 443/2009/EC, (defining fleet targets rather than regulating the greenhouse gas emissions of individual vehicles) such an approach seems to be too restrictive. It would be more appropriate to add methane to the CO_2 equivalent emissions of a vehicle for the purposes of the automotive CO_2 Regulation and to "deregulate" methane emissions at type approval (i.e. increase or abolish the THC emission limit). This would also help the entry into the market of natural gas vehicles (NGV), which naturally have relatively high methane but low CO_2 emissions. As natural gas consists primarily of methane, the exhaust emissions of NGVs contain some uncombusted methane. The inclusion of methane therefore makes it difficult for NGVs to meet THC limit values. However, per unit of energy, natural gas contains less carbon than other fossil fuels, and thus produces lower GHG emissions per distance travelled. Industry stakeholders have raised this issue as a matter of major concern for CNG vehicles.

3.2. Underlying drivers of the problem

Increasing demand for transport

New motor vehicles are, on average, more energy-efficient and emit fewer pollutants than older ones. However, due to the persistent growth of road transport volume, this is not translating into an equivalent decrease of atmospheric pollutant and GHG emissions from road transport. The distance travelled in passenger cars, expressed in terms of passenger kilometres, has been growing continuously between 1995 and 2009 by an average of 1.5% year on year in the EU[14]. The picture is similar for road freight transport in the EU with an average year on year increase of 2% between 1995 and 2009 in terms of tonne-kilometres. The only difference between passenger and freight transport being that, while passenger transport stayed relatively stable, the effects of the economic crisis resulted in a marked reduction in road freight transport in the years following 2007.

In line with this overall trend of steadily growing transport demand, GHG emissions from road transport have continued to increase since 1990, while those from other sectors are generally falling[15].

Market and regulatory failures aggravating the problems

In order to help reduce GHG emissions and fuel consumption, tools exist that allow more fuel efficient driving (problem 1). However, their mandatory introduction has only started for passenger cars, and no requirements exist for other categories of motor vehicles. No stimulus to better exploit fuel reduction potential is currently provided for these vehicles.

As explained above, some regulatory failures (problems 2 and 6) hinder the uptake of more environmentally friendly vehicles (e.g. gas powered ones) and are thus problem drivers that can and should be addressed.

Similarly, current emission limits do not fully reflect technical progress (problem 4) or do not fully address environmental concerns in sufficient detail (problem 5). These regulatory failures can and should equally be addressed.

Finally, current type approval requirements are rather burdensome for certain vehicle types (problem 3) and could possibly be simplified (regulatory failure).

3.3. Who is affected, in what ways and to what extent?

A range of different groups are affected by the problems discussed above:

– The population of the European Union is affected by poor air quality through the acute (i.e. short-term) and chronic (i.e. long-term) effects on health[16].

14 European Commission 2011, EU transport in figures, Statistical Pocketbook 2011.
15 DG CLIMA
16 WHO 2004, Health aspects of air pollution.

Effects can range from minor respiratory irritation to cardiovascular diseases and premature death. A number of groups within the population are particularly vulnerable, including children, elderly people and those with an existing cardio-respiratory disease;

– Consumers of motor vehicles are affected by changes in the price of new vehicles, which may alter as a result of stricter or more lenient vehicle emission limits. However, they may also profit from increased fuel economy;

– Manufacturers of motor vehicles are affected as stricter emission limits necessitate improvements to new vehicle types through the development and introduction of better technologies. However, manufacturers could benefit from simplification and a possible revision of NH_3 and THC emission limits. The impact on third-country manufacturers is not expected to differ from the impact on domestic ones;

– Manufacturers rely on a complex, tiered network of suppliers. Some component suppliers may be affected by increasing demand for certain parts, such as catalytic converters and piezoelectric fuel injectors. SMEs are almost exclusively located at the beginning of the automotive supply chain and in the traditional manufacturing sectors e.g. cast or pressed metal parts, plastic mouldings etc. The effect on SMEs is therefore expected to be minimal.

3.4. Foreseen evolution of the problem

As this assessment is focused on six specific problem areas that all relate to the emission of air pollutants and greenhouse gases by motor vehicles, the baseline scenario is centred on this issue. Without additional public intervention, the evolution of the problem would be mainly determined by the regulation already in force or already adopted by Member States and at European level, transport volume and the rate of fleet renewal.

A recent assessment by the European Environment Agency[17] finds that despite a 26 % increase in transport fuel use over the period 1990–2005, the introduction of the Euro vehicle standards has reduced road transport emissions significantly. However, in contrast to other pollutants, road transport remains the dominant source of NOx emissions (42% of total NOx in 2009).

Overall, road transport emission reduction measures have proven to be effective in reducing NOx, CO and NMVOC emissions from gasoline-fuelled vehicles and PM2.5 emissions from diesel-fuelled vehicles. CO and (exhaust) NMVOC cannot be reduced much further. NOx emissions from diesel-fuelled vehicles have so far not been considerably reduced.

By problem area, the situation is expected to evolve as follows, if EU policy is left unchanged:

[17] EEA (2010) Impact of selected policy measures on Europe's air quality.

– The continued absence of technical systems assisting the driver in adopting an eco-efficient driving style from parts of the vehicle fleet would result in a foregone reduction of pollutant and GHG emissions;

– The share of natural gas HD vehicles (mostly urban transit buses) would most likely decline, as older diesel fuelled vehicles would be either replaced by LPG or new diesel vehicles instead of natural gas ones. This, in turn, would result in higher NOx and GHG emissions;

– Variants of motor vehicles spanning across the heavy duty / light duty borderline would require double emissions certification. Unnecessary compliance costs would continue to be imposed on the manufacturers of these vehicles;

– The emissions of NOx, CO and HC from modern light duty vehicles would continue to be strongly elevated during a cold start;

– The amount of NO_2 emitted by Euro 6 diesel vehicles is expected to increase further above today's already very high level (potentially giving rise to significant air quality problems) as the share of NO_2 within their overall NOx emissions is expected to increase further due to new technologies;

– Relatively clean natural gas vehicles would be put at a disadvantage in comparison to more polluting diesel and petrol vehicles, and as a consequence of CNG vehicles losing market share, the PM and NOx and GHG emissions would increase.

3.5. EU right to act

In line with other legislation concerning the type-approval of motor vehicles, the action under consideration is based on Article 114 of the TFEU ensuring the functioning of the internal market. As this concerns amendments to existing EU legislation, only the EU can effectively address the issues. The subsidiarity principle is respected, since the policy objectives cannot be sufficiently achieved by actions of the Member States, and can be better achieved at Community level. European Union action is necessary because of the need to avoid the emergence of barriers to the single market notably in the field of the automotive industry, and because of the transnational nature of air pollution and climate change. Even though the effects of the main toxic air pollutants are most severe close to the source, the effects on air quality are not limited to the local level and cross-border pollution is a serious environmental problem that often frustrates national solutions. Atmospheric modelling shows that the pollution emitted in one Member State contributes to pollution in other Member States[18]. In order to solve the problem of air pollution, concerted action at the EU scale is required.

[18] WHO 2008, Health risks of ozone from long-range transboundary air pollution.

4. OBJECTIVES

4.1. General policy objectives

The proposal pursues the following general policy objectives:

– Ensuring the proper functioning of the internal market; and

– Providing for a high level of environmental and health protection in the European Union.

– Contribute to the European Union's ambitious Greenhouse Gas reduction targets.

4.2. Specific policy objectives

The specific objectives are:

– to have emissions legislation and type approval requirements that reflect technical progress and that address regulatory failures that have been identified; and

– to make use of simplification potential in the legal framework for the type approval of motor vehicles; and

– to improve the efficiency of driving patterns in order to reduce air pollutant and GHG emissions.

4.3. Operational policy objectives

The operational objectives are:

– to ensure that new motor vehicles are equipped with the essential technical systems assisting the driver in adopting an eco-efficient driving style where potential fuel savings are not fully exploited;

– to avoid that the agreed NH_3 limits for all heavy duty vehicles obstruct the further development and market-uptake of certain positive ignition vehicles;

– to resolve the need for costly double emissions certification for variants of vehicles spanning across the heavy duty / light duty borderline and thereby eliminate unnecessary compliance cost;

– to enable the Commission to propose updated low temperature emission limits in a timely manner by way of delegated act if this is deemed necessary and justified by the evidence base;

– to enable the Commission to propose a separate NO_2 limit for light duty vehicles by way of delegated act if this is deemed necessary and justified by the evidence base;

– to enable the Commission to propose the deregulation of methane emissions in the context of motor vehicle type approval by way of delegated act if this is deemed necessary and justified by the evidence base, and provided that methane emissions are included as CO_2 equivalent emissions under the automotive CO_2 Regulation;

4.4. Consistency with other policies and objectives

The initiative under consideration is aimed at correcting market and regulatory failures and by doing so improving environment and health protection. At the same time, it is aimed at ensuring the functioning of the single market for motor vehicles, while removing unnecessary burden on the companies operating in it. It is therefore entirely consistent with the Europe 2020 strategy and fully aligned with the EU's Sustainable Development Strategy.

Additionally, the European Union has committed itself to providing for a high level of environmental and public health protection and has taken on ambitious objectives as part of the EU air quality policy and the integrated climate and energy policy framework.

In this context, the objectives of the initiative under consideration tie in with the following policy communications and legislation:

Air quality

– The EU's 6th Environmental Action Programme which proposed to attain "levels of air quality that do not give rise to significant negative impacts on, and risks to human health and the environment";

– The Thematic Strategy on Air Pollution published in September 2005;

Furthermore, the initiative under consideration is aligned with all other relevant policies in the areas of transport, energy, environment and health.

Integrated climate and energy policy

– The European Council in March 2007 set three objectives to be reached by 2020 as part of the EU integrated climate and energy policy framework, namely to save 20% of the EU's total primary energy consumption, and binding objectives to increase the share of renewable energy (RES) of the EU final energy consumption by 20% and to reduce the EU greenhouse gas emissions (GHG) by 20% compared to 1990 levels. Particularly the first and the last target are of relevance for this initiative.

– The "Effort Sharing Decision" specifies that the transport sector will have to make an important contribution to reaching these commitments. In this context, the European Commission has devised the "integrated approach", i.e. a comprehensive strategy to reduce CO_2 emissions from new motor vehicles sold in the European Union (COM(2007)19), to ensure that the EU meets its greenhouse gas emission targets. Regulation 443/2009/EC on the reduction of

CO_2 emissions from passenger cars and Regulation 510/2011/EC addressing light duty commercial vehicles are the main legislative instruments underpinning this strategy. In this context, Regulation 661/2009/EC of 13 July 2009 concerning type-approval requirements for the general safety of motor vehicles plays an important role by defining the complementary technical requirements of in-vehicle systems designed to support this goal, in line with the objectives of the integrated approach.

Regulatory simplification

– The Commission Communication of October 2010 on "Smart Regulation in the European Union" (COM(2010)543) calls for a continuation and merging of simplification and administrative burden reduction efforts. This is to ensure that businesses feel the benefits of the smart regulation agenda. In particular, regarding double certification (see specific problem 3 above), an elimination of this burden would be in line with simplification and administrative burden reduction objectives.

5. POLICY OPTIONS

In line with the description of six specific problem areas in section 4.1, policy options are presented under six headings that correspond to these areas.

5.1. Potential to reduce fuel consumption through efficient driving behaviour insufficiently exploited

Option 1: No changes to the existing situation

– This option would imply that no measures are put in place to improve fuel efficient driving behaviour, apart from the requirement to install GSI in new passenger cars.

Option 2: Introduce mandatory fuel consumption meters (FCM) for light duty (LD) vehicles and extend the mandatory installation of gear shift indicators (GSI) from only passenger cars *to all LD vehicles*

– This option would consist of introducing the obligation to install FCM and GSI to all LD vehicles by adding the respective requirements to Article 11 of Regulation 661/2009/EC[19]. It should be noted that the vast majority (approximately 90%) of LD vehicles fall under the type approval rules for passenger cars (M1) and therefore already need to have a gear shift indicator as of 2012 (all new car models) or as of 2014 (all new cars). This option would extend that requirement to those 10% (mostly light commercial vehicles) that don't fall under M1. For fuel consumption meters, no obligation exists today for passenger cars and light commercial vehicles.

[19] Article 11 of the General Safety Regulation 661/2009/EC already provides for the mandatory installation of GSI in passenger cars (M1 vehicles that are subject to LD vehicle legislation)

Option 3: Introduce mandatory FCM for LD and HD vehicles and extend the mandatory installation of GSI from only passenger cars *to all LD and HD vehicles*

– This option would consist of introducing the obligation to install FCM and GSI to all LD and HD vehicles by adding the respective requirements to Article 11 of Regulation 661/2009/EC. A number of stakeholders, including an environmental NGO and a public authority, spoke out in favour of this option during the stakeholder consultation.

Option 4: A "soft law" approach focused on driver information and education

This option would have the following implications:

– As driving behaviour is a key factor in determining the fuel consumption, and therefore also the pollutant and GHG emissions of a motor vehicle, any measure aimed at encouraging fuel-efficient driving is a potentially effective way to address the problem;

– However, the regulatory options identified above are considered to be complementary to such a component. There would be synergies between technical and awareness raising measures, since GSI and FCM would provide the necessary information to drivers open-minded for fuel-efficient driving. Educational measures to encourage fuel-efficient driving already form part of compulsory driver training in some Member States and could potentially be implemented on a broader scale alongside the mandatory introduction of GSI and FCM. For professional drivers, EU Directive 2003/59/EC already stipulates that their training needs to cover principles of eco-driving. As such, it appears necessary to first introduce the technical preconditions for assisted eco-driving in the most relevant categories of motor vehicles, and then to consider whether EU action or coordination concerning the training of non-professional drivers may potentially be needed.

Therefore this option is **discarded** from further analysis in the given context.

5.2. Scope of ammonia (NH_3) emission limits threaten to drive HD natural gas vehicles out of the market

Option 1: No changes to the existing situation

– This option would leave the situation unchanged and the Euro VI NH_3 emission limits would apply to all heavy duty vehicles.

Option 2: Change the scope of the Euro VI NH_3 limits so that they only apply to heavy duty vehicles with compression ignition (diesel) engines

– This option would limit the scope of Euro VI NH_3 limits so that they only apply to heavy duty vehicles with compression ignition engines.

5.3. Upper mass limit of LD Euro 6 regulation necessitates two type approvals for some vehicle platforms

Option 1: No changes to the existing situation

– This option would leave the current situation unchanged. Where different vehicles share a common platform but some vehicles have a reference mass of more than 2610 kg while some are below, this means type approval needs to be done according to two different sets of rules.

Option 2: remove the upper mass limit of the LD Euro 6 regulation for emission purposes

– This option would give manufacturers a choice to type approve vehicles with a reference mass of more than 2610 kg according to the LD or HD emission requirements. In particular, in case of vehicle platforms cross cutting the current LD-HD borderline, the manufacturer could simply type approve all vehicles according to LD rules. As will be examined in the impacts section, LD requirements are at least equivalent or even more stringent than HD requirements in terms of environmental standards.

5.4. Euro 6 LD Low temperature emission limits not adjusted to technical progress

Option 1: No changes to the existing situation

– As outlined in the problem definition, this option would mean that the current low temperature emission limits would remain unchanged.

Option 2: introduce a mandate for the Commission to set low temperature emission limits for carbon oxide (CO) and hydrocarbons (HC) of positive ignition (petrol and gas) vehicles and NOx for positive ignition and compression ignition (diesel) vehicles by way of a delegated act

– This option would consist of giving a mandate to the Commission for a delegated act by amending Euro 5/6 Regulation 715/2007/EC. Such a mandate would allow the Commission to propose rather technical and narrow legislation in a lighter procedure. At this point in time, the available information does not allow including the technical aspects in this initiative. Before proposing any delegated act, the Commission would investigate the need to do so and possible options in a follow-up impact assessment.

5.5. Euro 6 LD emission regulation specifies a limit value for total emissions of nitrogen oxides (NOx), but no separate limit value for nitrogen dioxide (NO2)

Option 1: No changes to the existing situation

– As explained in the problem definition, this option would imply that the NO_2 emissions of light duty vehicles limit would continue to be accounted for as part of the overall NOx limit.

Option 2: Introduce a mandate for the Commission to specify in addition to the limit value for total emissions of NOx a limit value for emissions of NO_2 by way of a delegated act

– This option would consist of giving a mandate for a delegated act to the Commission by amending Euro 5/6 Regulation 715/2007/EC[20]. The same reasoning applies as for the previous issue.

5.6. Euro 6 LD THC emission limits cause problems for CNG vehicle manufacturers

Option 1: No changes to the existing situation

– This option would leave the current THC limits unchanged.

Option 2: Introduce a mandate for the Commission to account for the greenhouse gas effects of methane emissions as CO_2 equivalents in vehicle type approval information and accordingly increase or remove limit values of THC emissions of positive ignition vehicles by way of a delegated act

– This option would consist of giving a mandate to the Commission by amending Euro 5/6 Regulation 715/2007/EC to make the necessary changes to Annex XII of the Euro 5/6 implementing Regulation 692/2008/EC by way of a delegated act. Again, the same reasoning as for the previous two issues applies concerning the usefulness of having a mandate for a delegated act.

Each of the regulatory options in the 6 issue areas are considered to be in line with the proportionality principle as they envisage that the EU would only act to the extent that is needed to achieve the objectives. For any subsequent delegated acts (issues 6.4, 6.5, and 6.6), follow-up impact assessments would be done that would also look at the proportionality aspect.

6. ANALYSIS OF IMPACTS

As this impact assessment concerns a 'narrow' legislative action, it will assess the options in a proportionate way with quantification of those impacts for which sufficient data is available. The options will be analysed with focus on the economic and environmental aspects, as these are the most pertinent given the nature of the present initiative. The economic impacts considered include the effects on industry and the indirect impact on consumers. The environmental impacts considered include the emissions of greenhouse gases and of the relevant air pollutants. If any, social impacts are mainly expected in the area of employment. However, due to the low order of magnitude of the possible employment effects, the scope for meaningful quantification is very limited in this domain.

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[20] It should be noted that Article 12(1) of Euro VI Regulation 595/2009/EC already provides for such a mandate with respect to Euro VI heavy duty vehicles.

Given that the regulatory options identified in problem areas 4, 5 and 6 are aimed at giving the Commission a mandate to amend or supplement emission legislation by delegated act, no assessment of impacts can be provided for these options at this stage. The decision to modify or introduce specific limit values for the pollutants in question will be taken at a later stage and will be supported by a separate impact assessment. Therefore, this report is focused on providing a proportionate assessment of the impacts of the policy options devised to address problem areas 1, 2 and 3.

6.1. Potential to reduce fuel consumption through efficient driving behaviour insufficiently exploited

The impact of the possible introduction or extension of the requirement to fit motor vehicles with GSI/FCM is to be assessed here. The analysis is focused on CO_2 and pollutant emission reduction and additional costs imposed on vehicle manufacturers that can be expected from the mandatory fitting of GSI and FCM to the most relevant motor vehicle categories. This assessment is mainly based on a TNO study on the effects of a gear-shift indicator and a fuel economy meter on fuel consumption[21] which is in annex to this report. It should be noted that this study is first of all applicable to the LD sector.

Option 1: No changes to the existing situation

The no policy change option coincides with the baseline scenario. GSI would continue to be mandatory for vehicles of category M1 (passenger cars) only and no legal requirement for FCM would be introduced.

Option 2: Introduce mandatory fuel consumption meters (FCM) for light duty (LD) vehicles and extend the mandatory installation of gear shift indicators (GSI) from only passenger cars to all LD vehicles

Economic impacts

This option would require the fitting of FCM and GSI to all light duty vehicles. Economic benefits would result from energy savings through reduced fuel consumption (for quantitative figures see figure 5 below) and potentially an increase in consumable income resulting from reduced spending on fuel.

For the manufacturers of the vehicles concerned, the extension of the requirement to fit FCM would mean moderate additional costs, estimated to be in a 0-10 EUR bracket per vehicle[22]. Since in a modern vehicle the information about the injected fuel is already available, the main cost of implementing a FCM arise from the adaptation of the dashboard. Therefore the low end of this bracket would be applicable to vehicle types that already have the possibility to display fuel consumption information in the existing dashboard. The higher end would apply to vehicle types for which a redesign of the dashboard would become necessary.

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21 TNO 2010, Effects of a gear shift indicator and a fuel economy meter on fuel consumption

22 TNO 2010, Effects of a gear shift indicator and a fuel economy meter on fuel consumption

However, it can be expected that the extra cost per unit produced would converge towards the low end of the cost bracket quickly. An overview of the estimates for passenger cars from a short and a long term perspective is presented below.

*Figure 3 – Passenger car fleet penetration and cost of **Fuel Consumption Meter***

	FCM short term*	**FCM long term**
Small passenger car fleet penetration	currently <5%	mandatory
Costs/vehicle	Up to 20 Euro	0-10 Euro
Medium passenger car fleet penetration	Unknown	mandatory
Costs/vehicle	5-10 Euro	0-10 Euro
Large passenger car fleet penetration	currently >95%	mandatory
Costs/vehicle	0-10 Euro	0-10 Euro

* depending on dash board properties, redesign and component costs
Source: TNO 2010

For light commercial vehicles no separate cost estimates are available but costs are expected to be similar to costs of medium or large passenger cars and thus be in the range of 0 to 10 EUR.

For GSI, it needs to be recalled that these will be mandatory for all passenger cars (M1) as of 2012 (all new car models) 2014 (all new cars) already under the baseline. M1 vehicles constitute the large majority of light duty vehicles. Under this option, those light duty vehicles that are not in category M1, such as light commercial vehicles, and for which a GSI is not mandatory in the baseline would fall under the mandatory fitting obligation. The extra cost per unit is estimated to be between 0 and 15 EUR for passenger cars in the short term. In principle, the motor management system of modern motor vehicles supplies all information needed for the GSI. The upper range of the cost bracket would be reached if the addition of a GSI would necessitate a redesign of the dashboard to accommodate a suitable display. In the long term the costs per vehicle would be in a 0-7 EUR range.

*Figure 4 – Passenger car fleet penetration and cost of **Gear Shift Indicator***

	GSI short term*	**GSI long term**
Fleet penetration	currently <5%	mandatory
Costs/vehicle	0-15 Euro	0-7 Euro component costs

*depending on dash board properties and existence of fuel meter, redesign and component costs
Source: TNO 2010

Separate estimates for other LD vehicles are not available. However, as their technical and design features relevant in this context are very similar to those of passenger cars, the estimates are fully transferable and also valid for these vehicles.

However, next to the extra costs imposed on manufacturers, the mandatory fitting of FCM and GSI in all light duty vehicles would also create additional demand for

sensors, suitable dash boards and related components and could thereby open-up certain business opportunities for suppliers.

Social impacts

Due to the low order of magnitude of the cost increase per vehicle no effects on employment are expected.

Environmental impacts

The main expected benefit would be CO_2 emission savings, which are directly linked to reduced fuel consumption. When analysing effects of systems supporting fuel efficient driving, it is important to make a distinction between achievable effects and actual effects. Achievable effects refer to the obtainable effects in fuel reduction in case the system's advice is optimally followed. The actual effect is determined as follows:

Actual effect (%) = achievable effect (%) x effectiveness (%) x durability (%)

The actual effect equals the achievable effect adjusted for effectiveness and durability. Effectiveness is the percentage of exposed drivers really adapting their driving style and durability is the longevity of the effect (i.e. how much of the effect is maintained in the longer term).

Using the above formula, it is estimated that the fitting of a GSI effectuates a net reduction in CO_2 emission of up to 1.5%. The corresponding figure for a FCM is in the order of magnitude of 0.3 to 1.1 %. These estimates are based on the findings of a number of earlier studies[23] on achievable effect, an effectiveness rate of 30% and a durability of 75%. The below table summarises these findings.

Figure 5 – Summarised effects of a GSI and FCM used to calculate an estimate of the combined effects

	GSI	**FCM**
Achievable effect (lower estimate) [%]	7	1.5
Achievable effect (higher estimate) [%]	N/A	5
Effectiveness rate [%]	30	30
Durability rate [%]	75	75
Actual effect (lower estimate) [%]	1.5	0.3
Actual effect higher estimate) [%]	N/A	1.1

Source: TNO 2010

When the actual effects of both measures are simply added up, the combined effect would be between 1.8% (for the lower estimates) and 2.6% (taking into account the higher estimate for the FCM). Since no empirical studies are available on their combined effectiveness and durability an expert estimate had to be made. Overall,

[23] See for example Van der Voort (2001), Vermeulen (2006) and Smokers et al. (2006).

there are compelling arguments for synergies between GSI and FCM as their effects on driving behaviour are assumed to be mutually reinforcing (e.g. the FCM immediately displays the consequences of following or not following the advice of the GSI). The combined effect of higher effectiveness and durability rates is estimated at 10-15%. This would result in an actual combined effect between 2% (1.8 * 1.10 = 2%) and 3% (2.6 * 1.15 = 3%). Fuel consumption could therefore be reduced by 2-3% for the average driver if FCM and GSI are implemented together on a vehicle type.

The above figures are best estimates for light commercial vehicles. Taking into account that M1 vehicles (cars) will in future need to be equipped with a GSI already under the baseline, the additional fuel saving from requiring the installation of a fuel economy meter will be lower than the 2-3% mentioned above. At that same time it is expected to be at least as high as the 0.3 to 1.1 % savings that are expected from having only an FCM (without GSI), given that synergies between the two are likely. A conservative estimate would therefore be a 1% fuel saving on all M1 vehicles. It should be noted that in light of the rather low cost of FCM and GSI, even a relatively low fuel saving potential will make the investment pay off very quickly.

The effect that FCM and GSI would have on the noxious emissions of vehicles fitted with them is less straight forward. While it can be expected that the introduction of a FCM would lead to a decrease of noxious emissions due to more fluent driving, better anticipation, more coasting and possibly lower average speeds on motorways, there is some evidence that GSI in vehicles with modern diesel engines or direct injection petrol engines could lead to slightly elevated NOx emission. A study[24], which assessed a range of measures to reduce fuel consumption, suggests that the implementation of a GSI might increase NOx emissions from some modern diesel and direct injection petrol engines as a result of shifting up at lower engine speed. The magnitude of the total effect when both instruments are implemented is however unknown. It should be noted that these studies were done on Euro 3 and Euro 4 vehicles, where NOx emissions are controlled with internal engine measures and are therefore sensitive to engine torque (which in turn is influenced by the gear shift strategy). The proposed legislation is valid for Euro 6 (and possibly future higher Euro classes) vehicles, which will be equipped with efficient NOx aftertreatment systems that are not sensitive to these impacts. In addition, NOx emissions of Euro 6 vehicles under real driving conditions, including the use of GSI, will be assessed by more robust type approval procedures. Therefore, NOx emissions of Euro 6 vehicles are not expected to increase when the GSI is used.

Option 3: Introduce mandatory FCM for LD and HD vehicles and extend the mandatory installation of GSI from only M1 to all LD and HD vehicles

Economic impacts

Albeit no precise cost estimates exist for FCM and GSI to be installed in HD vehicles, the following qualitative statements can be made:

[24] Vermeulen 2006

– Costs for FCM are probably of the same order as costs for LD vehicles, since the same technology (display of injected fuel quantity normalised to distance driven) can be used.

– Costs for GSI are estimated to be significantly higher than for LD vehicles since the variety of HD vehicles is much higher than the one of LD vehicles (HD vehicle variants are typically only produced in small series of a few hundred vehicles) and the GSI has to be adapted to each vehicle type and variant. In addition, most modern HD vehicles have a highly efficient automatic gear shift mode, which makes a GSI redundant.

The economic impacts of option 3 therefore appear to be less favourable than those of option 2. It should also be noted that industry stakeholders oppose the mandatory installation of GSI in HD vehicles.

Social impacts

Due to the low order of magnitude of the cost increase no effects on employment are expected.

Environmental impacts

While, in principle, similar positive effects on eco-driving and therefore reductions of CO_2 emissions can be expected when installing FCM and GSI in HD and LD vehicles, the following elements need to be considered:

– HD vehicles are typically driven by professional drivers, which is not the case for LD vehicles. For economic reasons operators of HD vehicles are concerned about fuel costs and professional drivers are advised to keep fuel consumption low, for which they also need to be trained, as prescribed in the Professional Drivers Directive (2003/59/EC). Therefore, the positive effect of tools supporting eco-driving, such as FCM and GSI, is more limited than for LD vehicles.

– The vast majority of new HD vehicles are equipped with automatic gearboxes, which render GSI obsolete.

– As compared to LD vehicles, HD vehicles are typically operated at higher and more constant engine loads. This limits the degree of freedom for operational parameters, such as acceleration and choice of gear and speed. Boundary conditions such as vehicle load and traffic flow largely determine the driving style, giving only limited scope for improved eco-driving that could be assisted by FCM and GSI.

– As a consequence of the above, the additional positive environmental impact of option 3 over option 2 is considered to be very limited.

6.2. Scope of ammonia (NH_3) emission limits threaten to drive HD natural gas vehicles out of the market

Option 1: No changes to the existing situation

Economic impacts

In Euro VI legislation, ammonia emission limits have been introduced for all heavy duty vehicles regardless of engine or fuel type. This limit value is set at the level of 10 parts per million (ppm) and becomes binding at the end of 2012[25]. While the technology to bring the NH_3 emissions from compression ignition (diesel) engines under this limit is commercially available, no such system exists for the small market segment of heavy duty vehicles with positive ignition (natural gas and petrol) engines. For these vehicles to meet the ammonia limit value, the development, testing and fitting of a number of additional aftertreatment components would be required. Therefore, it is plausible that the development and production costs of these vehicles would increase disproportionately. This also corresponds to the feedback received from industry stakeholders concerned by the issue.

The effect of the current limit value on natural gas HD vehicles is further aggravated by the way emissions are measured in the type approval process[26].

In 2010 roughly 473,000 new heavy duty vehicles were registered in the EU27[27]. The vast majority was equipped with diesel engines (i.e. compression ignition) which dominate the European market. In contrast, heavy duty vehicles equipped with positive ignition engines registered annually in the EU are only a few thousands. Most of these vehicles are urban transit buses running on natural gas. The total number of positive ignition vehicles in the EU that would be affected by the Euro VI NH_3 limit is expected to be in the range of 2000 – 4000 units per year depending on future demand trends.

The following material and development cost estimate is based on the assumption that, in order to meet the NH_3 limit, a clean-up catalyst would need to be installed in addition to the 3-way catalyst that would otherwise suffice. The required additional material would include the following main components:

- clean up catalyst;

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25 Regulation 595/2009 stipulates that all new type approvals have to comply as of 31/12/2012 and all new vehicles as of 31/12/2013.

26 This is caused by the fact that the NH_3 limit has been expressed in concentration (ppm) instead of mass per power output (mg/kWh). As diesel engines typically operate with a high quantity of air in excess, the pollutants in the exhaust gas are subject to a relatively high level of dilution. In contrast to that, natural gas engines typically work with a quantity of air exactly proportionate to the amount of fuel to be burnt. So the level of dilution is lower and the exhaust concentration is higher than in case of diesel engines. This means that, under certain conditions, the NH_3 emission measured as concentration (ppm) of natural gas engines could exceed the Euro VI limit, even if the NH_3 emissions expressed in mass (mg/kWh) is lower than the one of a diesel engine with same power output and displacement.

27 Source: ACEA

- injection system to inject oxidant to convert NH_3;
- NH_3 concentration sensor;
- more complex wiring harness;
- various modifications due to the impact on vehicle lay-out and packaging

As already stated, these components would still need to be developed for the given purpose as they are not commercially available at present. A reliable cost estimate is therefore very difficult to produce, but due to the considerable increase in technical complexity, it can be assumed that the material cost of the aftertreatment system would increase by at least 50%. The only available estimate of the additional material costs in absolute terms comes from an industry stakeholder, who stated that they would amount to at least EUR 1600 per vehicle[28].

Alongside the material cost that would be incurred for each produced unit, there are also additional project costs for each engine/vehicle family that would need to comply with the limit. An industry estimate of these additional costs is in the range of EUR 6-8 million per engine/vehicle family[29]. This is particularly salient as the vehicles in question are normally produced in relatively small series and often according to specific requirements of individual public transport providers.

Assuming a market of 3000 units/year composed of 10 engine families, the total additional material costs would amount to EUR 48 million per year and the total additional project costs would be in the range of EUR 60-80 million. This would lead to total additional costs under the baseline of EUR 108-128 million. Moreover, the related activities would require an estimated 2 years for completion, delaying as a consequence the start of production of Euro VI compliant natural gas vehicles, assuming that producers would continue offering them.

Social impacts

The employment effects of the no policy change option largely depend on how the entry into force of NH_3 limit values will affect the business case for natural gas transit buses. However, the order of magnitude of the cost increase suggests that the market potential of these vehicles would be seriously diminished. Next to the direct effect on the producers, this would disproportionately affect specialised small and medium sized component suppliers. If the potential loss in employment could be offset by positive employment effects triggered by an increase in the demand for conventional diesel buses is doubtful.

Environmental impacts

The main reason why the segment of natural gas fuelled transit buses has developed, in a market that is otherwise dominated by diesel engines, is the overall emission

[28] Source: IVECO
[29] Source: IVECO

performance of natural gas vehicles. These vehicles are normally used in urban areas as they have low PM and NOx emissions. Due to the low carbon content of natural gas in comparison to other fossil fuels, the CO_2 emissions are also lower.

Assuming that producers decide to develop and market natural gas buses that comply with Euro VI in its current form, the associated cost increase and the likely effect on the price could inhibit the production and diffusion of these comparatively clean vehicles. The gradual replacement of natural gas buses, reaching the end of their service life, by diesel buses would result in an increase of PM, NOx and CO_2 emissions.

The NH_3 emission reduction linked to maintaining the status quo would be largely insignificant, as the contribution of the entire road transport sector to the total NH_3 emissions in the EU is very small. In 2009, agriculture was responsible for 93.3% of the total EU27 ammonia emissions. In contrast to that, road transport only accounted for 1.9%[30]. Based on the total EEA emission figure of 3,783,000 tonnes of NH_3 for 2009, the 1.9% share of transport would amount to 71,877 tonnes in absolute terms.

Option 2: Change the scope of the Euro VI NH_3 limits so that it only applies to diesel engines

Economic impacts

The proposed change would facilitate the introduction of new natural gas HD vehicles to the market, taking into account that in cost-sensitive cases the development of Euro VI compliant vehicles may be critically affected. Therefore, there is a positive economic impact for manufacturers and operators of natural gas HD vehicles, as additional material and project costs estimated to be EUR 108-128 million per year would be avoided. This option is also strongly favoured by a majority of the stakeholders who replied to the public consultation.

Social impacts

As the business case for HD natural gas vehicles would stay unaffected by Euro VI, the effect on employment is expected to be neutral or slightly positive compared to today, as there may be some limited creation of jobs in manufacturing of natural gas HD vehicles. The potential negative effects on employment under the baseline would be avoided in this option.

Environmental impacts

The only available estimate of the additional NH_3 emitted following a removal of the limit value for positive ignition engines was provided by an industry stakeholder[31] and is based on a number of simple assumptions:

30 Source: EEA

31 Source: IVECO

Registration of diesel Euro VI vehicles	450.000 units/year
Registration of natural gas Euro VI vehicles	3.000 units/year
Standard annual mileage of a HD vehicle	50.000 km
Assumed energy efficiency	1 kWh/km
NH_3 emissions of typical diesel Euro VI SCR engine	40 mg/kWh
NH_3 emissions of typical gas Euro VI engine with NH_3 limit	20 mg/kWh

The total NH_3 emissions from such a fleet of Euro VI vehicles would amount to 903 tons per year. Assuming that the NH_3 emissions of a typical Euro VI natural gas engine would go up to 36 mg/kWh if the NH_3 limit were to be removed, the amount emitted would increase to 905.4 tons per year. This corresponds to a 0.2-0.3% increase. Even if the above calculation is very indicative, it makes clear that the additional NH_3 emissions from removing the limit value would be largely insignificant.

In contrast to that, the wider replacement of diesel by natural gas heavy duty vehicles, in particular in urban areas, would have a significant positive environmental effect with respect to the emissions of NOx and CO_2. In principle, this positive environmental impact has to be balanced with potentially slightly higher NH_3 emissions. As it has been explained above, the overall importance of these emissions is small. Therefore, the global environmental impact of this option can be considered positive.

6.3. Upper mass limit of LD Euro 5/6 regulation necessitates two type approvals for some vehicle platforms

Option 1: No changes to the existing situation

Economic impacts

Where different vehicles share a common platform but some vehicles have a reference mass of more than 2610/2840 kg while some are below, type approval needs to be done according to two different sets of rules, which creates some burden for manufacturers. Here two different types of costs have to be distinguished:

– Administrative costs for two type approval procedures (these are relatively limited, i.e. are in the order of 100 000 Euro per type approval)

– Additional design and development costs since the same vehicle platform has to be calibrated for two different design requirements. Such costs are difficult to estimate because they are considered as commercially sensitive, it can however be estimated that they correspond to several million Euros per calibration of a vehicle type (and depend of course on the complexity of individual calibrations).

Social impacts

No impacts on employment are expected.

Environmental impacts

No environmental impacts are expected.

Option 2: remove the upper mass limit of the LD Euro 5/6 regulation for emission purposes

Economic impacts

Vehicle manufacturers would get an additional choice for type approval, which would reduce the regulatory burden in particular for vehicle platforms with some vehicles above and others below today's LD-HD reference mass borderline. While LD requirements are at least equivalent but possibly more stringent than HD requirements (see below under environmental impacts), the freedom of choice for manufacturers allows them to determine whether the benefits of simplification outweigh possible additional costs of having to meet more stringent requirements. If those costs are higher than savings from simplification, manufacturers can simply decide to type approve a vehicle under HD standards and are thus at least not worse off than under the baseline. Where the additional costs are lower than the cost savings from single certification true cost savings this option will allow true cost savings. However, no data is available for reasons explained above as to the likely magnitude of the overall cost savings.

Social impacts

No major employment impacts are expected. To the extent that manufacturers make use of the simplification possibility, this should lead to cost reductions that could potentially translate into lower prices for buyers.

Environmental impacts

The central question in the assessment of environmental impacts is whether the application of Euro 6 instead of Euro VI emission legislation on a voluntary basis would result in negative environmental consequences. A direct nominal comparison between the two is not possible as they set pollutant limits in different ways (mass per distance travelled in Euro 6 vs. mass per unit of power output in Euro VI) and define different testing methods. While the qualitative requirements defining the scope of emission relevant elements of a vehicle being tested can be considered technically equivalent for Euro 6 and Euro VI, the effect of the quantitative requirements (i.e. the actual limit values) is more difficult to establish.

In this context, it is important to recall that the reference quantity for emission limits is the distance driven (regardless of the weight or size of the vehicle) in LD Euro 6 and the work generated by the engine in HD Euro VI. Since heavier vehicles tend to emit more pollutants per km driven, the application of LD Euro 6 becomes more demanding with increasing mass. As a consequence there will be a "natural" limit for the voluntary application of LD Euro 6 legislation to heavier vehicles. It is, therefore, extremely unlikely that Euro 6 would be applied to vehicles with reference masses above 5 tons.

Also for "borderline" HD vehicles with reference masses just above the LD-HD borderline, which in the future would typically be the subject to the voluntary application of Euro 6 (LD) instead of Euro VI (HD) emission limits, the former would be more demanding than for typical light duty vehicles falling in the mandatory scope of Euro 6, which have smaller masses. In particular, if Euro 6 emission limits are applied to a "borderline" HD vehicle, it would not be more polluting than any light duty vehicle falling in the mandatory scope of Euro 6.

Unfortunately no data for Euro VI (HD) tested against Euro 6 (LD) requirements are available at this stage, since Euro VI "borderline HD" vehicles are not available on the market yet. The European automobile manufacturers' association (ACEA) has however provided some data on NOx emissions[32] of a Euro V (HD) vehicle, which was tested against Euro 5 (LD) requirements. These data suggest that the Euro V "borderline HD" vehicle in question would exceed Euro 5 NOx emission limits by about 50%. Compliance with Euro 5 instead of Euro V emission limits requirements would therefore result in lower emissions.

As a consequence the impact of this option can be considered as environmentally neutral, if not slightly positive.

Given the different nature of the issue areas covered by this impact assessment, there are no synergies or trade-offs between the options assessed in different areas. Their cumulative effect across options is therefore equal to the sum of the parts.

7. COMPARING THE OPTIONS

When comparing the policy options in the three problem areas that were subject to a detailed assessment of impacts, the following picture emerges:

COMPARISON OF THE OPTIONS FOR PROBLEM 1 **Potential to reduce fuel consumption through efficient driving behaviour insufficiently exploited**			
OPTIONS	**EFFECTIVENESS**	**EFFICIENCY**	**COHERENCE**
Option 1: *No changes to the existing situation*	N.A	N.A	N.A.
Option 2: *Introduce mandatory fuel consumption meters (FCM) for light duty (LD) vehicles and extend the mandatory installation of gear shift indicators (GSI) from only passenger cars to all LD vehicles*	**HIGH**: Puts in place essential devices for more fuel efficient driving in the most important segment of the new vehicle fleet.	**MEDIUM**: Some limited costs imposed on the producers of light duty vehicles (0-10 EUR per vehicle)	**HIGH**: Coherent with relevant EU strategies and objectives, in particular with the EU's energy and climate change policy.

[32] Looking at air quality problems of Member States and the real driving emissions, NOx is the most critical regulated pollutant.

Option 3: *Introduce mandatory FCM for LD and HD vehicles and extend the mandatory installation of GSI from only passenger cars to all LD and HD vehicles*	**HIGH**: Puts in place essential devices for more fuel efficient driving in the entire new vehicle fleet.	**LOW**: Some limited costs (0-10 EUR per vehicle) c imposed on the producers of light duty vehicles. Slightly higher costs imposed on producers of heavy duty vehicles (per unit).	**MEDIUM**: Coherent with relevant EU strategies and objectives.

Option 2 emerges as the preferred one from this comparison, as it is the more efficient way to address the problem. The positive environmental impacts of option 3 are unlikely to be significantly higher than the ones for option 2. Although there would be some limited, additional environmental benefits of option 3 over option 2, these are unlikely to be proportionate to the associated costs. Therefore, at the current stage, the mandatory installation of GSI or FCM in HD vehicles appears difficult to justify.

COMPARISON OF THE OPTIONS FOR PROBLEM 2 **Scope of ammonia (NH3) emission limits threaten to drive HD natural gas vehicles out of the market**			
OPTIONS	**EFFECTIVENESS**	**EFFICIENCY**	**COHERENCE**
Option 1: *No changes to the existing situation*	0	0	0
Option 2: *Change the scope of the Euro VI NH3 limits so that they only apply to heavy duty vehicles with compression ignition (diesel) engines*	**HIGH:** Avoids that Euro VI NH3 limits for heavy duty vehicles obstruct the further development and market-uptake of natural gas vehicles.	**HIGH**: No associated costs (would avoid potential costs for industry in the area of EUR 108-128 million per year in comparison to the baseline)	**HIGH**: Fully coherent with all relevant EU strategies and objectives

Option 2 is clearly preferable to the baseline, as it solves the problem without creating any costs. The coherence with EU policy objectives is high as the environmental and social impacts are expected to be positive on balance

COMPARISON OF THE OPTIONS FOR PROBLEM 3 **Upper mass limit of LD Euro 6 regulation necessitates two type approvals for some vehicle platforms**			
OPTIONS	**EFFECTIVENESS**	**EFFICIENCY**	**COHERENCE**
Option 1: *No changes to the existing situation*	0	0	0
Option 2: *Remove the upper mass limit of the LD Euro 6 regulation for emission purposes*	**HIGH**: Resolves the need for costly double emissions certification.	**HIGH**: No associated costs	**HIGH**: Coherent with the competitiveness and sustainability concept of Europe 2020, the objectives of industrial policy and the simplification agenda.

Option 2 is clearly preferable to the baseline, as it solves the problem without creating any costs. No negative environmental or social impacts expected.

8. MONITORING AND EVALUATION

A joint evaluation of the measures contained in this impact assessment and the follow-up impact assessment could be usefully carried out five years after entry into force of the act adopted through the ordinary legislative procedure and any delegated acts that may be adopted.

Extensive reporting mechanisms are already in place to monitor ambient air quality and Member States' adherence to Community air quality objectives. Non-compliance with legal air quality requirements is enforced pursuant to existing Treaty provisions. These reporting mechanisms also generate data that allow the monitoring of pollutant emissions, e.g. whether urban NOx emissions increase or decrease. The compliance of motor vehicles sold in the European market with EU requirements is checked by the national type approval authorities during the approval process for new vehicle types. The existing reporting mechanisms, therefore, would allow the Commission to monitor the effects of the proposed legislation to a certain extent. However, due to the relatively low order of magnitude of the initiative under consideration, it may be difficult to link the data obtained from the existing reporting mechanisms to the actual impact of the intervention. Therefore, it could be considered to complement this data with additional evidence that could be obtained through a background study.

Glossary

CNG	Compressed natural gas
CO	Carbon monoxide
CO_2	Carbon dioxide
Compression ignition	Diesel engine
FCM	Fuel consumption meter
Gg	Gigagram
GHG	Greenhouse gas
GSI	Gearshift indicator
HC	Hydrocarbon
HD	Heavy duty vehicle
kWh	Kilowatt hour
LD	Light duty vehicle
LPG	Liquefied petroleum gas
MVEG	Motor vehicle emissions group
NGV	Natural gas vehicle
NH_3	Ammonia
NMHC	Non-methane hydrocarbons
NMVOC	Non-methane volatile organic compounds
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NOx	Generic term for NO and NO_2
O_3	Ozone
PM	Particulate matter
ppm	Parts per million
Positive ignition	Petrol or gas engine

SCR	Selective catalytic reduction
THC	Total hydrocarbons
UN/ECE	United Nations Economic Commission for Europe