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IMPACT ASSESSMENT

Accompanying the document

Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 for a resilient Energy Union and to meet commitments under the Paris Agreement and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change

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1. WHAT IS THE PROBLEM AND WHY IS IT A PROBLEM?

1.1. Policy context

The Paris Agreement of December 2015 under the United Nations Framework Convention on Climate Change (UNFCCC) is a historically significant landmark agreement that covers almost all of the world's emissions. It has set the goal of holding the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels and aims to limit the increase to 1.5°C in order to reduce significantly the risks and impacts of climate change. To achieve this, all Parties are to undertake and communicate ambitious efforts as nationally determined contributions to the global response to climate change. Developed country Parties should continue taking the lead by undertaking economy-wide absolute emission reduction targets.

In line with scientific findings reported by the International Panel on Climate Change (IPCC) in the fourth Assessment Report, the EU's objective, in the context of necessary reductions by developed countries as a group, is to reduce GHG emissions by 80-95% by 2050 compared to 1990. The Commission in its 2050 Low Carbon Economy Roadmap[1] proposed concrete milestones to ensure the EU is on track to reduce these emissions by at least 80% domestically by 2050, with milestones of 40% and 60% reductions in 2030 and 2040. In preparation of Paris, the EU and its Member States submitted a domestic 2030 target of at least 40% GHG emission reductions compared to 1990 as its Intended Nationally Determined Contribution under the UNFCCC.

For 2020, the EU had agreed in 2007 on an economy-wide and binding target of at least 20% GHG emission reductions, as well as a binding renewables target of 20% and an indicative target of 20% energy savings. The EU is expected to meet its 2020 target. Total GHG emissions (excluding LULUCF) in the EU 28 fell by 23% over the period 1990-2014, while the overall economy grew by 46%[2].

The main policy architecture to implement the binding EU climate targets is comprised of the EU Emissions Trading System (ETS), which includes a cap for the EU-wide GHG emissions of the sectors covered, and a set of legally binding country specific targets for the emissions of sectors not covered by the EU ETS in the so-called Effort Sharing Decision (ESD)[3]. Emissions and removals from land use, land-use change and forestry (LULUCF) are currently neither included in the ESD, nor in the ETS.

With regard to post-2020 binding targets, the Commission proposed in its January 2014 Commission Communication on a 2030 climate and energy framework[4] a set of targets for the year 2030. This included an impact assessment that examined in detail the interaction of targets and policy instruments on greenhouse gases, renewable energy and energy efficiency, respectively. Taking this into account and in line with the EU's long term climate objective the Commission proposed to reduce domestically GHG emissions by at least 40%, to be delivered collectively by the EU in the most cost-effective manner

[1] COM(2011) 112 final
[2] Climate action progress report, COM(2015) 576 final
[3] Decision No. 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas reduction commitment up to 2020; http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009D0406&from=EN
[4] Commission COM(2014)15, SWD(2014)15

possible, with the reductions in the ETS and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively.

The impact assessment accompanying the 2030 framework proposal also assessed in detail the cost and benefits of the set of targets. In relation to the 40% greenhouse gas reduction it for instance concluded that a domestic 40% reduction of GHG emissions, the additional energy system costs compared to the Reference scenario of adapting the energy system would be contained to 0.15–0.54% compared to GDP in 2030, compared to the Reference scenario. It also concluded that such costs are not a reduction of GDP compared to what would otherwise be the case, but reflect the increased costs for all final consumers (industry, consumers, transport users) arising from changed investment patterns and related fuel savings to receive the required energy services.

These need to increase investments upfront, followed with reduced costs over time, of course would benefit of an enabling framework that fosters innovation and investments. Elements of such an enabling framework were proposed in the form of modernisation and innovation funds under the proposed revised ETS directive and by other policies that foster innovation and investment in the EU.

After the endorsement of the European Parliament[5], the October 2014 European Council (hereafter referred to as European Council) confirmed these climate targets, including the split between efforts in the ETS and non-ETS sectors. It asked for setting corresponding national reduction targets for the non-ETS sectors and for the LULUCF sector to be included into the 2030 greenhouse gas mitigation framework. It also agreed a renewable energy target of at least 27%, binding at the EU level, an at least 27% indicative energy savings target, that will be reviewed having in mind an EU level of 30% and a 15% interconnection target. It gave further guidance on key elements for a 2030 Climate and Energy Policy Framework[6]. In March 2016, the European Council reaffirmed after Paris its earlier conclusions and invited the Commission to rapidly present all the remaining relevant proposals to this end so as to swiftly engage the legislative process.

Continuing an ambitious climate policy is an integral part of the Energy Union with a forward looking climate change policy. The aim is an Energy Union as a sustainable, low-carbon and climate-friendly economy. The Commission has started the next steps towards implementing these targets. In 2015 it presented a legislative proposal to amend the ETS for the period after 2020[7]. This impact assessment focusses on the implementation of the 2030 framework for the sectors outside the ETS as covered in the current ESD, i.e. the proposed Regulation on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 for a resilient Energy Union and to meet commitments under the Paris Agreement (referred to in this document in short as Effort Sharing Regulation, ESR). It is further accompanied by an impact assessment that focuses on the integration of LULUCF into the 2030 Climate and Energy Framework[8]. It is coherent with the impact assessment that is being prepared for the revision of energy efficiency targets under the Energy Efficiency Directive for the 2030 horizon and uses central policy scenarios also used in the analytical work underpinning the

[5] European Parliament resolution P7_TA(2014)0094 of 5 February 2014
[6] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145397.pdf
[7] COM(2015) 337 final
[8] Impact assessment accompanying the proposal for a Regulation of the European Parliament and of the Council on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework, SWD(2016) 249

Communication on the decarbonisation of transport and other impact assessments for policy initiatives prepared in 2016 under the Energy Union such as the revision of the Renewable Energy Directive. These central policy scenarios are not abstract policy scenarios but reflect the current EU policy design, modelling among others ambitious energy efficiency policies relevant for the non-ETS sectors.

1.2. The Effort Sharing Decision

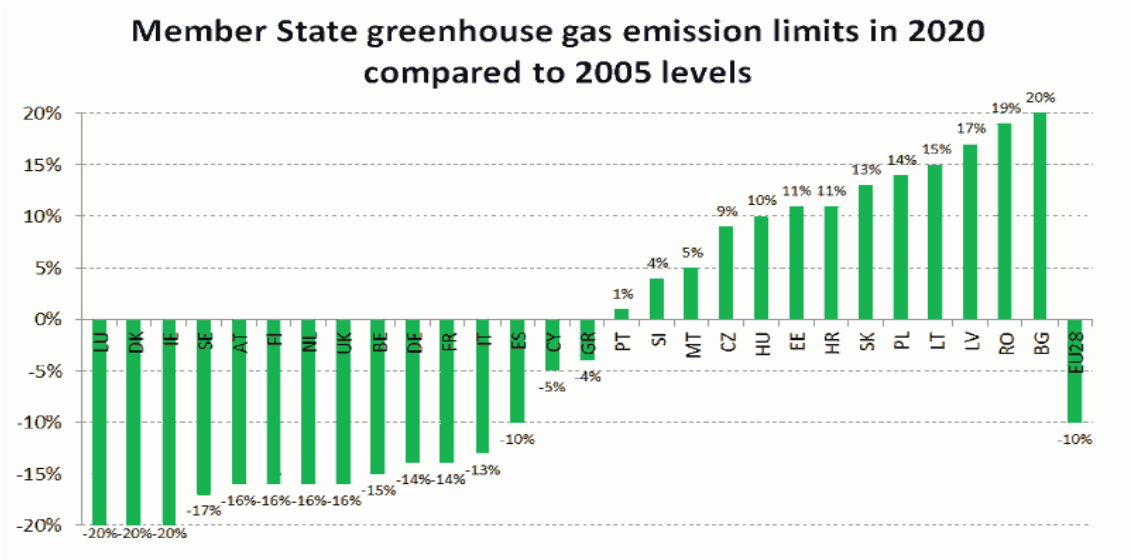
1.2.1. Background

The objective of the Effort Sharing Decision (ESD) is to reduce GHG emissions in the EU by 10% by 2020 compared to 2005 by setting national targets and to promote reductions of GHG emissions within its scope in a fair and cost-effective manner.

The current ESD entered into force in June 2009. It covers all GHG emissions excluding those from sectors covered in the ETS and excluding emissions and removals from LULUCF[9]. The ESD covers mainly emissions in the transport, buildings, agriculture, small industry and waste sectors. These sectors accounted for more than 55% of total EU GHG emissions in 2013. The ESD does not set specific emission targets for these individual sectors covered by the ESD, but leaves it to Member States to choose where and how to achieve the necessary reductions.

National targets for 2020 are set for Member States according to economic capacity on the basis of their relative wealth (measured by 2005 Gross Domestic Product per capita). They range from a 20% emissions reduction by 2020 (from 2005 levels) for the richest Member States to a 20% increase for the least wealthy one (See Figure 1).

Figure 1: Member State greenhouse gas emission limits in 2020 under the ESD



Source: Decision 406/2009/EC

The ESD not only sets 2020 targets, but also defines a linear trajectory of corresponding binding emission limits (annual emission allocations, AEAs) for each year from 2013 to

[9] The current ESD covers the same greenhouse gases as the Kyoto Protocol, with the exception of nitrogen trifluoride NF3. GHG emissions from international shipping are not covered by the ESD, nor by the ETS.

2020. Progress towards the 2020 targets is ensured through annual reporting obligations and compliance checks.

Member States are responsible for implementing policies and measures to meet their obligations under the ESD and are supported by a number of EU measures[10], some of which also are expected to help achieving the EU's 2020 renewable energy and energy efficiency targets. These supporting EU policies are important to stimulate emission reductions in the sectors under the ESD, but also here there are often important elements of subsidiarity when implementing these policies, for instance in sectors such as transport, buildings and agriculture.

In order to provide for flexibility for Member States in implementing their commitments and as a means to enhance the overall cost-effectiveness of reaching the EU-wide 2020 target, the ESD provides a range of flexibility instruments. These concern Member States' possibilities to manage their own AEAs within the compliance period ("inter-temporal" flexibility) and engage in transfers of AEAs among each other ("inter-Member State" flexibility). Should a Member State's GHG emissions exceed its AEAs for a given year, then it can borrow 5% of its AEAs from the next year or buy AEAs from other Member States or use international project credits in order to meet its annual limits. Should a Member State reduce its emissions by more than needed, thus overachieving its target for a given year, it can keep the surplus AEAs for later use within the commitment period or transfer it to other Member States. For more details of the existing flexibility instruments, see annex 8.10.

The ESD has an annual reporting and compliance cycle consisting of Member States reporting their GHG emissions, emissions inventory reviews to validate the emissions and compliance checks (i.e., comparing the actual emission of Member States with their annual emission allocations for a given year). If a Member State's emissions exceed its annual emission allocation, even after accounting for flexibility instruments, they will be subject to certain penalties and have to take corrective measures.

1.2.2. Progress made and lessons learnt

The ESD is still in an early stage: the compliance check for the first two years of the compliance period (2013-2014) is due in 2016. However, thanks to the existing annual reporting of emissions it is possible to discern the main emission trends in Member States and on EU level.

Emission reductions have so far been much deeper than expected in 2007 when the European Council agreed on the overall EU climate targets for 2020 and the Commission performed the impact assessment of the Climate and Energy Package. According to the business as usual scenario in that assessment, EU-wide ESD emissions were expected to increase by 2.4% between 2005 and 2020. Even for 2020 it was not projected that ESD emissions would be at the level of the -10% target given that the use of international credits was permitted in the period 2013-2020.

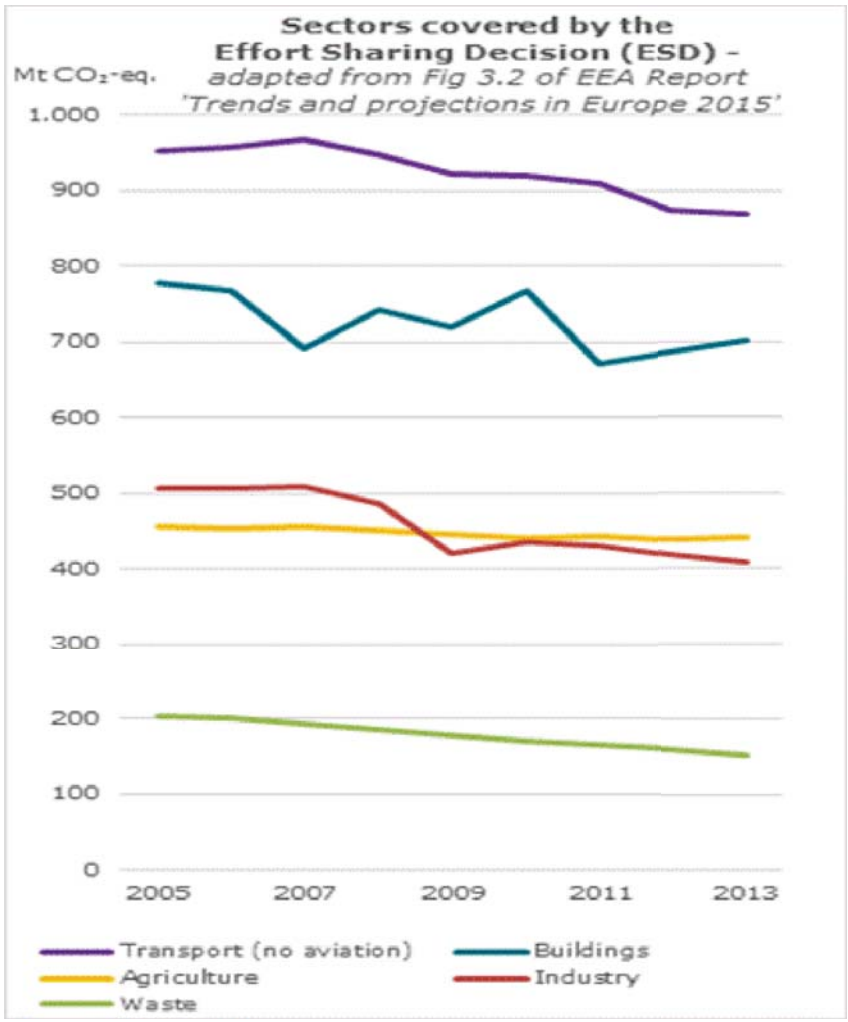
[10] Examples of relevant EU legislation are the regulation of CO_2 emissions from passenger cars and vans, the Landfill Directive, the Energy Performance of Buildings Directive, the Energy Efficiency Directive, the Renewable Energy Directive, the F-gas Regulation and Mobile Air-Conditioning Systems Directive, the eco-design framework, the Nitrates Directive, and the greening of the Common Agricultural Policy.

Instead, total 2013 emissions covered by the ESD at EU level were 9.7% lower than the 2005 emissions, basically reaching the EU target for 2020. In 2014 EU emissions covered by the ESD further decreased to a level 12.9% below 2005 levels, already overachieving the target[11].

Preliminary estimates indicate that all Member States appear to be meeting their annual emission limits for the years 2013 and 2014. This means that the EU is on track to meet its ESD target in 2020 and that all Member States have contributed to the reduction in GHG emissions. The achieved emission reduction represents a large improvement in performance relative to the business-as-usual scenario when the 2020 targets were first agreed.

Emission reductions between 2005 and 2013 were achieved in all sectors, ranging from -3 % in agriculture to -25 % in the waste sector. See also Figure 2 below. In this period there was also a convergence of GHG emission intensities across Member States, both per capita and per GDP.

Figure 2: Achieved EU-wide ESD emission reductions 2005-2013



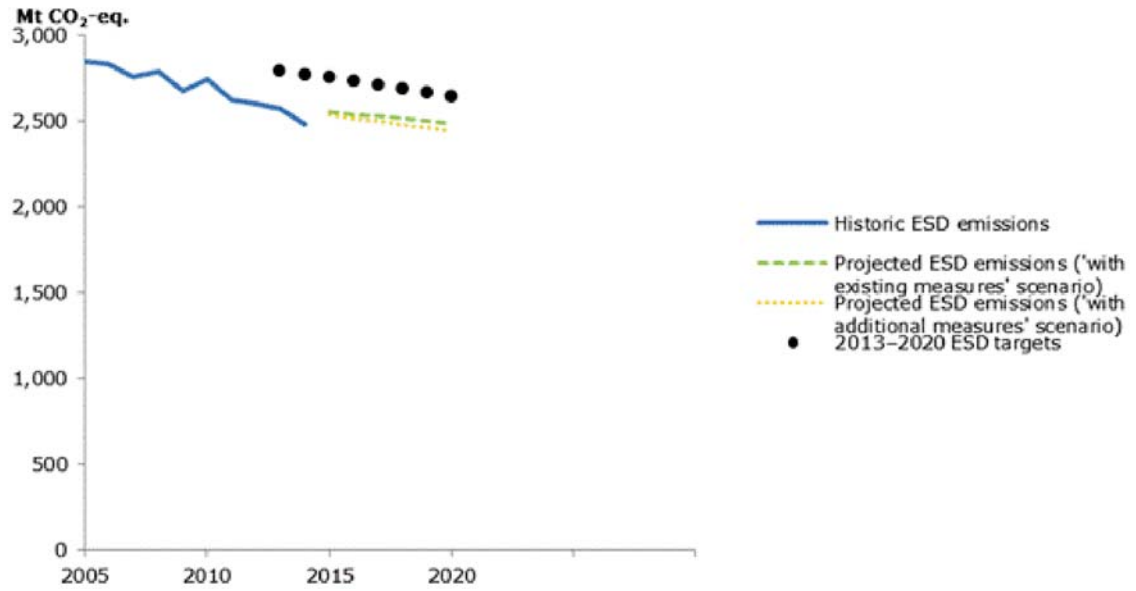
Source: EEA

[11] 2014 inventory figures are pending review and thus preliminary. Reviewed emission figures for the years 2013 and 2014 will be available by September 2016.

Emissions per Member State in sectors under the ESD have also decreased significantly since 2005 (see Figure 3). As shown in Figure 39 presented in annex 8.11 in practically all Member States estimated ESD emissions were below their annual limit in 2014. Overachievements were typically larger in those countries that were allowed to increase emissions compared to 2005. Countries that experienced a particularly severe economic recession (e.g., Greece, Portugal and Spain) also had emissions significantly below their 2014 limits.

According to Member State projections submitted in 2015, ESD emissions are expected to keep decreasing until 2020 (Figure 3), continuously being below target at the EU level. 24 Member States are projected to meet their national targets domestically, while four Member States are expected to need additional measures or use flexibility instruments within the ESD to reach their targets[12].

Figure 3: Actual and projected total ESD emissions 2005-2020



Source: EEA (2015) Trends and projections in Europe 2015, updated with March 2016 emission inventory figures.

Article 14 of the ESD requires the European Commission to evaluate the implementation of the ESD by 31 October 2016. The evaluation was undertaken in 2015 to allow for the results to be reflected in this impact assessment[13].

The ESD is still in the early stages of implementation. Nevertheless, it seems clear from the evidence gathered so far that ESD targets have been effective in stimulating new national policies and measures promoting effective reductions of GHG emissions within the ESD scope. Most emission reductions have come from technological changes and policies which have resulted in increased uptake of less carbon-intensive technologies. Overall the achievement of the targets has thus clearly happened faster than expected when developing the 2020 climate and energy framework in 2007 and 2008.

[12] Climate action progress report, COM(2015) 576 final.

[13] Report from the Commission to the European Parliament and the Council on evaluating the implementation of Decision No. 406/2009/EC pursuant to its Article 14, COM(2016) 483 and Evaluation of the implementation of Decision 406/2009/EC - 'the Effort Sharing Decision', Commission SWD(2016) 251

Effects on the ESD GHG emissions have been reinforced by the fact that the ESD was launched together with a number of other EU climate and energy policies as part of the 2020 package, in particular on energy efficiency and renewable energy. For several of the ESD sectors, including buildings, transport, agriculture and waste, a significant part of the emissions reductions to date can be attributed to factors that are influenced by policy interventions related to the 2020 package. Overall it seems clear that policies implemented in the field of climate and energy have contributed significantly to the take-up of clean technologies.

A decomposition analysis[14] carried out for the 2005-2012 period covered CO_2 emissions from fossil fuel combustion, which account for about 80 % of total GHG emissions, in both ETS and ESD sectors. The results provide insights why CO_2 emissions decreased overall by 11.5 % between 2005 and 2012.

Technological changes had the most significant effect on driving down emissions, leading to an 18.5 % decrease and by far outweighing the contribution of the shift between economic sectors. The policies implemented in the field of climate and energy contributed significantly to the take-up of less carbon-intensive technologies, including renewable energy. Growth in economic activity (GDP) caused a 6.8 % increase in emissions. Structural changes in the economy caused a small increase in emissions, by 1.7 %. In other words the shift between economic sectors (at constant GDP and CO_2 intensity in every economic sector) only had a relatively small effect on emissions[15]. The analysis concluded that technological changes contributed most to drive down emissions, by far outweighing the contribution of the shift within and between economic sectors, and by far overcompensating GDP related emission drivers in times of economic crisis.

Based on the evaluation and comments from stakeholders in Member States, a number of lessons can be learned from the implementation of the ESD so far.

The ESD was recognised by Member State stakeholders as having an important role in supporting wider policy developments, for example improving coordination on GHG mitigation across the ESD sectors and between national and regional or local governments. Stakeholders highlighted that another important outcome of the ESD to date has been the improvement in the quality of the emissions data and projections relating to ESD sectors at a national level, which has helped improving policy preparation. The annual reporting of emissions, combined with biennial requirements for reporting of policies and measures, and projections, keep Member State better informed about the progress not only of GHG emissions but also of climate and energy policies. The reporting obligations also give them and other EU stakeholders a tool to compare their performance with that of other countries in the EU.

The evaluation of the ESD showed an apparent acceleration in the implementation of national policies in the ESD sectors in most years starting from 2007, when the European Council agreed on the overall EU climate targets for 2020. Without the ESD, actions to mitigate emissions in the ESD sectors at Member States level may not have been taken, or may have been taken at a slower pace. Annual emission limits with strict rules on reporting and monitoring thus have contributed to Member States efforts to reduce their emissions in sectors under the ESD, but it is difficult to quantify the effects.

[14] Decomposition analysis of the changes in GHG emissions in the EU and Member States. Final report by ICF International in association with ZEW, Umweltbundesamt GmbH and Eclareon, 22 April 2016
[15] Climate action progress report, COM(2015) 576 final, p. 9

So far, no Member State has used any of the flexibility instruments provided in the ESD as all countries appear to be meeting their annual emission limits for the first two years of the compliance period. In the future it can be expected that flexibility instruments, such as trade with other Member States, will be used by some Member States that are projected to emit above their limits by 2020. Although the flexibility instruments under the ESD are untested they remain widely supported and were further endorsed by Member States in the stakeholder consultation.

The ESD was found to have resulted in limited additional administrative burden on Member State level, although there may be opportunities for reducing administrative costs at EU level, for example by simplified or less frequent compliance controls.

1.3. What is the problem that should be addressed?

The general problem is that with current targets implemented by 2020 and existing policies, GHG emissions in ESD sectors are not expected to sufficiently decrease by 2030 to achieve the EU's domestic contribution to the Paris Agreement (see Figure 4 below). In the EU Reference scenario 2016[16], reflecting current trends and implementation of adopted policies, emissions covered by the ESD are projected to decrease by around 16% in 2020 and 24% in 2030 compared to 2005[17].

Achieving such reduction levels in practice will be facilitated by ongoing trends e.g. towards the circular economy and towards sustainable mobility.

In view of reported emissions for 2013, with already a reduction of -13% in the ESD compared to 2005, projecting a 16% reduction by 2020 seems well in line with observed trends.

See box below on main assumptions underlying the 2030 projection results.

Box 1: What drives the 2030 emission results of the EU Reference scenario 2016?

The EU Reference scenario 2016 projects EU and Member States energy, transport and GHG emission-related developments up to 2050, given current global and EU market trends and adopted EU and Member States' energy, transport, climate and related relevant policies. It has been developed building on an economic modelling framework including as core models PRIMES, GAINS and GLOBIOM-G4M and as supporting models GEM-E3, PROMETHEUS and CAPRI.

Member States were consulted for its development through a specific Reference scenario expert group. The projections are based on a set of assumptions, including on population growth, macroeconomic and oil price developments, technology improvements and policies.

[16] European Commission: EU Reference Scenario 2016 - Energy, Transport and GHG Emissions - Trends to 2050. Directorate-General for Energy, Directorate-General for Climate Action and Directorate-General for Mobility and Transport, July 2016. See also annex 8.4.2 for a summary.

[17] All sectors are projected to contribute under current trends to the continued emission reductions post 2020, with above average contributions of the buildings sector, mainly thanks to the continued impact of energy efficiency improvements, and of the waste sector.

The population projections draw on the European Population Projections (EUROPOP 2013) by Eurostat. The EU28 population is expected to grow by 0.2% per year during 2010-2030, a similar trend as assumed for the Reference scenario 2013.

GDP projections mirror the joint work of DG ECFIN and the Economic Policy Committee, presented in the 2015 Ageing Report. The average EU GDP growth rate is projected to remain relatively low at 1.2% per year for 2010-2020. In the medium to long term, higher expected growth rates (1.4% per year for 2020-2030) are taking account of the growth potential of countries with relatively low GDP per capita. EU28 2030 GDP levels are around 5% lower than assumed for Reference scenario 2013, taking into account the economic developments in recent years.

For oil prices it starts with the current low price levels and considers a gradual adjustment process. The oil price is projected to reach 87 $/barrel in 2020 (in year 2013-prices). Beyond 2020, as a result of persistent demand growth in non-OECD countries the oil price would rise to 113 $/barrel by 2030, around 10% lower than in the Reference scenario 2013.

Technology assumptions are based on extensive literature review and have been reviewed by the Joint Research Centre, with notably changes related to the power sector and battery cost developments compared to assumptions taken for Reference scenario 2013.

"Adopted policies" refer to those that have been cast in legislation in the EU or in Member States (with a general cut-off date end of 2014). Therefore the binding 2020 targets are assumed to be reached in the projection. This concerns EU GHG emission reduction targets (both for the EU ETS as well as ESD sectors) as well as Renewable Energy targets, including in transport. The Reference scenario 2016 shows the continued impact also post 2020 of the full implementation of policies such as the Energy Efficiency Directive, the Energy Performance of Buildings Directive, CO2 and cars, the Landfill Directive and the recent F-gas regulation, that also impact the stock of buildings and cars and the emissions of methane and fluorinated gases post 2020.

Compared with the Reference scenario 2013, while most policy assumptions are similar, the newly adopted F-gas regulation is expected to shave off in 2030 the equivalent of 2% of the effort sharing sector emissions. Furthermore there is also an impact of the new GHG emission inventory guidelines applied since last year, leading to more historic emissions in the waste sector and subsequent more reductions in the future due to waste policies.

For more details and an overview of results see annex 8.4.2.

Following the 2016 Reference projection, this leaves a gap of 6 percentage points to the 30% reduction in 2030, requiring cumulatively still around 1 billion ton additional reductions in the period 2021-2030. This is a marked improvement compared to the 2013 Reference scenario which projected a -20% reduction in 2030 and would still have required 1.5 billion tonnes additional reductions over the period 2021-2030 (see box above for more information on differences between the two Reference scenarios).

The EU Reference scenario 2016 is the most recent, consistent projection of current trends and existing EU and national policies. Its projected 2030 trends see overall higher reductions than Member States projections. Member States themselves in aggregate see emissions only reduce by 18% in their GHG projections submitted in 2015 that look at

the impact of existing measures[18]. This would result in an aggregate gap in 2030 as large as 12 percentage points. Achieving the target would then require almost 2 billion tonnes of additional reductions over the period 2021-2030.

Box 2: Explaining differences between EU and national GHG projections with existing measures

Differences in outcomes of aggregated Member States projections with the EU Reference scenario concern mainly the post 2020 period, which is by definition more uncertain; 2020 results are of a similar order of magnitude. Main reasons are:

- A moderately more optimistic outlook on GDP growth in some Member States, with aggregated a 6% higher EU GDP in 2030 assumed than in EU Reference 2016, which are based on a coherent methodology across Member States used in the ECFIN Ageing Report.

- Non-inclusion into national with existing measures projections of some policies adopted at EU level but not yet fully implemented at national level. An example is the revised EU F-gas regulation adopted in 2014 which has not been considered yet by some Member States projections.

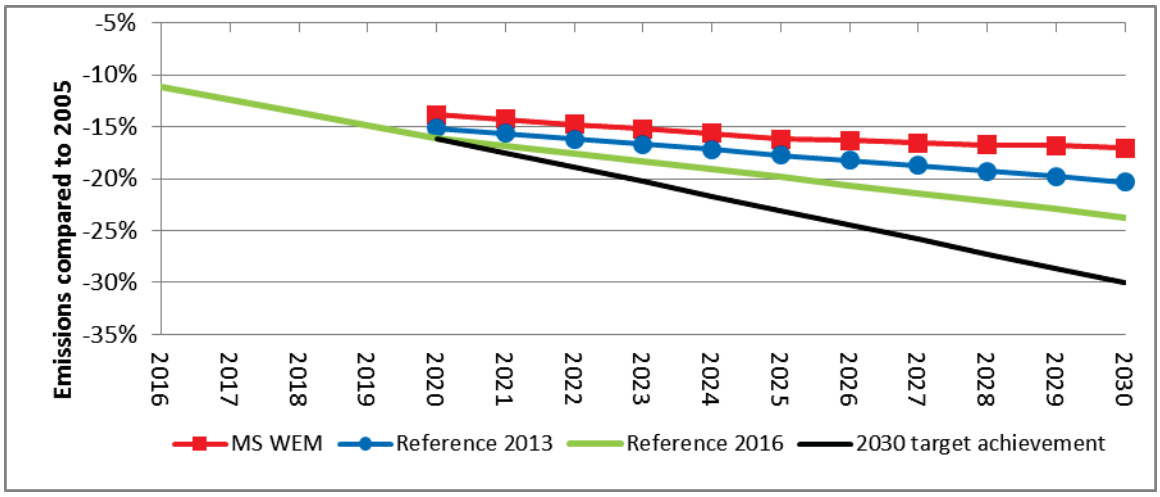
- Modelling limitations with regard to post 2020 stock turnover effects of currently adopted policies which are fully captured in the EU Reference scenario. An example is the revised Energy Performance in Buildings Directive which mainly has emission reduction effects from 2020 onwards due to the near zero emission building standard. Another example is the CO2 and cars regulation which includes a decrease of the fleet average to be achieved by all new cars to 95 g/km by 2021, of which a major effect on transport emissions will occur after 2020 with the continued turnover of the car fleet. For those national WEM projections that focus on the 2020 time frame and project post 2020 emissions through a simplified extrapolation, these post 2020 effects might not be covered.

The expected gap in EU and national projections shows that, while current ESD national targets as well as supporting climate-related EU policies appear effective to reduce emissions up to 2020 and beyond, the policy framework needs to be reinforced to ensure the achievement of the EU's 2030 target[19].

[18] Recent Member States projections with additional measures result in a reduction of 21%. For more information see also European Environmental Agency: Trends and projections in Europe 2015.

[19] An exception is the supporting EU F-gas policy for the post 2020 horizon which is consistent with long term targets; see Regulation (EU) No 517/2014 on fluorinated greenhouse gases.

Figure 4: Emissions projected under current trends and policies and required reductions to achieve the 2030 target



Source: Commission calculations based on PRIMES, GAINS, EEA 2015

The European Council agreed to address the general problem and has requested to continue the approach of the Effort Sharing Decision also after 2020, setting national targets while allowing for a number of flexibilities, but now in line with an overall reduction of 30% in the non-ETS compared to 2005 by 2030.

Therefore the **specific problem** addressed in this impact assessment is how the current methodology of the ESD can be continued in a manner that it (1) addresses fairness concerns, (2) takes into account the need for cost-efficiency and (3) avoids problems with overall environmental integrity.

When setting targets equity remains an important concern. Member States have significant differences in economic strength and investment capacity as well as in emission reduction potentials and costs. As the 2030 framework impact assessment[20] has shown, applying cost-effectiveness as sole criterion for the distribution of efforts would lead to considerable variations in the necessary national economic effort and would imply (on average) relatively higher efforts and costs per unit of GDP for lower income Member States. The current ESD addressed the differences in economic capacity by differentiating national targets according to relative differences in GDP per capita.

However, setting targets based solely on GDP per capita may result in large differences in the costs per ton reduced emissions between Member States if the reductions have to be achieved domestically, and might induce very costly efforts for those higher income Member States with more limited remaining mitigation potentials. For instance according to the 2030 Impact Assessment, five Member States with GDP per capita above the EU average have cost-effective mitigation potentials in effort sharing sectors below 30%, the required average total non-ETS reduction, and thus would see high costs per ton reduced emissions if targets would go well beyond 30% in 2030.

The European Council recognised both the need for fairness and cost efficiency in its conclusion in October 2014.

[20] Commission SWD(2014)15

(1) How to achieve a fair sharing of efforts?

The European Council requested to continue the methodology to set the national reduction targets for the non-ETS based on GDP per capita differentiation, keeping them in a range from 0% to -40% compared to 2005. But it also stated that the targets for Member States with a GDP per capita above the EU average need to be relatively adjusted to reflect cost-effectiveness in a fair and balanced manner. This impact assessment will need to examine how to translate this guidance in concrete 2030 targets for the Effort Sharing Regulation (ESR).

(2) How to ensure at the same time cost efficiency?

In addition, flexibility should allow for overall cost-efficiency in reaching the EU's GHG emission reduction target, while respecting environmental integrity. As in the current Effort Sharing Decision, such flexibilities are particularly important if target setting is to a significant extent based on equity considerations, which remains the case also for the post 2020 period as described above.

This problem was recognised by the European Council, which called for significantly enhancing the availability and use of existing flexibilities within the non-ETS sectors in order to ensure cost-effectiveness of the collective EU effort and convergence of emissions per capita by 2030. This also reflects the fact that the 2030 EU climate target is a domestic target which means that international credits will no longer be a flexibility option for the period after 2020. Thus the perception among Member States is that the existing flexibility provisions would not be sufficient to ensure EU-wide cost-effectiveness of mitigation efforts by 2030 without some kind of enhancement. A key concern for Member States with high emission reduction costs is to get access to additional AEAs from other Member States with lower reduction costs in the period in 2021-2030.

It is therefore important to examine the extent to which existing flexibilities in the ESD allow the achievement of cost-effective abatement across the EU. An important question is to what extent the existing set of rules could be enhanced without limiting Member States' freedom of choice with respect to using the flexibilities.

Another important area for ensuring cost efficiency is related to the potential administrative burden both at the level of the EU and in Member States to implement the Commission proposal. Therefore, it needs to be considered whether the current reporting and compliance system under the ESD should be changed in light of any enhanced flexibility instruments and whether the administrative burden could be further reduced.

Flexibility instruments should be transparent, predictable and easy to operate. A key element would be to improve the transparency regarding Member States' willingness to engage in such transfers and at what price.

Next to enhancing the existing flexibilities, the European Council also suggested to establish a new flexibility in achieving targets for Member States with national reduction targets significantly above both the EU average and their cost effective reduction potential (as well as for Member States that did not have free allocation for industrial installations in 2013), through a limited, one-off, reduction of ETS allowances, to be decided before 2020. It needs to be assessed which higher income Member States thus could be eligible to make use of this reduction of ETS allowances allowing for increased emissions in the sectors covered by the current ESD. The European Council stressed also

the need to preserve predictability and environmental integrity of both the ETS and the non-ETS sectors.

(3) How to maintain overall environmental integrity?

The design of the one-off flexibility and the 2030 target setting are not the only issues where maintaining environmentally integrity is key. Also binding emission limits for the period 2021 to 2030 need to be defined, in line with the approach under the current Effort Sharing Decision expressed as annual emission allocations, AEAs. The method for setting emission limit trajectories must preserve environmental integrity, i.e., it must ensure that the required 2030 emission levels are reached and that timely emission reductions take place over the whole period 2021-2030.

The instrument itself does not per definition deliver this 2030 reduction. If large surpluses of unused AEAs build up early in the period 2021-2030, that are not associated with real additional emission reductions, this could lead to deviations from the target trajectory towards the end of the period and put the domestic achievement of the 2030 target at risk. Achieving the 2030 target is also important in view of enabling Member States to take necessary action in time to meet the EU's climate objectives beyond 2030.

The ESD does not foresee that any overachievements under the current period could be used for meeting national targets during the next commitment period 2021-2030, and neither do the European Council conclusions. Estimates by the EEA based on Member State projections show that the expected surplus in the period 2013-2020 is about 1.5 to 1.7 billion AEAs[21], amounting to much more than the total emission reductions needed over the period 2021-2030 additional to the latest Reference projection. Any transfer between the periods would remove incentives for long-term mitigation action and would seriously undermine environmental integrity notably by putting the achievement of the 2030 domestic target at risk, not requiring any real additional action after 2020. In the same manner, the cumulative impact of additional flexibilities will have to be examined carefully in relation to the total emission reductions required for meeting the 2030 target.

When providing greater flexibility within the period it will also be essential to do it in a way that ensures environmental integrity. The non-availability of international credits is also important for maintaining the environmental integrity of the EU system. Sound emission reporting, monitoring and compliance checks continue to be crucial in this respect.

1.4. LULUCF policies and its integration into the 2030 framework

Emissions and removals from LULUCF are currently accounted towards the Kyoto Protocol obligations of Member States applying the so-called "no debit rule". This means that internationally, the EU and each of its Member States need to ensure that GHG emissions in this sector do not result in debits, and hence additional emissions. Any increase in emissions would need to be compensated by emission reductions in other sectors[22]. International Kyoto Protocol rules for Land Use, Land Use Change and

[21] For more information see also European Environmental Agency: Trends and projections in Europe 2015. This estimate does not even include the potential impact of the use of international credits in the period 2013-2020.

[22] Essentially, an ESD unit can be converted back to an assigned amount unit which then may be used for compliance under the Kyoto Protocol. See Council Decision 2015/1339 of 13 July 2015 on the conclusion, on behalf of the European Union, of the Doha Amendment to the Kyoto Protocol to the United Nations

Forestry (LULUCF) adopted in Durban have been incorporated into EU legislation by Decision 529/2013/EU ("LULUCF Decision"), and focus on setting minimum requirements for monitoring and reporting and accounting, including for cropland and grazing land management. The Kyoto Protocol regime, however, will not continue beyond 2020.

Within current EU internal legislation, however, emission reductions in the LULUCF sector cannot be used to compensate for increased emissions in other sectors; emissions from LULUCF are not part of the current ESD. Striving for using cost-effective mitigation potentials also justifies considerations in this direction, i.e. to allow Member States to overachieve their target in the LULUCF sector and to use it to a certain extent to comply with their national emission limits for the sectors covered under the current ESD, so long as overall environmental integrity of the compliance framework and additionality of LULUCF actions can be ensured.

The European Council encouraged the European Commission to put forward a policy proposal to include LULUCF into the EU's 2030 climate and energy framework. The European Council explicitly mentioned and linked this to "the lower mitigation potential" of the agriculture sector and requested to examine how to "optimise the sector's contribution to greenhouse gas mitigation and sequestration, including through afforestation." As a consequence, additional impacts to consider emerge from the possible implications of the integration of Agriculture and LULUCF into the 2030 non-ETS framework, including related cross-sectoral cost-efficiency considerations, notably between agriculture and land use. The question of this integration is analysed in a separate impact assessment (referred to as Impact Assessment for agriculture and LULUCF). Implications for the ESR arise once explicit policy links between both sectors are considered.

1.5. Who will be affected and how?

The proposal is addressed at Member States as institutional actors. The proposed policy is to be implemented at national level and thus mostly affects their national administrations. Depending on the nature and scope of national measures implemented by Member States they will affect various stakeholders in the sectors concerned, including consumers.

For an overview of stakeholder positions, see annex 8.2 with a summary of the results of the stakeholder consultation.

Practical and economic consequences for businesses might arise from the implementation of such national policies but not as a direct effect or obligation of this initiative itself. Any effects on enterprises will depend on the specific measures chosen on national level. With respect to businesses in general and SMEs in particular there are no direct reporting obligations for SMEs or other enterprises under the current ESD and the proposal would not change this situation (see also annex 8.3).

Framework Convention on Climate Change and the joint fulfilment of commitments thereunder; Commission Delegated Regulation 2015/1844 of 13 July 2015 amending Regulation (EU) No 389/2013 as regards the technical implementation of the Kyoto Protocol after 2012.

2. WHY SHOULD THE EU ACT?

Climate change is a trans-boundary problem which cannot be solved by national or local action alone. Coordination of climate action both at global and European level is therefore necessary and EU action is justified on grounds of subsidiarity. Since 1992 the EU has worked together to develop joint solutions and drive forward a global agreement to fight climate change. Articles 191 to 193 of the TFEU confirm and further specify EU competencies in the area of climate change.

Ahead of the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), parties to the UNFCCC presented their intended nationally determined contributions (INDCs) to the Paris Agreement of December 2015. The EU and its Member States communicated their INDC on 6 March 2015, which provides for the commitment to a target of at least -40% domestic GHG reductions below 1990 levels. The Paris Agreement of December 2015 foresees that Parties, including regional economic integration organizations and their member States, may 'act jointly' (Article 4, paragraphs 16 to 18). As under the Kyoto Protocol, the EU and its Member States intend to participate in the Paris Agreement by acting jointly. The current 2020 GHG targets and existing Member State policies would not lead to the necessary 2030 emission reductions. Few Member States have set post 2020 GHG emission targets and no Member State has specified a 2030 target for sectors under the current ESD. Also equity issues cannot be sufficiently addressed if Member States act alone. However, the role of Member State action will remain crucial and the responsibility for continued progress up to 2030 will have to be shared, as is already the case in current climate and energy package, which lays down EU and Member State obligations until 2020. The initiative sets binding national targets, but leaves it to Member States to decide how to achieve them, fully respecting the principle of subsidiarity.

Co-ordinated EU action is therefore needed to achieve the EU-wide 30% non-ETS GHG reductions for 2030 endorsed by the European Council, in particular to ensure a cost-effective and fair distribution of efforts across the EU and its Member States. Also Norway and Iceland have committed to the same GHG ambition levels as the EU and signalled in their INDCs the intention to join the EU's effort sharing.

3. WHAT SHOULD BE ACHIEVED?

3.1. General objective

The general objective is to contribute to achieving the Paris Agreement climate goal of holding the increase in the global average temperature increase to well below 2 degrees Celsius above pre-industrial levels in order to reduce significantly the risks and impacts of climate change. In line with scientific findings reported by the International Panel on Climate Change, the EU's long term climate objective is to reduce GHG emissions by 80-95% in 2050 compared to 1990, in the context of necessary reductions by developed countries as a group[23]. The Commission has proposed that the EU prepares for a domestic reduction of 80% by 2050[24]. A GHG target of at least 40% domestic reductions in 2030 compared to 1990 as agreed by the European Council ensures that the EU is on the cost-

[23] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/119175.pdf
[24] COM(2011) 112 final

effective path of a corresponding transition to a sustainable and competitive low carbon economy.

3.2. Specific objective

The specific policy objective is to achieve a 30% reduction in GHG emissions in the non-ETS sectors compared to 2005 in way that is

- fair, taking into account different economic capacities of Member States,
- cost-efficient, taking into account differences in cost-effective mitigation potentials between Member States, providing predictability and certainty for Member States and investors and increasing flexibilities to ensure cost efficiency,
- and that ensures environmental integrity by promoting timely and sufficient action to ensure that the EU 2030 GHG reduction target is achieved.

3.3. Operational objective

The operational objective is to design appropriate means to achieve an overall fair, cost-effective and environmentally sound outcome by appropriately:

- Defining national emission reduction targets for Member States for 2030;
- defining corresponding target trajectories for the period 2021-30;
- defining the modalities of a limited one-off flexibility between ETS and non-ETS;
- integrating LULUCF in the 2030 framework contributing to the 30% non-ETS target;
- enhancing the availability and use of existing domestic flexibility instruments within the ESR;
- ensuring appropriate compliance mechanisms.

An appropriate combination of these elements allows that the three specific objectives can be achieved and potential tensions between them can be mitigated.

3.4. Consistency with other policies and the Charter for fundamental rights

A legal proposal for continuing an EU effort sharing mechanism until 2030 in order to ensure achieving the binding EU climate target is an integral part of the 2030 Climate and Energy Framework as well as the Commission framework strategy for a resilient Energy Union with a forward looking climate change policy. In particular, it contributes to delivering the Energy Union's fourth dimension to decarbonise the economy. As outlined in the 2030 framework impact assessment, the policy aim has been to set climate and energy targets up to 2030, which are consistent and mutually reinforcing.

Therefore it is important to ensure that the methodology to assess the policy proposal implementing the non-ETS targets and related flexibilities looks at interactions with other EU-wide targets and policies on renewables and energy efficiency under development.

Therefore this impact assessment complements the analysis conducted in the 2014 impact assessments supporting the 2030 climate and energy framework[25] based on a set of consistent new scenarios, building upon the 2016 Reference. These new scenarios have been jointly developed in preparation of this initiative as well as other closely related initiatives in 2016 within the Energy Union Package[26], such as the energy efficiency package, which has a strong focus on energy efficiency in buildings, the renewable energy package, as well as the initiative on decarbonisation of the transport sector.

The new policy scenarios used in all these impact assessments reflect the 2030 targets agreed by the European Council (at least -40% GHG reduction target, at least a 27% share of renewables, at least 27% with a view to 30% energy efficiency improvements, for a detailed description of the scenarios used, see sections 8.4.2 and 8.4.3).

The scenarios reflect current EU policy design when modelling the achievement of different sets of GHG, EE and RES targets. In doing so they provide for a coherent analysis of the energy efficiency targets, including potential energy efficiency policies, and their impact on non-ETS targets at Member State level and the potential need and availability of related flexibilities in the ESR, and thus corresponding impact on fairness.

The assessment of the merits of different efficiency targets and policies will take place in their respective impacts assessments. But by using these scenarios in both impact assessments, it allows to assess to what extent different levels of energy efficiency ambition would impact the achievement of the non-ETS target and the distributional impacts between Member States, which is of importance for this impact assessment.

The proposal respects the fundamental rights and observes the principles recognised in the Charter of Fundamental Rights of the European Union. In particular, it contributes to the objective of a high level of environmental protection in accordance with the principle of sustainable development as laid down in Article 37[27].

4. WHAT ARE THE VARIOUS OPTIONS TO ACHIEVE THE OBJECTIVES?

The "no additional policy" baseline scenario is represented by the Reference Projection. With no additional policies put in place beyond 2020, the EU is not projected to achieve its -30% GHG reduction target in the non-ETS sectors.

The Commission 2014 proposal for the 2030 framework for climate and energy policies was to achieve exactly this -30% reduction level in the non-ETS sectors and suggested to share this equitably among the Member States in the form of setting binding national targets. Subsequently the European Council adopted this ambition level and requested explicitly to continue until 2030 with *'the methodology to set the national reduction targets for the non-ETS sectors, with all the elements as applied in the Effort Sharing Decision for 2020*'.

As such from a policy perspective this impact assessment is not about assessing the need or not to go to -30% GHG reductions in the non-ETS, but about what the options regarding the targets set per Member State are and the flexibilities available to achieve this, assuming a continuation of the current ESD.

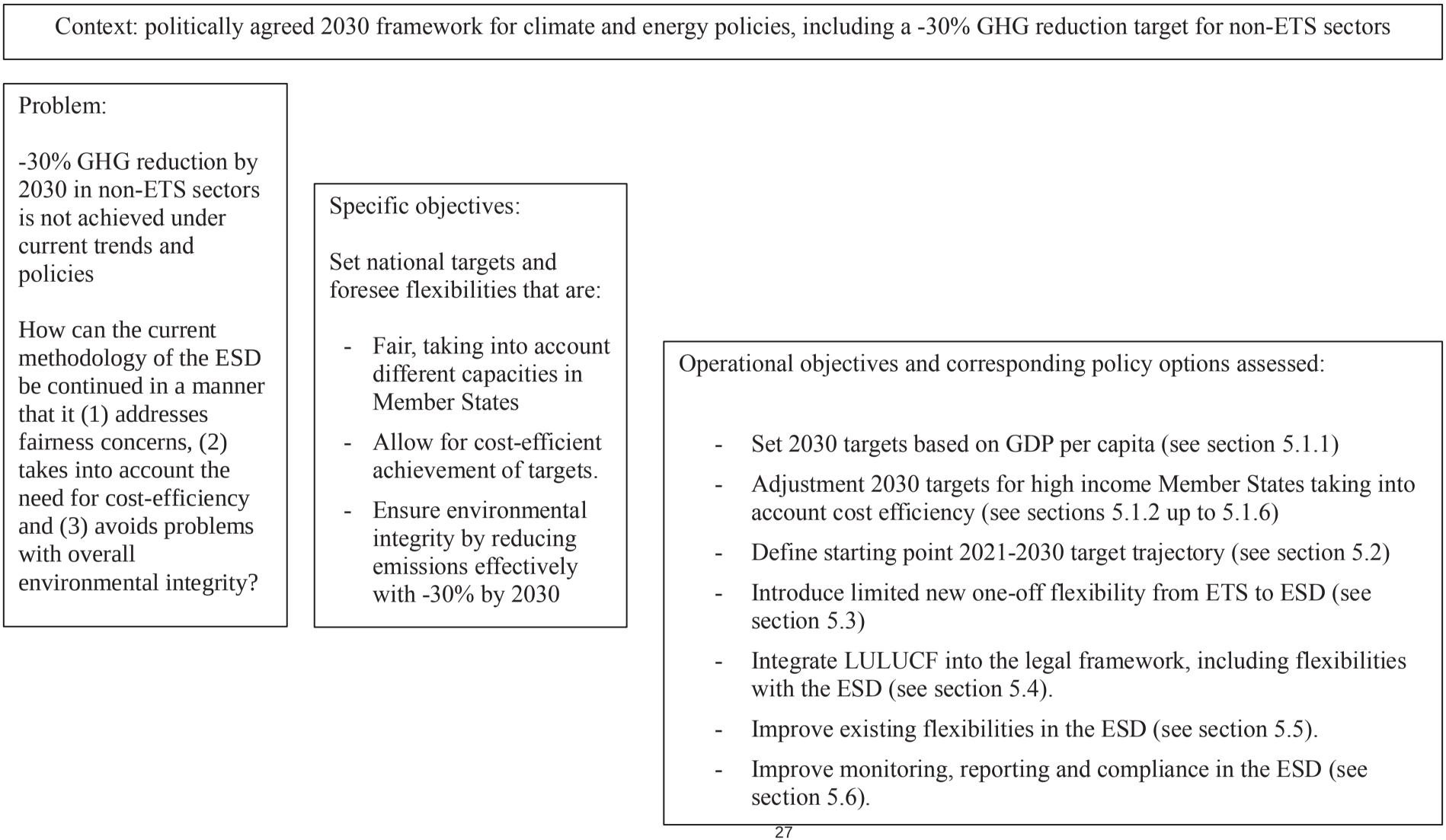
[25] SWD(2014)15, SWD(2014) 255 final
[26] COM(2015) 610 final, ANNEX 1
[27] OJ C 326, 26.10.2012

Therefore the policy baseline is one that sees continuation of the ESD with all its features, but translated to the period 2021-2030, and assuming a target in 2030 equal to -30% compared to 2005.

The policy options assessed build strongly on the guidance given by the European Council, foremost related to the setting of the 2030 target, the introduction of a new and limited one-off flexibility from the ETS into the ESR, the integration of LULUCF into the EU legal framework and any related flexibilities between the LULUCF sector and the ESR and the improvement of existing flexibilities.

See also Figure 5 for an overview on the problem that is being addressed, the objectives of the intervention and the policy options assessed.

Figure 5: Intervention logic Impact Assessment



4.1. Policy options for setting national 2030 targets

- Policy baseline option T1: Target setting for all Member States based on GDP per capita

  The baseline option is to apply the principles of the current ESD for setting the 2030 target which is to base them on GDP per capita data, but overall with an increased effort of around 20% for all compared to the 2020 targets, leading to Member States targets within a range of 0 to -40% compared to 2005, instead of the range of +20% to -20% currently for the 2020 targets.

  As the European Council in its conclusion in October 2014 recognised, continuing the current methodology would take into account considerations of fairness and solidarity. They also suggested using for this 2013 GDP per capita data, the latest year for which data was available at the time of the European Council made its conclusions.

- Policy options T2-T4: Target adjustments in the group of high income Member States

  However, in some high income Member States reduction potentials differ strongly from targets based on GDP per capita thus potentially resulting in very costly efforts for these Member States if targets would be achieved domestically. Within the group of high income Member States there are also clear differences, with some having more outspoken challenges than others. The European Council recognised this and asked to look at adjustments regarding the target to take this into account.

  These policy options thus look into adjusting targets within the group of Member States with a GDP per capita above the EU average to reflect cost-efficiency in a fair and balanced manner within this group. Adjustments within the group of high income Member States need to be balanced against each other so that the EU wide -30% reduction target is maintained.

  Based on assessing which high income Member States have a greater concern related to cost efficiency compared to others with targets set purely on the basis of GDP per capita, a group based approach to target adjustments is proposed. High income Member States are ranked in groups in a manner that is robust over a set of scenarios and avoids hence to base target setting on specific modelling results. Second the impact of any adjustments in targets between these groups needs to be assessed. Two options are assessed, one with only small adjustments (T2), and one with large adjustments within this group (T3). This is done in section 5.1.5.

  In addition, section 5.1.6 assesses an option T4 where 2030 targets for high income Member States are based for 50% on the target using GDP per capita and 50% on a target based on a cost-effective emission reduction projection. This option was suggested by Belgium and supported by five of eight high income Member States that participated in the public consultation.

4.2. Policy options for setting the starting point for target trajectories

The European Council concluded that the existing methodology under the ESD for target setting should be continued. This includes defining a linear trajectory to the 2030 target. This will also require setting a starting point that allows calculating an annual target for each year in the period 2021 – 2030.

Under the current ESD, the starting point for the 2013-2020 target trajectory has been defined in 2012 before the compliance period started. It uses the most recent inventory available, which in 2012 meant data up to 2010. It uses the available last 3 inventory years (2008, 2009 and 2010) to smooth out any ad hoc variability, for instance due to exceptional weather patterns. However, the starting points are defined differently depending if a Member State is allowed to increase emissions or not compared to 2005[28].

With the shift to a 2030 target where all Member States see a reduction of emissions (with a range from 0 to -40%), a continuation of this differentiated baseline option loses its purpose and all should receive the same approach to set the starting point of the 2020.

The European Council guidance is less specific on this issue. Section 5.2 assesses the impact of a continuation of the approach similar to the current methodology for Member States which by 2020 need to reduce emissions compared to 2005. For all Member States the target trajectory would be defined in the same way. As starting point the most recent available emissions by 2020 would be used, i.e. 2016-2018 emissions. This level would be applied in 2020 to define a linear trajectory up to the 2030 target. This section will also provide a sensitivity analysis on alternative approaches as requested by a number of stakeholders and Member States.

4.3. Policy options for a one-off flexibility between ETS and non-ETS

- Policy baseline option O1: No flexibility from the ETS towards the ESR

Currently there is no flexibility to use emission reductions under the ETS for compliance in the non-ETS.

But the European Council concluded to establish a new flexibility mechanism for Member States with national emission reduction targets significantly above both the EU average target and their cost effective reduction potential, as well as for Member States that did not have free allocation for industrial installations in 2013[29], to facilitate the achievement of their ESR targets.

These allowances are transferred from the auctioning amounts of the ETS of a Member States and can be used for compliance purposes in the ESR by that Member State. The guidance from the European Council makes it clear that predictability for the carbon market and environmental integrity of both the ETS and the ESR must be preserved in the establishment of such a mechanism. The new flexibility mechanism that is foreseen is a limited, one-off reduction in ETS allowances to be decided before 2020. Also many stakeholders confirmed that the one-off flexibility mechanism should not compromise the functioning of the ETS as well as the environmental integrity of the ESR and the ETS.

[28] For Member States that have a 2020 emission reduction target compared to 2005, the 2013 starting point for the target trajectory is set as equal to the average 2008-2010 emissions. For Member States that have a 2020 target that allows for an emission increase compared to 2005, the 2013 starting point is set as equal to the value for 2013 of a linear trajectory from 2009 to 2020, with the 2009 value being equal to the average emissions 2008-2010 and the 2020 value being equal to the 2020 target.

[29] The only country to which this criterion applies is Malta. The main concern for Malta was that they already have the lowest per capita emissions in the ESD in the EU, less than half of the EU level, with transport emissions being the largest source. This led to concerns about the achievability of the 2030 ESD targets similar to the concerns of some high income Member States related to cost efficiency that also have access to the one-off flexibility.

Taking this into account, certain design parameters for such a mechanism are defined from the outset:

One crucial aspect to ensure predictability for the carbon market is certainty about the volume of allowances concerned. This can be ensured by requiring that the choice to use the mechanism is irreversible and for the volume to be determined at a date that is fixed in advance of the trading period concerned, i.e. before 2021. Therefore, this is assumed to be the case for all options.

Another aspect that can be of importance is clarity about the timing of the transfer of these allowances and when they can be used for compliance in the ESR.

Two design parameters are analysed in detail in section 5.3:

- Eligibility: which Member States can use this one-off mechanism
- Limit of access: maximum amount of ETS allowances which each eligible Member State can transfer to the ESR.

These two choices determine the maximum volume of allowances to be transferred from the ETS to the ESR through the one-off flexibility.

Related to eligibility, the European Council has given clear guidance. Section 5.3 first assesses who has a target that is significantly above EU average target and significantly above the cost effective reduction potential. Subsequently it assesses the impact of two options for a limit of access:

- Policy options O2: For Member States eligible a small amount of allowances is available for the one-off flexibility.
- Policy options O3: For Member States eligible a large amount of allowances is available for the one-off flexibility.

4.4. Options to include a limited LULUCF flexibility into the Effort Sharing

At present, credits generated in the LULUCF sector cannot be used in the ESD for compliance.

The European Council encouraged the European Commission to put forward a policy proposal to include the LULUCF sector into the EU's 2030 climate and energy framework. The European Council explicitly mentioned and expressed concern about the lower mitigation potential of the agriculture and land use sector and the need to optimising this sector's contribution to greenhouse gas mitigation and sequestration, including through afforestation.

The options for and implications of the integration of LULUCF into the 2030 non-ETS framework, and notably how they interact with the agriculture sector, are explored in the parallel impact assessment on addressing GHG emissions in agriculture and LULUCF, in the context of the 2030 climate and energy framework (Impact Assessment on agriculture and LULUCF).

A policy option that came forward from that assessment is to allow a limited extent of LULUCF credits from activities with sound accounting and overall environmental

integrity for compliance in the ESR, corresponding to the lower mitigation potential in the agriculture sector. The aim would be to stimulate real additional action in the land based sector, including agriculture, while respecting these conditions.

The total amount coming into the ESR is to be limited over the period 2021 to 2030. Any distribution in the right to use LULUCF credits in the ESR would have to relate to the fact that the emissions in agriculture are seen as very challenging to reduce.

The higher the share of agricultural non-CO2 emissions in the effort sharing sectors, the more challenging it may be to achieve a certain amount of reductions in the ESR as it is difficult to reduce emissions from agriculture.

To assess this, section 5.4 looks at the impacts of distributing this maximum limit of the use of LULUCF credits looking at the following two options:

- Policy baseline option L1: No use of LULUCF credits for compliance;

- Policy option L2: Use of up to 280 million tons LULUCF credits for compliance.

4.5. Policy options for enhancing existing flexibility instruments

The options presented below reflect possible solutions that were considered in the stakeholder consultation.

- Policy baseline option F1

It should be noted that the existing rules already provide for a high degree of flexibility. The *policy baseline option* for flexibility instruments is to maintain the current provisions in the Effort Sharing Decision without any changes or additional rules. As described in section 1.2, Member States can manage their own AEAs within the compliance period ("inter-temporal flexibility") and engage in transfers of AEAs among each other ("inter-Member State flexibility"). Member States can set up their own transfer mechanisms on a voluntary basis and decide themselves how many AEAs to sell and at what price. A Member State can also fund a project in another Member State in return for AEAs on an agreed basis reflecting the emissions reductions delivered by the project. This can take place bilaterally without any EU-level mechanism to facilitate such agreements. It is also possible for Member States to establish and fund a project mechanism as part of its policy portfolio to achieve additional mitigation to deliver its own targets or to sell it in the form of AEAs to other Member States.

The baseline option and other policy options need to reflect that there are certain limits to flexibility after 2020. There is no use of international credits as the EU has set a domestic target, and there should be no carry-over of any surplus AEAs from the 2013-2020 period to the 2021-2030 period as this would seriously jeopardise environmental integrity, notably the achievement of the 2030 target. It is neither foreseen under existing legislation nor in the European Council conclusions and would also erode the strong incentive to use the existing flexibility instruments in the ESD.

- Policy option F2: Increased permitted borrowing within the commitment period

With respect to *inter-temporal flexibility*, full banking of any surplus within the commitment period is already allowed in the policy baseline option. Therefore the only remaining enhancement option for inter-temporal flexibility is to allow a higher level of

borrowing of AEAs from subsequent years. Alternative options screened for borrowing are (i) an increase in permitted borrowing to a rate of 10% throughout the compliance period 2021-2030 and (ii) an increase in permitted borrowing to 10% from the subsequent year in 2021-2025, reduced to 5% from 2026 onwards. These options are in line with responses received in the stakeholder consultation, where many Member States wanted a higher rate of borrowing within the commitment period. Their argument was that a higher rate would make it easier to manage their emission allocations over the period and ensure compliance with their annual obligations. There are linkages with policy options for administering compliance checks described in section 4.6.

Only the second alternative is retained for further assessment. The first alternative, increasing permitted borrowing to 10% for all years in the compliance period, was discarded. It would provide greater flexibility to Member States, but increases the risk for non-compliance by creating incentives to delay the introduction of new policies. It also creates a greater risk that Member States will not be able to cover any deficit created for future years either from domestic mitigation, or by securing AEAs from other countries.

The following policy options concern enhancement of *inter-Member State flexibility*. They are listed according to the degree of EU-level interference and concern both transfers and project-based alternatives. They are not mutually exclusive.

- Policy option F3: Central information site

Creation of a central site where all offers and requests for AEA transfers would have to be notified by Member States selling or buying AEAs. The information submitted by participating Member States could include the amount of AEAs, the requested price and other conditions requested for the transfers. Similarly, offers and expression of interest as well as information on potential projects in Member States would be notified here.

The site would be open only to Member States and would be used only for sharing this information, not for concluding actual transfers. Member States would be expected to organise their own public tenders for hosting or investing in any emission reduction projects. The site could be hosted by the European Commission or by an organisation contracted by it. The information submitted by participating Member States would include the amount of AEAs, the price and other conditions requested for the transfers.

In addition to the information made available to Member States at the central site, the European Commission would annually publish all offers and requests, including price, volumes and other relevant information, to increase transparency.

- Policy option F4: Central market place for AEA transfers

This option involves establishing a central market place for inter-Member State transfers of AEAs. The market place would enable Member States to offer AEAs for sale and submit requests to purchase allowing for full price transparency. The market place would act as a broker matching sellers with buyers. It could be hosted by a European Institution or contracted to an external organisation. The market place could also be used as a match-making facility for projects. The facility could be voluntary or mandatory for Member States that would want to engage in transfers. In the latter case, bilateral Member State transfers outside the central market place would not be allowed.

- Policy option F5: Mandatory auctioning[30]

This option would constitute a central initial auction at the beginning of the 2021-2030 commitment period based on a limited set-aside (e.g., 1%) of the AEAs in the first year(s) of the period[31]. It could possibly be combined with later auctions held on a regular basis, with Member States required to contribute a share of any surplus AEAs established after compliance checks (i.e., any positive difference between their allocations for each year and their actual emissions in that year) to the auctioning pool.

In the stakeholder consultation the majority of Member States and other stakeholders were open to different solutions with respect to the policy options F2 to F4. There were also different views regarding to what degree the existing flexibilities should be enhanced. For example, although Member States in general support enhancing AEA transfers, most would oppose mandatory trading[32]. Thus, no clear preference emerged from the consultation.

4.6. Policy options for administering compliance

Transparent and regular reporting and compliance checks of Member States are two fundamental elements to ensure progress towards delivering the EU long-term emission reduction commitments.

Firstly, annual emissions reporting is the very basis of monitoring the European Union's internal and international climate mitigation obligations and therefore needs to be maintained as a main provision for the non-ETS sectors. It is widely supported by Member States and other stakeholders. Another fundamental element of the ESD is that it, like the EU ETS, is based on a linear trajectory with annual limits to ensure delivery of the EU's emission reduction targets. It is therefore assumed that annual emissions reporting would be maintained in the ESR also after 2020. Continuing with the present practice, the Commission would, every autumn, report on annual progress as part of the Annual State of the Energy Union report and the European Semester.

Secondly, the current compliance cycle is based on annual compliance checks: an EU-internal GHG emission inventory review is performed by the European Commission and the European Environment Agency, based on which the actual emissions of Member States are compared with their annual emission allocations for a given year[33]. The experience from the first two years of the annual compliance cycle under the current ESD suggests that it is difficult to complete the whole compliance cycle from the submission

[30] Voluntary auctioning is already possible under the current ESD and part of the policy baseline option. For example, a Member State can sell any surplus AEAs to other countries by organising an auction. It is therefore not assessed as an alternative option.

[31] This type of solution was supported by Belgium, Denmark, Luxembourg and Netherlands in the stakeholder consultation.

[32] While four high-income Member States supported mandatory mechanisms such as described in policy option F5 that would ensure supply of AEAs to create a more liquid market, at least four other Member States opposed them.

[33] In the current ESD, the annual inventory review is performed in two steps with a first general check of all Member State inventories, followed by a second step where Member State inventories with significant technical issues undergo a comprehensive review. This approach reduces the workload for the Member States and the Commission as most Member States are not expected to complete the second step. Two times during the compliance period (in 2016 and in 2022 after the inventories for the final year 2020 have been submitted) a comprehensive review is performed where all Member State inventories undergo more extensive checks. In these years the comprehensive review replaces the annual review.

of emission inventories to the final compliance check in the Union Registry within the same year.

In the stakeholder consultation, several Member States expressed a preference for less frequent compliance checks for the sectors under the current ESD after 2020. For these reasons the policy options will consider different ways to make the compliance checks less frequent, while maintaining annual reporting and compliance:

- Policy baseline option C1

  The policy baseline option is to continue the system under the current ESD with annual compliance checks.

- Policy option C2: Biennial compliance checks

  A second option is to check compliance with annual AEA limits every second year, i.e. the first compliance check of reported annual emissions for the years 2021 and 2022 would be performed in 2024.

- Policy option C3: Compliance checks every fifth year

  A third option is to perform compliance checks after every 5 years, i.e. the first compliance check of reported annual emissions for the years 2021, 2022, 2023, 2024 and 2025 would be performed in 2027.

5. WHAT ARE THE IMPACTS OF THE DIFFERENT POLICY OPTIONS AND WHO WILL BE AFFECTED?

The 2014 impact assessment for the 2030 framework for climate and energy has provided a comprehensive assessment of environmental, economic and social impacts of the 2030 targets, including at Member State level[34]. It has also assessed impacts on competitiveness.

The following assessment focuses on the detailed design elements of the Effort Sharing policy proposal and related national binding targets and flexibilities, with as policy baseline the continuation of the ESD for the period 2021-2030 with unchanged principles and main provisions. The assessment of the policy options will in general use this policy baseline to compare the relevant advantages and disadvantages of policy options, as required by the Better Regulation Guidelines. Where relevant, also the baseline without additional policies, as represented in the Reference projection, will be taken into account.

The policy options will be assessed with a view on meeting the specific objectives (see section 3.2), i.e. to ensure EU wide environmental integrity with respect to achieving the at least 40% domestic reduction target in 2030, to achieve fairness between Member States with different economic capacities as the social dimension, and to ensure EU wide cost efficiency as key economic dimension.

The initiative sets targets for Member States and covers mainly the buildings, transport, agriculture and waste sectors. Impacts on competitiveness of industrial manufacturing plants and SMEs are difficult to be quantified and are not expected to be significant.

[34] Commission SWD(2014) 15

Impacts on the agriculture sector are also assessed in the Impact Assessment for agriculture and LULUCF.

A number of modelling scenarios are used to assess the impact of different options as described in section 4:

- The EU 2016 Reference scenario produced with the PRIMES and GAINS models[35] covers recently adopted EU and national policies and overachieves on this basis the 2020 EU level ESD targets, but no additional policies. As such it represents a baseline with no new policies after 2020.

In addition, where relevant reference is made to two other projections which also achieve in 2020 the EU level ESD targets but do not assume additional policies beyond 2020:

- Aggregated national projections "With Existing Measures", here referred to as MS WEM as included in the EEA (2015) Trends and projections Report 2015[36];

- the EU Reference scenario 2013 used for the 2030 framework impact assessment[37].

The assessment of policy options builds foremost on a set of newly developed scenarios based on the recent 2016 Reference scenario. The two central policy scenarios reflect the 2030 targets agreed by the European Council but recognising that for energy efficiency a review will still be undertaken if the target should be set at 30% rather than 27% (referred to as EUCO27 and EUCO30)[38]:

- EUCO27: A scenario that achieves the at least -40% GHG reduction target (with the split ETS/non-ETS reducing by -43%/-30% in 2030 compared to 2005), a 27% share of renewables and 27% energy efficiency improvements.

- EUCO30: A scenario that achieves the at least -40% GHG reduction target (with the split ETS/non-ETS reducing by -43%/-30% in 2030 compared to 2005), a 27% share of renewables and an increase of the energy efficiency target to 30%.

The approach followed for the definition of the scenarios is to use a combination of policy instruments including carbon pricing to reduce emissions in the ETS and non-CO2 emissions in effort sharing sectors, standards, reduction of market barriers, incentives and obligations related to energy efficiency and renewables policies in a coherent manner across Member States, taking into account the current policy framework (as developed in the Reference scenario). These policies are varied in stringency and intensity to meet the

[35] PRIMES covers the energy system and CO2 emissions from energy and processes, while the GAINS model covers the mitigation potentials for non-CO2 GHG emissions, mainly from activities outside the energy system. These models ensure for a comprehensive and coherent modelling framework across sectors, gasses and Member States. When assessing impacts in the form of achieved reductions compared to the 2005 base year, it has to be noted that these models have to assume over time (2005-2030) a consistent sectoral coverage in the ESD and ETS, and thus its 2005 emission estimate are calibrated to include already any change in sectoral coverage in the ESD that occurred afterwards. For more detail on the models used in this IA see annex 8.4.1.

[36] EEA (2015): Trends and projections in Europe 2015 — Tracking progress towards Europe's climate and energy targets. Copenhagen.

[37] European Commission (2013): Energy, Transport and GHG emission trends to 2050 – EU Reference scenario 2013. Brussels.

[38] These scenarios also aim to provide consistency across a number of impact assessments underpinning 2016 Energy Union policy proposals.

GHG, energy efficiency and renewables targets of the scenarios for 2030 but applied equally across the EU Member States. Overall this reflects a cost efficient achievement of GHG reductions in the context of different sets of EE and RES targets and existing policies. While informative about the achieved additional emission reductions in case of coherent cost efficient actions across the EU in all policy areas to achieve all targets, these scenarios outcomes cannot be attributed to the effort sharing mechanism itself, which will sets targets differently from the cost effective outcome to allow for fairness between Member States. These scenarios also achieve the long term milestone to reduce GHG emissions domestically in the EU by 80%. For more detail of incentives and policies simulated, see annex 8.4.3.

In addition a scenario, referred to as WEM-EXTRA, is developed based on Member States' own projections as reported in 2015 under the Monitoring Mechanism Regulation reflecting existing policies ('With Existing Measures', referred to in this assessment as MS-WEM[39]). The MS-WEM projections when aggregated do not achieve the -30% ESR GHG target and thus need to be extrapolated to meet the -30% target using estimates for additional reduction potential from the PRIMES-GAINS model (see also annex 8.4.3). This scenario aims at capturing major differences in projections regarding the impact of the existing policy framework between Member States and the modelling tools used by the Commission.

Finally for further check of the robustness of the differences in impacts, notably regarding the 2030 target on high income Member States, two scenarios as developed for the 2014 Impact Assessments of the 2030 framework are revisited. These scenarios are based on the old 2013 Reference scenario and can serve as robustness with regard to the impact of changes in data and changes in assumptions of existing and new policies[40]. These scenarios can also be informative given that high income Member States have shaped up their expectations about ESR target setting, notably on how to take into account cost efficiency, based on these existing scenarios:

- The GHG40 scenario included in the 2030 framework impact assessment[41] projecting the ETS/ESR split of -43%/-30% in 2030 compared to 2005 achieving only the -40% GHG target (compared to 1990), but only achieving 25% energy efficiency .

- The EE30 scenario included in the impact assessment supporting the Energy Efficiency communication[42] respecting the agreed ETS/ESR split and achieving 30% energy efficiency improvements, resulting in energy efficiency being the primary tool to reduce emissions beyond the Reference to achieve the ESR target.

5.1. Assessing policy options for setting national 2030 targets

5.1.1. Calculating Effort Sharing Targets based on fairness (policy baseline option)

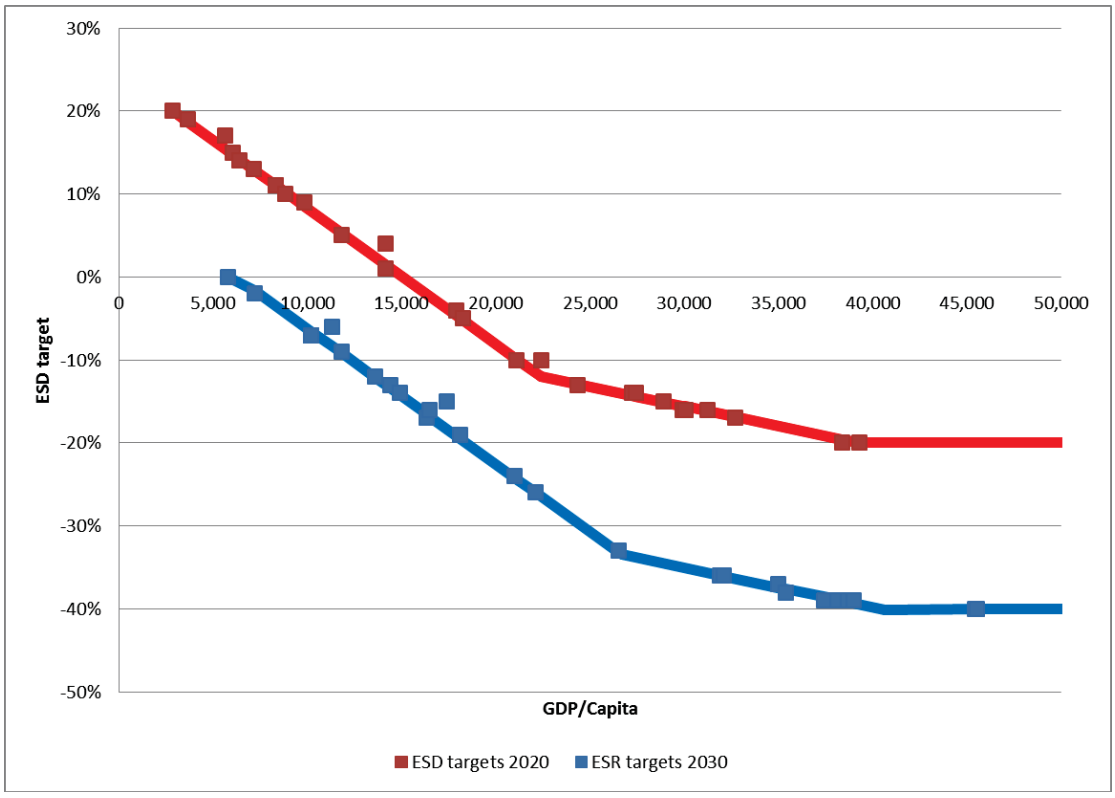
The Effort Sharing Decision targets for 2020 were based on differentiation of efforts depending on relative GDP per capita for 2005 with GDP measured at market prices, as

[39] With Existing Measures projections ("WEM") as reported in EEA (2015) Trends and projections in Europe 2015.
[40] These scenarios are built on the old EU Reference scenario 2013.
[41] SWD(2014)15
[42] SWD(2014) 255 final

shown in Figure 6. Member States with a GDP/Capita above and below the EU average GDP/Capita were allocated a corresponding target ranging from +20% to -20%. The slope of the function is steeper for Member States with a GDP/Capita below the EU average, leading to a faster decrease in ambition for lower income levels. The slope for higher income Member States is less steep and thus leads to less rapid increases in ambition for the highest income Member States, in part already limiting economic impacts and recognising different capacities for all these countries. The 2020 targets for Greece, Latvia and Slovenia were adjusted for specific Member State concerns. The results meet the overall ambition within the ESD sectors of close to -10% GHG reduction by 2020 compared to 2005[43].

The starting point for calculating the 2030 targets is to apply all elements of the 2020 methodology with the same differentiation in efforts depending on relative differences in GDP per capita. The lower and upper limits will have to be reduced by 20%, to 0% and -40% as the average target changes from close to -10% to -30%. Furthermore, data for GDP per capita needs to be updated from 2005 to 2013 data as well as emission inventory data. The figure below shows the 2020 ESD targets and resulting 2030 targets if the 2020 ESD methodology based on GDP per capita is applied but updated: i.e. the graph shifts lower due to increased ambition and to the right as a result of an increase in EU average GDP/Capita.

Figure 6: National effort sharing targets for 2020 and 2030 resulting from the current methodology in relation to GDP per capita



Source: Commission calculations based on Eurostat and reported GHG emissions

[43] The ESD targets in 2020 were originally set at a level that meets overall -10% compared to 2005, but when applied on actual GHG inventory data, which is recalculated every year for the whole time series (incl. 2005) due to improvements in inventory methodologies, the resulting EU wide reduction effort oscillates between 9 and 10%.

Table 1 shows the 2030 rounded non-ETS target resulting from applying the methodology. Some Member States are affected by the limitation on the range of targets between 0 and -40%. This is shown in the brackets in the right column. If there would be no limitation, DK, SE and LU would receive targets going beyond 40%, with notably LU a target as high as -61%.

Table 1: Targets for the non-ETS sectors based on GDP/Capita alone

	2030 Target ***(Target if there would be no target range of 0 to -40%)***
LU	-40% *(-61%)*
DK	-40% *(-42%)*
SE	-40% *(-42%)*
IE	-39%
NL	-39%
AT	-39%
FI	-39%
BE	-38%
DE	-37%
FR	-36%
UK	-36%
IT	-33%
ES	-26%
CY	-24%
MT	-19%
PT	-17%
EL	-16%
SI	-15%
CZ	-14%
EE	-13%
SK	-12%
LT	-9%
PL	-7%
HR	-7%
HU	-7%
LV	-6%
RO	-2%
BG	0% *(+1%)*

Source: Commission calculations, data GDP per capita: Eurostat, Gross Domestic Product at market prices, nama_10_pc, as of 19 April 2016, see also annex 8.5 for overview GDP per capita data

As the 2030 framework impact assessment[44] already showed, applying cost-effectiveness as the principle for target setting would lead to higher costs per GDP for lower income Member States. Overall the distribution based on GDP per capita improves fairness towards lower income Member States.

[44] Commission SWD(2014)15

5.1.2. Methodology for assessing policy options related to adjustment to targets within the group of higher income Member States

The European Council concluded that targets for the Member States with a GDP per capita above the EU average should be relatively adjusted to reflect cost-effectiveness in a fair and balanced manner. 11 Member States fulfil the criterion of having a GDP above EU average in 2013. LU, DK, SE, IE, NL, AT, FI, BE, DE, FR, UK, referred to as high income Member States, are together responsible for around 60% of ESD GHG emissions.

The economic analysis used focusses on a gap analysis between the cost effective reduction potential of high income Member States i.e. the difference between what they would reduce if the EU were to achieve its GHG target cost effectively in a context that achieves also the renewables and energy efficiency targets, and what their target would be using the policy baseline of a pure GDP per capita approach as described in section 5.1.1.

For high income Member States, a target set on the basis of GDP per capita typically would mean higher reductions than their reduction potential in case of cost efficient target achievement across the EU.

As a group this is no surprise, given that the GDP per capita approach is one based on fairness, and thus exactly aims at giving high income Member States a relatively more ambitious target than what they would get based on pure cost minimisation. The extent of the gap, however, varies considerably across high income Member States.

The table below gives an example of the average gap for the group of high income Member States, as well as the highest and the lowest gap of the individual Member States (comparing the targets as set in Table 1 with the cost efficient reductions as projected in the scenario that achieves all agreed 2030 targets with energy efficiency at a level of 30% in 2030). On average the group is only 4 percentage points away from their target based on GDP per capita in case of cost efficient achievement (with the EUCO27 run this gap is around 5%). But one high income Member States has a gap of rather 30%, while on the other extreme, one high income Member State would actually reduce more in the cost efficient projection at EU level than its target based on GDP per capita.

Table 2: Example of Gap analysis between cost-efficiency and GDP per capita

	EU targets achieved cost-effectively	**MS target based on GDP per cap.**	**Gap (as a % of 2005 emissions)**
EU	**-30%**	**-30%**	**0%**
All High Income MS	**-33%**	**-37%**	**4%**
MS with large gap	-10%	-40%	30%
MS with smallest gap	-41%	-36%	-5%

Source: Commission calculations based on PRIMES and GAINS, EUCO30 scenario

The assessment carried out focuses on the size of the gap taking into account that a fair and balanced reflection of cost-efficiency would require the differences between high income Member States gaps to reduce.

Most affected Member States seem to recognise merits in an approach based on reducing the gap between cost efficient projections and targets based on GDP per capita, either by

supporting to set the 2030 target for 50% based on the target determined by GDP per capita and for 50% based on a cost-effective emission reduction projection or by indicating that limited cost efficient mitigation potential should be taken into account when reflecting cost efficiency.

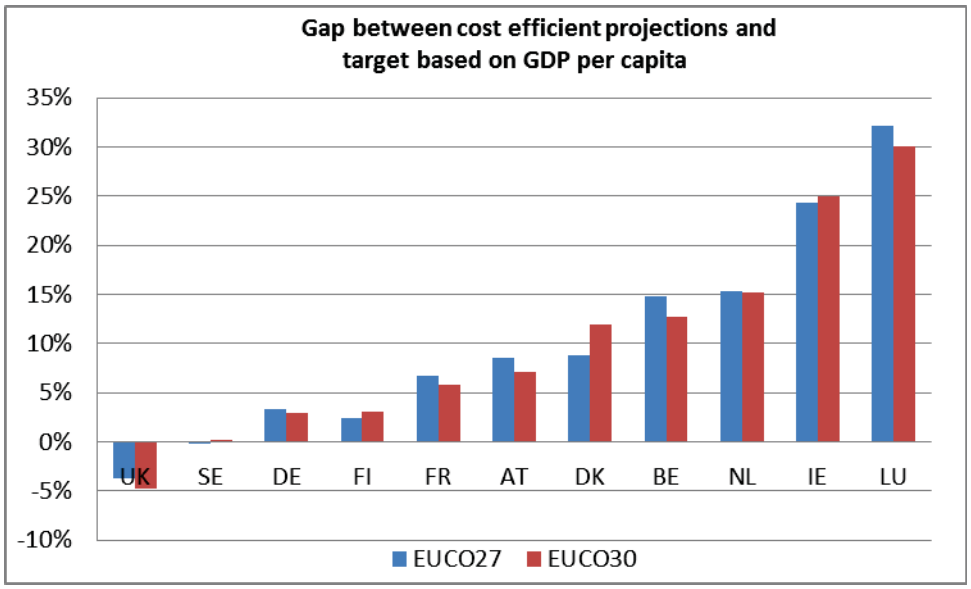
It needs to be assessed to what extent these differences in gap between high income Member States is robust across multiple sources of information. For this a number of relevant projections are used as described in the introduction of section 5.

5.1.3. Divergence of cost efficient projection and targets, using updated projections with various levels of energy efficiency based on the 2016 Reference

Two policy scenarios reflecting the 2030 targets agreed by the European Council have been developed (EUCO27, EUCO30) based on the updated EU Reference scenario 2016 and produced with the PRIMES and GAINS models.

Based on these projections, the below graph shows the gap, or basically deficit, between the projected cost efficient emission reductions at an EU level, and the target based on GDP per capita for each higher income Member State (as included in Table 1).

Figure 7: Gap in 2030 between GDP-based targets and cost-effective EU emission reductions for high income Member States (as a % of 2005 emissions)



Source: Commission calculations based on PRIMES and GAINS

The EUCO27 scenario has an average gap of 5% for the group of high income Member States, while in the EUCO30 scenario this gap is on average 4%. 5 Member States are at levels below or around to the 5% average gap (UK, SE, DE, FI and FR), while the others have a higher gap. Two Member States stand out due to a very large gap above 20% (IE, LU). This picture does not change between the EUCO27 and EUCO30 projection.

But there is sectoral variation between these projections which impacts Member States differently. The EUCO30 scenario achieves higher reductions in energy related emissions in for instance building heating and transport due to increased energy efficiency. In the EUCO30 scenario, typically sectors with non-CO2 emissions such as agriculture need to reduce less to achieve the same emission target compared to the EUCO27 scenario. Therefore the EUCO30 scenario shows typically higher reductions than the EUCO27

scenario in Member States with the highest shares of energy emissions in the ESR, resulting in a decrease in the gap for those Member States in the EUCO30 scenario compared to the EUCO27 scenario (e.g. LU, AT and BE). The opposite is the case for Member States with a low share of energy emissions in the effort sharing sectors (e.g. IE and DK). These see less reductions in the EUCO30 compared to the EUCO27 and an increase in the gap.

Conclusion: There are significant differences in the size of the gap between Member States in the scenarios achieving in a coherent manner across the EU all the targets of the 2030 climate and energy framework. Having 27% or 30% energy efficiency does not materially affect the relative achieved emissions reductions between Member States in the non-ETS sectors, and thus would not change materially which high income Member States would be categorised as having more or less of a challenge with cost efficiency when targets are determined on the basis of GDP per capita.

5.1.4. Divergence of cost efficient projection and targets, using additional projections to confirm robustness

All scenarios in section 5.1.3 are based on the 2016 Reference scenario.

This section expands this to other projections to check robustness of the differences in gap between high income Member States, the WEM-EXTRA, GHG40 and EE30 scenarios as described in the introduction of this chapter. Also these projections all achieve the GHG targets, including the split ETS, ESR as agreed.

The scenarios based on the 2013 Reference (GHG40, EE30) can serve as robustness check compared to the new scenarios with regard to the impact of changes in data and changes in assumptions of existing and new policies in the underlying Reference scenarios. These scenarios are also informative given that high income Member States have shaped up their expectations about ESR target setting around these scenarios.

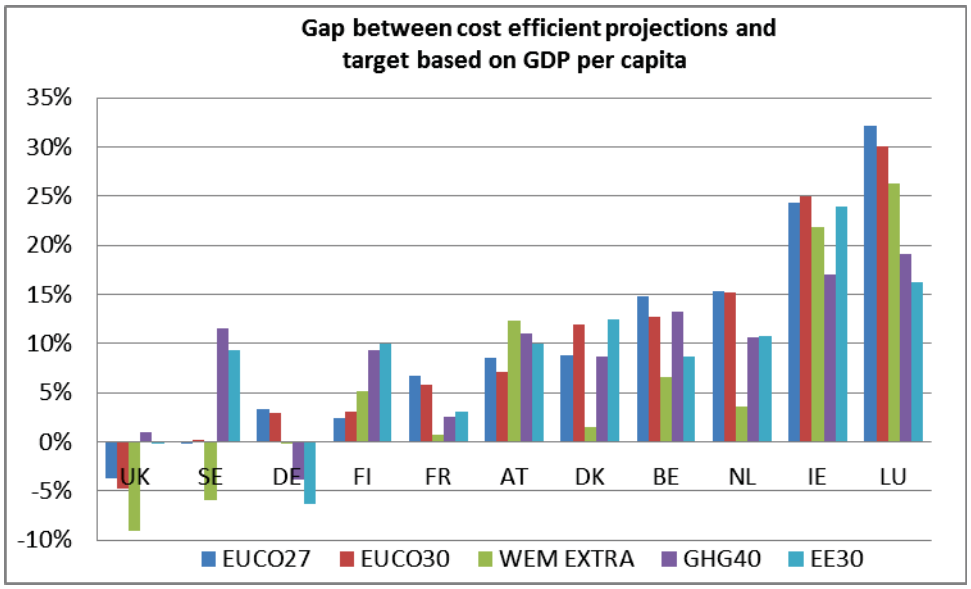
The WEM-EXTRA scenario based on Member States own projections aims at capturing any major differences in projections regarding the impact of the existing policy framework between Member States and the modelling tools used by the Commission[45]

No other projections were used for the robustness check[46].

[45] An important caveat of this approach is that the assumptions regarding which policies are included into the WEM projections are different between Member States. For example some Member States include national targets and thus go beyond existing implemented policies, or consider EU policies as fully implemented, while other Member States are more conservative and have a WEM projection that does not seem to assume full implementation of already decided EU policies.

[46] A number of Member States, notably the UK, France and Poland have conducted studies related to the 2030 framework, but none includes achievement of all agreed targets and/or ESD specific results for all Member States and were published in the relevant level of detail (see Enerdata (2014) Costs and Benefits to EU Member States of 2030 Climate and Energy Targets and CENTER FOR CLIMATE POLICY ANALYSIS (2015): Sharing the burden of the EU climate and energy policy 2030: an economic impact assessment for the EU Member States, Warsaw 2015).

Figure 8: Gap between GDP-based 2030 targets and cost-efficient emission reductions for high income Member States (as a % of 2005 emissions)



Source: Commission calculations based on PRIMES, GAINS, Eurostat and EEA 2015

Overall the three additional scenarios do not alter significantly the differentiation of groups of Member States when it comes down to the gap. Notably IE and LU consistently show the highest gaps, above 15%. The three large Member States UK, DE and FR consistently show a gap which is below or at worst around the average of the group of higher income Member States. AT, DK, BE and NL are part of the middle category having a gap above the EU average, but not as wide as LU and IE. DK, and to a lesser extent BE and the NL see a larger reduction in the WEM-EXTRA scenario. However, the Danish national WEM projections 2015 include a national target, with the resulting 'simple' extrapolation to WEM EXTRA potentially in relative terms overestimating the cost effective additional reductions.

For SE and to a lesser extent FI more recent national projections as well as the EUCO projections see a significant shift compared to the older scenarios based on the 2013 Reference, resulting in a smaller gap[47].

The GHG40 and EE30 also confirm that higher levels of energy efficiency, in line with an overall 30% GHG reduction, have some distributional impact, but not sufficient to change the ranking or grouping of Member States according to their gap.

Conclusion: The following four groups of Member States can be defined:

[47] It is due to a combination of elements that the projections based on the more recent 2016 Reference show in particular stronger reductions for Sweden and Finland. In Sweden projections see increased efficiency, stronger decarbonisation of the energy sources used in the service sector, more biofuel use in transport, the impact of the revised F-gas regulation and reductions in non-CO2 emissions from energy use. For Finland, key country specific explanations are recent less dynamic economic developments, which impact in particular industry, and a stronger decarbonisation of the fuels used in residential and tertiary sectors, the revised F-gas regulation and waste related inventory methodology changes.

- Group 1: DE, UK and FR, the group with a low gap below or around 5% across all scenarios. These Member States represent 75% of the 2005 ESD emissions of the group of higher income Member States.

- Group 2: SE and FI, a group with a low gap below 5% across the EUCO27, EUCO30 and WEM-EXTRA scenarios, but clearly a significantly higher gap in scenarios based on the 2013 Reference. These two Member States represent 5% of the 2005 ESD emissions of the group of higher income Member States.

- Group 3: A group of small rich Member States ranging above the average gap of higher income Member States and below 15% across most scenarios (AT, DK, BE, NL). These Member States represent 17% of 2005 ESD emissions of higher income Member States.

- Group 4: A small group with a very high gap of above 15% across all scenarios, comprising two smaller Member States (LU, IE). These two Member States only represent 3% of higher income Member State emissions and the highest ESD per capita emissions in the EU.

5.1.5. Assessment of target adjustment options based on grouping of Member States

If targets based on GDP per capita would need to be adjusted, then it is logic that the Member States with a more challenging target based on cost effectiveness (e.g. Groups 3 and 4) would see a decrease in ambition compared to a target based only on GDP per capita, more outspoken for group 4 than for group 3, compensated by an increase in ambition for groups 1 and 2, with for group 2 a more prudent approach given that the robustness of classification is not consistent over all projections. This adjustment has to result in the same reduction (and thus gap) by all higher income Member States but a reduction of the variance of the individual gaps.

Moreover, it is worth noting that Groups 1 and 2 represent nearly 80% of all ESD emissions of Member States with GDP above EU average. This implies that an increase of the targets for members of Group 1 with 1% allows decreasing targets for all members of Groups 3 and 4 by roughly 4%.

These results lead to the following specification of further options T2 and T3 in addition to the policy baseline option (T1) which is based on the update of the GDP per capita methodology (see Table 1). T2 sees limited adjustments and T3 high adjustments.

The adjustment starts from the targets based on GDP per capita before being constrained by the maximum range of targets from 0% to -40%, in order to continue to recognise the significant differences in income levels for some high income Member States, and thus the capacity to pay:

- Option T2: An upward adjustment in ambition of 1 percentage point for group 1, no adjustments for group 2 and a downward adjustment in ambition of 3 percentage points for group 3 and 9 percentage points for group 4.

- Option T3: A doubling of the upward adjustment in ambition to 2 percentage point for group 1 and also an upward adjustment in ambition of 1 percentage point for group 2, and a downward adjustment in ambition of 7 percentage points for group 2 and 13 percentage points for group 3.

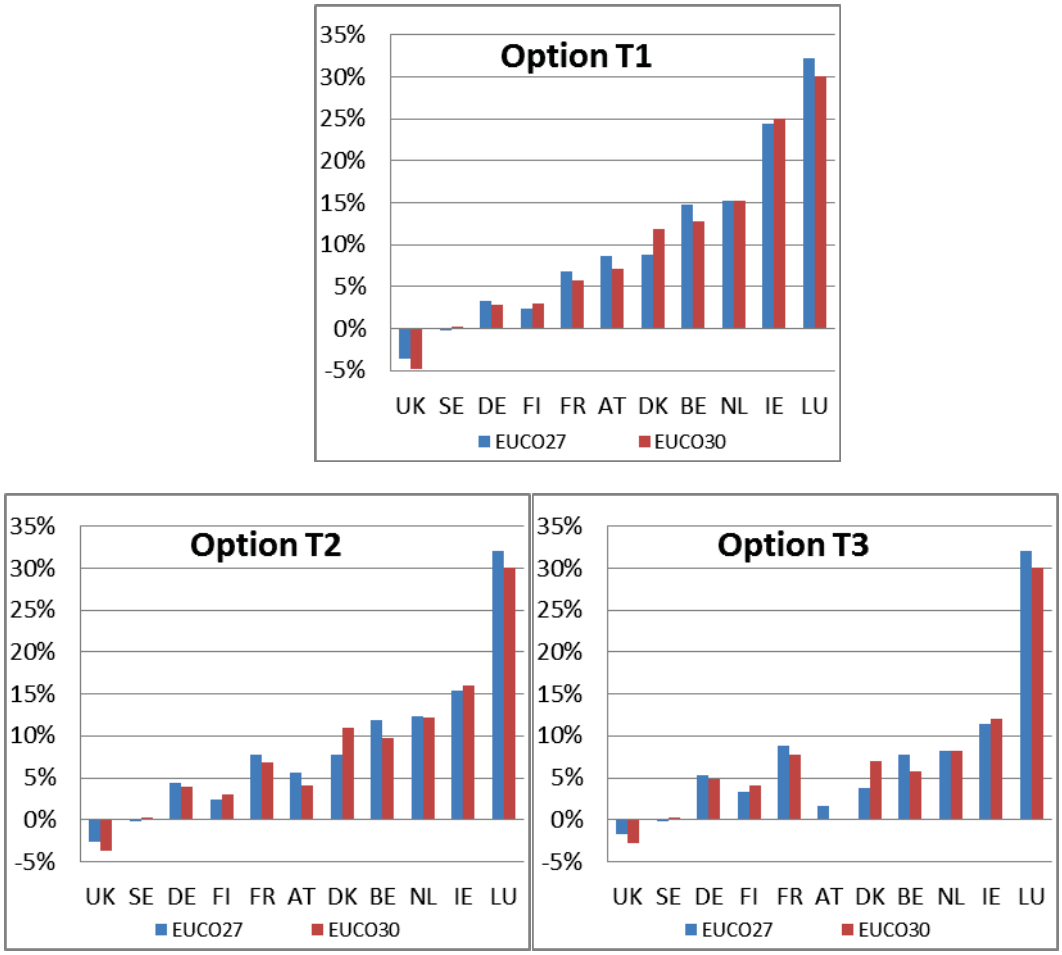
See Table 3 for the resulting targets per Member States for the three options. In all 3 options LU would remain at the highest level, recognising it already gets a major benefit from the fact that the overall range of targets are limited to -40% (LU would receive a -61% target otherwise under option T1). Similarly SE has in all 3 options an equal target, given that targets cannot increase beyond -40%. All other high income Member states see variation in their targets. In options T1 and T2, Ireland would see the lowest target (-30% and -26%). Typically DE, FR with and UK would see a slightly higher target in T2 than NL, AT, BE. In T3 this would be much more outspoken with also DK seeing its target reduce below DE, FR and UK.

Table 3: Target adjustments for groupings of high income Member States

Option	T1: No target adjustment	T2: Limited target adjustment	T3: High target adjustment
LU	-40%	-40%	-40%
SE	-40%	-40%	-40%
DK	-40%	-39%	-35%
FI	-39%	-39%	-40%
NL	-39%	-36%	-32%
AT	-39%	-36%	-32%
IE	-39%	-30%	-26%
BE	-38%	-35%	-31%
DE	-37%	-38%	-39%
FR	-36%	-37%	-38%
UK	-36%	-37%	-38%

Figure 9 below shows the impact of the 3 target options on the gap in 2030 for the EUCO projections.

Figure 9: Gap between GDP-based 2030 targets and EUCO27 and EUCO30 projections for different target adjustments between groupings (as a % of 2005 emissions)



Source: Commission calculations based on PRIMES and GAINS

Distributional impacts

Significant differences exist between Member States' gaps making them more challenging to be achieved domestically for groups 3 and 4 or requiring higher need for access to flexibility mechanisms. If these Member States would opt to achieve the targets domestically, this would certainly require higher efforts and thus more economic and potentially also social strain. On the other hand, these Member States, even in the group of high income Member States tend to be those with the highest incomes, and thus highest potential to take action.

A group based target adjustment can lessen distributional impacts considerably, except for Luxembourg that due to its high GDP per capita level would keep the same target and thus gap, already benefitting strongly from the maximum range up to -40% of the target. The moderate adjustment option T2 already reduces the gap. For DK, BE, NL in group 3 the gap reduces and putting this grouping already on a more equal footing from a distributional perspective.

In the large adjustment option T3 the differences in gaps clearly reduce strongly, for all except LU bringing gaps down well below 15% across all scenarios and Member States except LU. The correction is so large that the gaps between group 1, 2 and 3 are starting to become similar and notably for FR and FI the gap could even be higher than for some of the Member States in group 3 which raises new distributional concerns.

This is also illustrated in Table 3 above, with option T3 translating into considerably higher targets for DE, FR and UK, compared to the DK, NL, AT, BE, and IE, while DE, FR and UK have relatively the lowest GDP per capita levels in the group of high income Member States.

Environmental impacts

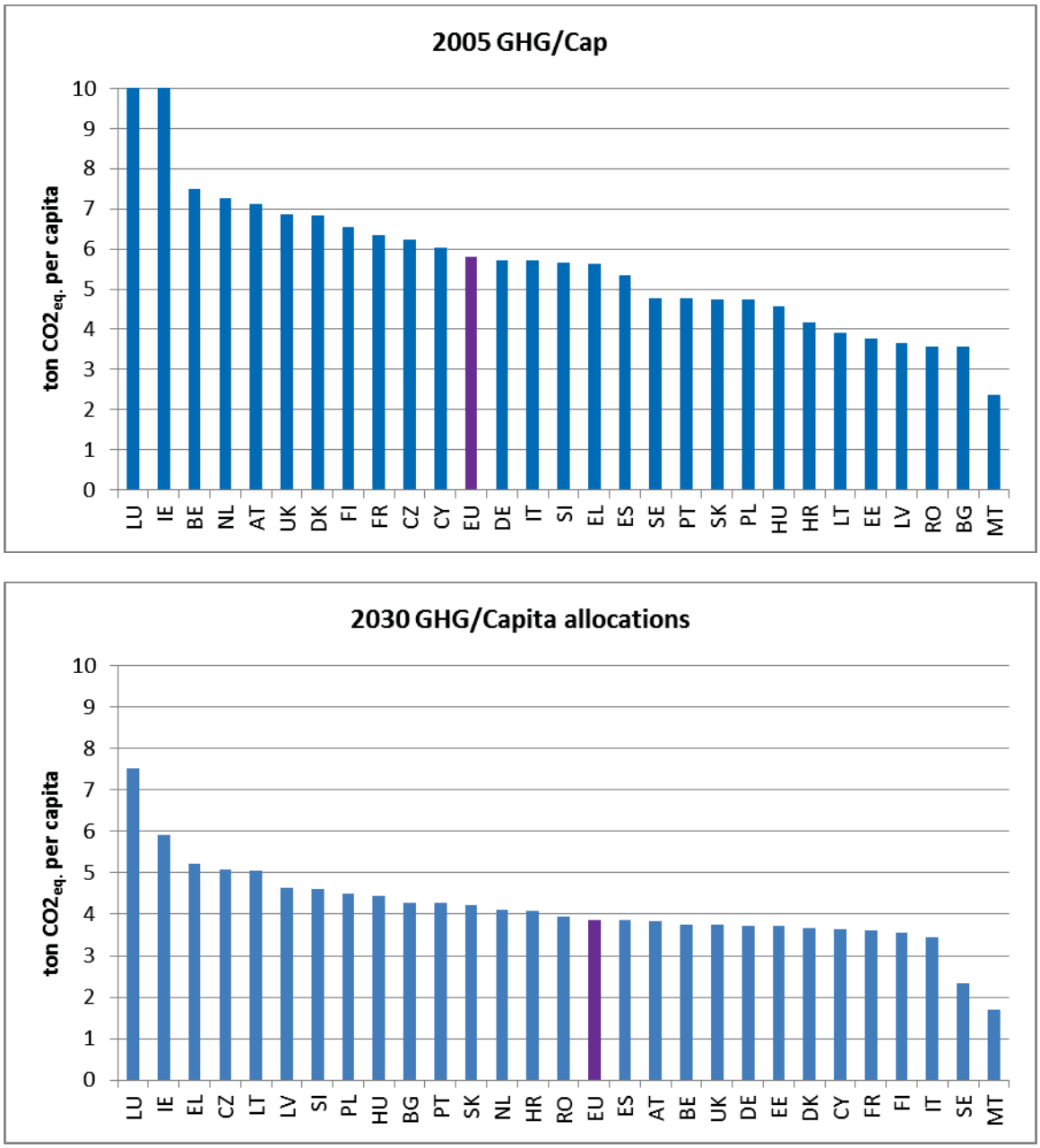
In itself, the distribution of targets between Member States should be without climate impacts as long as the overall -30% target is maintained and achieved, with flexibilities and enforcement mechanisms in place. In this context the overall starting point for the target trajectory is of more important concern (see also section 5.2).

But an additional element of environmental integrity is the notion that achieving low emissions would require over time convergence of per capita emissions to levels overall lower than today. The European Council referred explicitly to the need to ensure such convergence.

The figure below represents the GHG emissions per capita in 2005 and what the allocation in 2030 per capita would translate into when applying the option T2. Of course, real emissions per capita can deviate by 2030 and will depend on the extent to which flexibilities are used.

Compared to 2005, option T2 (as well as options T1 and T3) achieves a considerable degree of convergence by 2030 of allocation per capita between the Member States. 16 Member States have an allocated emissions level per capita within a range of 1 ton around EU average. Only two higher income Member States (LU, IE) and 8 lower income Member States have allocated emissions per capita above this range. Instead SE and MT have allocated emissions per capita below this range.

Figure 10: Towards convergence of ESR GHG per capita in 2030: T2



Source: Commission calculations based on PRIMES, and GAINS. For 2005, LU and IE emissions per capita are 21.5 and 11.6ton per capita respectively.

IE allocated emissions per capita are higher in T3 and T2 than in T1 due to the target adjustments, with for instance IE per capita emissions at around 6 tonnes in T1 but above 7 tonnes in T3.

Group 3 countries similarly have higher level of emissions in T2 and T3, with none of them having emissions below EU average in case of option T3, and the NL even having emissions just outside the range of 1 ton around EU average.

Economic impacts

Option T1 with targets set based only on GDP per capita basis would lead a gap for the whole group of high income Member States of around 5%.

High income Member States could opt to reduce more than what typical cost efficient projections at the EU level might imply, or they could acquire AEAs from other countries. However, the size of the gaps to be filled with reductions going beyond domestically cost-efficient target levels in group 3 and in particular group 4 is clearly much larger than for groups 1 and 2, making for groups 3 and 4 the need for well functioning flexibility mechanisms within the ESR much more important.

A target adjustment (options T2 and T3) would lower the divergences between the gaps and thus also lower the concerns of Member States in group 3 and 4 for the need on higher availability of AEAs through the flexibility mechanisms. This would be more outspoken in case of option T3 than option T2.

Conclusion: A target adjustment clearly lowers the divergences between high income Member States in the gap they have between EU wide cost efficient emission reduction projections and the target they would receive. Option T2, a limited adjustment, would still see the richest Member States take the highest targets, but differences in gaps would decrease for all with the exception of LU, that majorly benefits from the fact that targets can't go beyond -40%. Overall a target adjustment as proposed has no impact on the environmental integrity because it does not lead to increases of overall surplus in the sectors covered by the current ESD.

5.1.6. Assessment of 50/50 target adjustment options based on Member States proposals

Belgium in its reply to the public consultation suggested setting 50% of the 2030 target based on the target determined by GDP per capita and 50% based on a cost-effective emission reduction projection (proposing for the latter to use the 2030 framework impact assessment), and recalibrating all targets upwards if the group as a whole doesn't meet its required reduction.

Table 4 below includes what the targets would be under the approach proposed by Belgium if as cost effective emission reduction projections one would use the EUCO30 or GHG40 scenarios.

Table 4: Comparing the group based approach to targets set following the 50/50 proposal

Option	T1: No target adjustment	T2: Limited target adjustment	T3: High target adjustment	T4 50/50 approach using as cost efficient projection	
				EUCO30	GHG40
LU	-40%	-40%	-40%	-27%	-32%
SE	-40%	-40%	-40%	-40%	-36%
DK	-40%	-39%	-35%	-36%	-37%
FI	-39%	-39%	-40%	-40%	-36%
NL	-39%	-36%	-32%	-34%	-35%
AT	-39%	-36%	-32%	-38%	-35%
IE	-39%	-30%	-26%	-29%	-32%
BE	-38%	-35%	-31%	-34%	-33%
DE	-37%	-38%	-39%	-38%	-40%
FR	-36%	-37%	-38%	-35%	-36%
UK	-36%	-37%	-38%	-40%	-37%

Strong difference in the approaches is the outcome for Luxembourg, where in options T2 and T3 they do not benefit from the target redistribution because of their high GDP per capita levels, while they do in T4.

For the other Member States differences are smaller between all the approaches, be it that option T3 is on average more divergent from the approach proposed by Belgium than option T2.

Option T2 typically leads to somewhat higher targets than T4 for the highest income Member States with DK, NL, BE and FR having equal or higher targets in T2 than both the scenarios assessed in T4 for the approach proposed by Belgium.

Option T4 sees significant differences between target setting depending on the scenarios used. 6 Member States see a difference in target of 3 to 5% depending on which scenario is used. This raises questions to which scenario would need to be selected which might in itself be controversial. This is also clear when looking at the Member States that need to contribute to a target distribution, with T4 seeing DE take on a target of -40% when using the GHG40 projection, and UK having to do so when using the EUCO30 projection.

5.2. Assessing the trajectory starting point

The policy baseline of this impact assessment is to continue with an approach that uses the most recent inventory data available in the year before the start of the commitment period to define the total annual emission allocations for Member States over the upcoming commitment period, in the form of a linear trajectory with using these most recent emissions as the starting point.

For the commitment period 2021-2030 this would mean defining in 2020 the annual emission allocations based on linear trajectory that uses the most recent inventory. The most recent inventory in 2020 will cover emissions up to 2018. To take into account any unexpected annual variability, the average of 3 years, 2016 to 2018, would be used.

The current approach to set targets for 2013-2020 further differentiates the exact starting date of the linear trajectory, depending if a Member State has a target that allow it to increase or decrease emissions compared to 2005 by 2020.

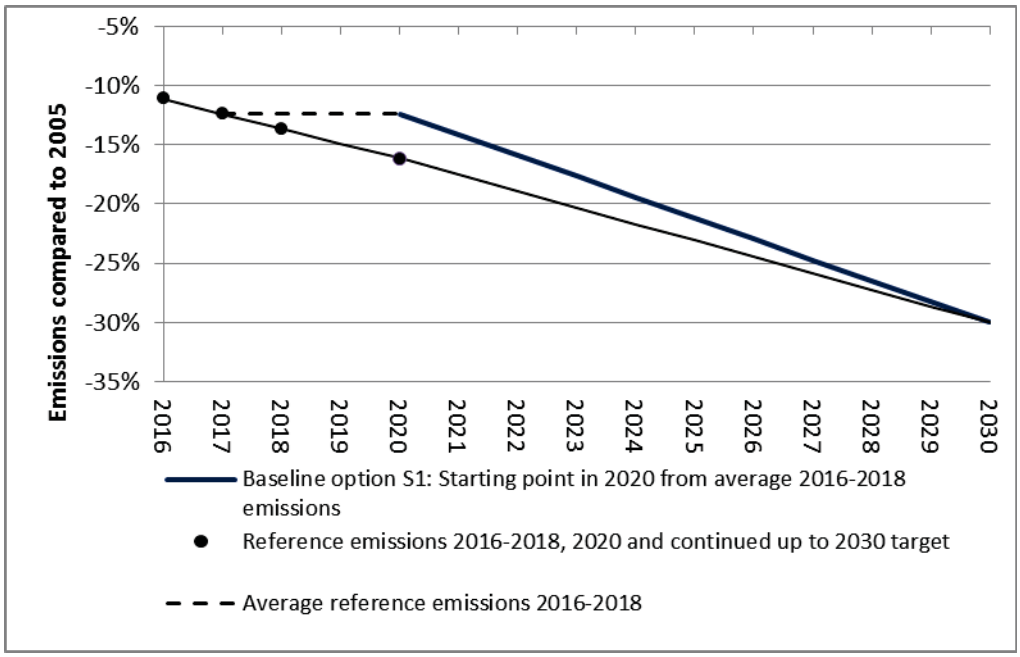
An approach similar to the current one for Member States with a 2020 target that requires emissions to be reduced compared to 2005 is used, given that for 2030 all Member States have target between 0% and -40% compared to 2005. This method uses average 2016-2018 emissions as a starting point in 2020 to extrapolate the target linearly to the 2030 end point and as such define the total annual emission allocations for the period 2021-2030. See also annex 8.8 for more details on how this compares to the methodology applied in the current commitment period 2013-2020, as well as other methodologies proposed by stakeholders.

Figure 11 below represents the EU target trajectory using this approach and how it would relates to an emission profile that starts from the EU Reference 2016 projection in 2020 and achieves in 2030 a reduction of -30%.

If emissions decrease as in the Reference scenario until 2020 and continue to do so up to 2030 to achieve the target of -30%, as in Figure 11, then this results in 2021 in a situation that emissions are lower than the actual target, generating at the EU level a surplus of

AEAs. This annual surplus would reduce over time, with emissions being on target in 2030.

Figure 11: 2021-2030 target trajectory



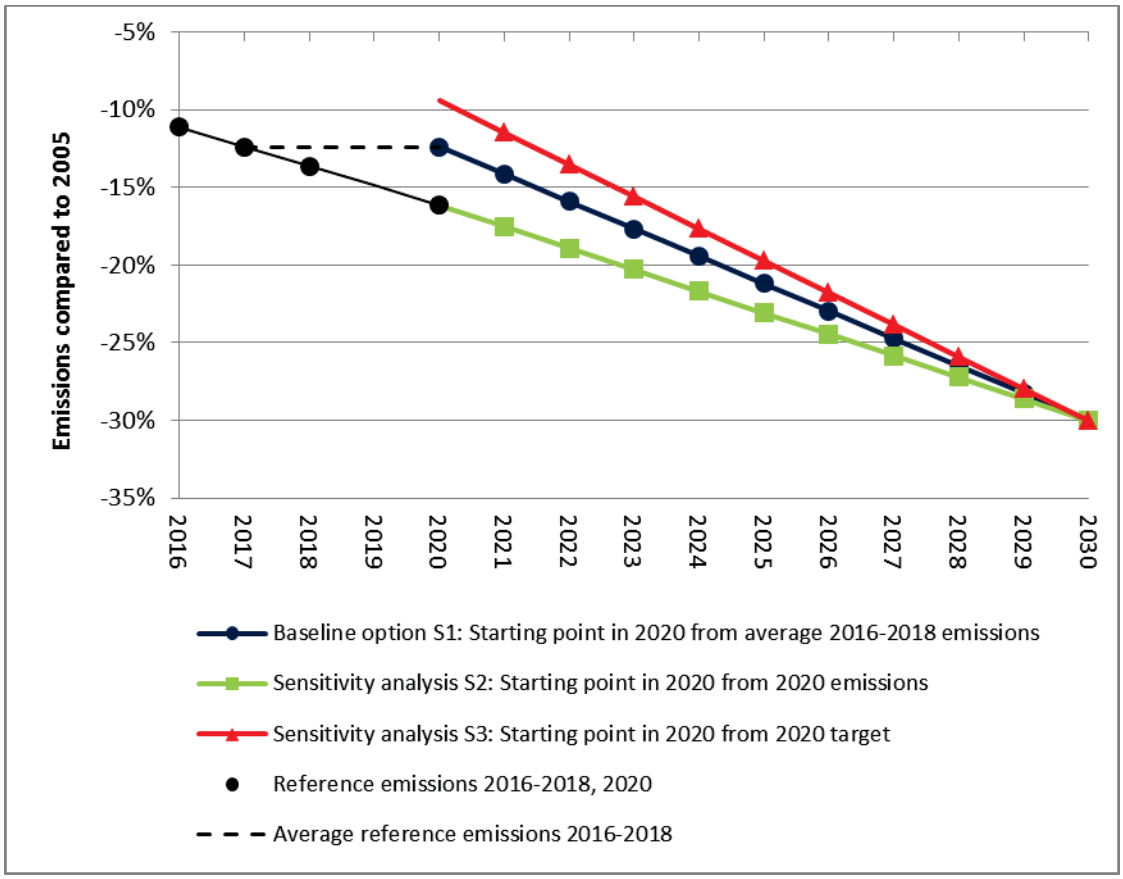
Source: Commission calculations based on EU Reference scenario 2016

This method ensures Member States know before the start of the period their target. It also gives incentives to continue to take action in the period 2016-2021 and it in principle ensures that a buffer is created, which is of use in a system that sees annual compliance. But if the surplus gets too large too early in the period 2021-2030, this actually might also create a risk, reducing incentives on Member States to take action during the period and potentially resulting in a situation that later in the period emissions become higher than target. This could endanger the effective achievement of the -30% target in 2030.

A number of stakeholders pointed out in the public consultation that there could be variations on this starting point, such as using the 2020 target or 2020 emissions to define the starting point.

This section assesses the methodology as presented in Figure 11 that is similar to the existing method used for the period 2013-2020, but also does a sensitivity analysis on the impact of the approaches as listed by stakeholders, using 2020 emission or existing 2020 targets as starting point. See Figure 12 for an overview.

Figure 12: Comparing 2021-2030 target trajectories using different starting points



Source: Commission calculations based on EU Reference scenario 2016

Environmental impacts

Starting from recent 2016-2018 emissions (S1, dark blue circle line) is more stringent than sensitivity S3 but less than S2. Average emissions in 2016-2018 are already below the 2020 target thus this starting point would be more stringent than S3, which starts from 2020 target in 2020. Recent inventory data seem to confirm this order of magnitude of reductions. Emission reductions in 2014 were already at -13%, below the 2020 target, and might be expected to further reduce by 2020.

The least ambitious target trajectory would thus be sensitivity S3 (red triangle line) which starts in 2020 from the existing aggregated 2020 national targets of almost -10% in 2020, as such recognising over-achievement of the target in the period up to 2020.

On the opposite, sensitivity S2 (green quadratic line) with 2020 emissions as its starting point in 2020, has the most stringent target trajectory, given that emissions are projected to continue to decrease between 2015 and 2020 to -16% in the EU Reference scenario (and to -13% in aggregated MS WEM projections), well below the 2020 target levels.

Table 5 gives an overview of how the choice of a different starting point impacts the build-up of a potential deficit or surplus of cumulated emissions compared to the target trajectory over the period 2021-2030 for a number of different emission scenarios different emission scenarios.

Table 5: Impact on the build-up of a surplus or deficit in sectors covered by the current ESD over the period 2021-2030 of different starting points for target trajectory

Option	Sensitivity S2	S1	Sensitivity S3
Starting point	2020 emissions	2016-2018 emissions	2020 targets
	EU Mt surplus (+) or deficit (-) over the period 2021-2030		
MS WEM	-1918	-1739	-1326
2013 Reference	-1500	-1090	-758
2016 Reference	-972	-491	-74
EUCO27	31	512	928
EUCO30	26	511	929

Source: Commission calculations based on EEA, PRIMES and GAINS

The 2016 Reference scenario as well as the 2013 Reference and the MS-WEM scenario represent the baseline situations of no additional policies beyond current ones. This type of emission profiles should typically result in deficits compared to the assessed target trajectories, indicating that current policies are not sufficient to achieve the targets.

If the starting point is defined using 2020 emissions (S2), the most stringent one, then an emission profile such as the 2016 Reference projections would result in a deficit over the period 2021-2030 equal to 972 million. This deficit would be even higher if the emission profile would correspond to the MS WEM projections which would result in a deficit of 1.9 billion tonnes with S2 as starting point.

Instead the scenarios that effectively achieve -30% target in 2030, such as EUCO27 and EUCO30, would see the opposite with no deficit building up over the commitment period. Instead surpluses could arise, most notably associated with overachievement of the target early in the period, due to the choice in starting point.

This can be clearly seen in the policy baseline option S1 (starting point 2016-2018 emissions) and the sensitivity S3 (starting point 2020 targets), which see a build-up of surplus in the early years of the period with emissions profiles similar to the EUCO27 and EUCO30 scenarios. This is particularly large with sensitivity S3, leading to a surplus by 2030 as high as 929 million.

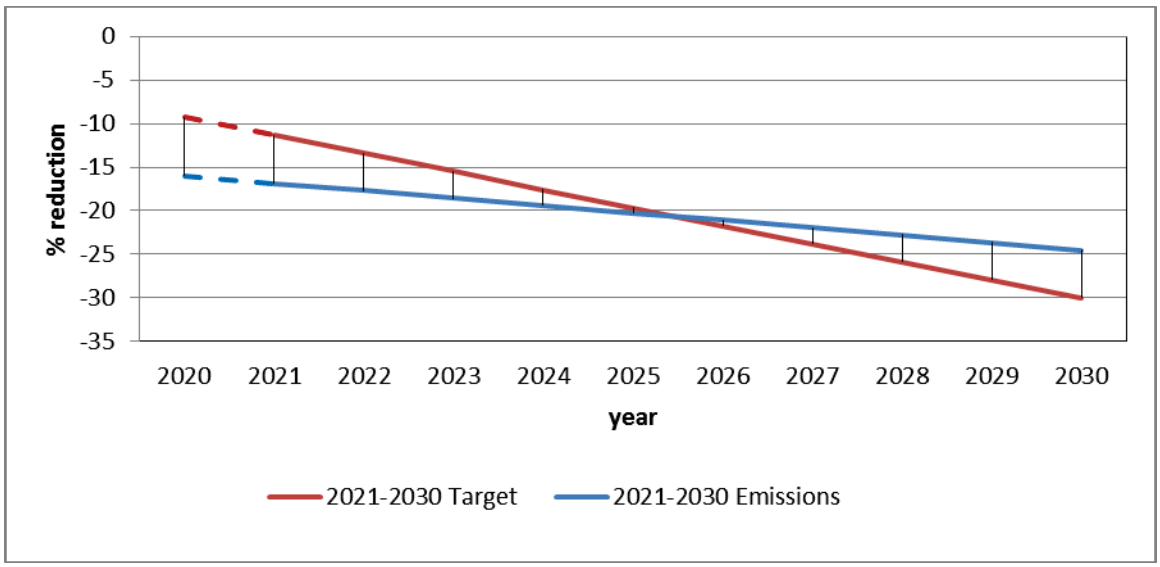
But if the starting point is defined by using 2020 emissions (S2), the most stringent one, then emissions profiles similar to the EUCO27 and EUCO30 are roughly in line with the trajectory, and no significant surplus builds up over the commitment period.

Of course in scenarios EUCO27 and EUCO30 it is assumed actions are taken to effectively achieve the -30% target in 2030. But notably the build-up of large surpluses early on can increase the risk that this is not the case, and that there are not enough reductions later in the period. Emissions might actually increase above target, with surpluses from early in the period being used for compliance later in the period. **This would mean that the 2030 target of -30% would be missed and of course this risk is larger with a large build up early on in the period of large surpluses.**

Figure 13 gives a stylised example of such a situation. The target trajectory starts with 2020 targets (sensitivity S3), the least stringent target trajectory. In 2020 there is an overachievement equal to the 2016 Reference scenario, reaching -16% emission

reductions or more than 6% better than the 2020 target. This allows to build-up a surplus in the beginning of the decade, and as a result, this could allow underachievement in later years, resulting in achieving only around -24.5% reductions (instead of -30%) by 2030 with the system overall still in compliance over the period.

Figure 13: Sensitivity S3 sees overachievement in 2021 but risks underachievement in 2030



Source: Commission calculations

The 2016 Reference scenario fits very closely to such an emission profile, with emissions in 2030 being at -24% and with overall only a deficit of 39 million over the period (or roughly 4 million a year) if starting point would be set equal to 2020 targets (sensitivity S3).

It is hence clear that sensitivity S3 poses a big environmental risk for the system as a whole, in the worst case resulting in an emission profile similar to the baseline with no additional action (Reference 2016), and thus not achieving the required reduction by 2030.

Instead, the risk not to be on target in 2030 would be lower for the methodology that continues to use recent 2016-2018 emission inventories (S1).

But it is sensitivity S2 that from an environmental perspective would have the least risk not being on target in 2030 and would normally ensure the EU as a whole will meet its 2030 target of -30% emission reductions in the ESR.

While sensitivity S2 ensures environmental integrity at the EU level, it also has an environmental disadvantage. It rewards those Member States that do not achieve their 2020 targets and gives them a less stringent starting point in 2021 than their 2020 target In the new 2016 EU Reference scenario five high income Member States would be in this situation (BE, DK, IE, LU and NL).

Option S1 has a similar disadvantage, but at least it gives incentives to take action all the way to 2020, with Member States benefiting to be below 2016-2018 emissions already in 2021.

If high energy efficiency improvements of 30% or more are effectively achieved by 2030, then it is more likely that the ESR will meet its 2030 target of -30% reductions. This would lower the risk of not achieving the GHG objective even with a large surplus building up early in the commitment period.

Some stakeholders suggested defining the starting point at Member States level on whatever is most stringent: 2016-2018 emissions, 2020 emissions or 2020 targets. Of course this would make the target trajectory overall at EU level more stringent. If Member States targets starting points where defined for instance on the basis of the most stringent outcome of sensitivities S2 or S3, the deficit over the period would increase to around -60 Mt. This actually would mean that the target would be set at even more stringent levels than a linear reduction from 2020 emissions to the 2030 target. If these additional reductions would be achieved towards the end of the period this could potentially lead to a limited overachievement in 2030 of the target.

Table 6: Impact on the build-up of a surplus or deficit in the ESR over the period 2021-2030 of a combination of starting points for target trajectory

Option	Sensitivity S2	S1	Sensitivity S3	MS targets based on most stringent of 2 options
Starting point	2020 emissions	2016-2018 emissions	2020 targets	S2 and S3
Scenario	EU Mt surplus (+) or deficit (-) over the period 2021-2030			
EUCO27	31	512	928	-58
EUCO30	26	511	929	-62

Source: Commission calculations based on PRIMES and GAINS

Economic impacts

Table 7 below represents how over time the cumulative surplus or deficit evolves under the EUCO30 target scenario, splitting it also between those Member States that have a surplus (and thus may potentially be sellers of Annual Emission Allocations, AEAs), and those Member States that have a deficit (and thus need to acquire AEAs). It is important to note that such calculations of surpluses and deficits over time are sensitive to the underpinning emission projections and interpolations. Therefore the concrete figures should be seen as illustrating orders of magnitude.

Table 7: Development of surplus and deficit and potential to buy and sell AEAs

Option S1, starting point 2016-2018 emissions (EUCO30 scenario)			
Cumulative surplus (+) or deficit (-), million ton	2021 – 2023	2021 - 2026	2021 – 2030
EU total	256	414	511
MS with net deficit (potential buyers)	-11	-75	-282
MS with net surplus (potential sellers)	267	489	793
Sensitivity S2, starting point 2020 emissions (EUCO30 scenario)			
Cumulative surplus (+) or deficit (-), million ton	2021 – 2023	2021 - 2026	2021 – 2030
EU total	-3	-6	26
MS with net deficit (potential buyers)	-58	-203	-523
MS with net surplus (potential sellers)	56	197	550

Sensitivity S3, starting point 2020 targets (EUCO30 scenario)			
Cumulative surplus (+) or deficit (-), million ton	2021 – 2023	2021 - 2026	2021 – 2030
EU total	479	776	929
MS with net deficit (potential buyers)	-77	-205	-482
MS with net surplus (potential sellers)	556	982	1411

S1 sees relatively low demand for AEAs, with overall demand over the period just at 284 million tons. This is most outspoken in the beginning of the period, which of course relates to the fact that S1, using average 2016-2018 emissions generates an initial EU-wide surplus early in the period and very little demand. This makes certainly the need for flexibility in the beginning less outspoken a problem, even in a system with annual compliance cycles.

With 2020 emissions as starting point as more stringent sensitivity (S2) overall the total supply and demand in the system are finely in balance, with all Member States achieving the reductions associated with a cost efficient reduction at the EU level and with full demand for any supply in the system.

This may however exactly make the use of flexibility mechanisms more contentious. Given that demand and supply are so tightly matched, more Member States will need to use flexibilities and less Member States might be willing to sell early in the period given that any surpluses will only build up gradually. Instead, those Member States that expect to become early buyers of AEAs, even with S2 as starting point will want to be sure that the supply is available and they might experience S2 as too restrictive (or ask for instance for mandatory auctioning of any surpluses).

Using 2020 emissions as starting point (S2) also has a practical disadvantage. 2020 emissions will only be known when the inventory in 2022 is released, and thus any 2021-2030 target trajectory will only be known late 2022, which increases policy uncertainty and may delay the necessary investments early on.

Sensitivity S3 is less stringent than S1 overall but would see a slightly higher demand in the first years as option S2, and only a marginal lower demand than option S2 over the whole period, but has foremost a much bigger supply in the system, and has this already early on. This will for certain increase willingness to sell and thus make supply easy available. On the other hand it is exactly this abundance that increases the risk of too little emission reduction action and thus not achieving the 2030 target in the end (see discussion section above on environmental integrity).

One additional important difference between S2 and S3 is who the buyers are. In sensitivity S3 it are those Member States that are off target in 2020 that are the biggest buyers already early on in the period, with NL, IE and BE representing 85% of the demand in the first three years and DK and LU representing the remainder. Instead in S2 more high income Member States develop some demand already early on, with the biggest buyers in absolute terms actually being DE and FR.

By and large the EUCO27 projection would give similar impacts on the demand for AEAs as EUCO30, for instance in case of S1 resulting in a net demand of 319 million AEAs instead of 282 million in case of EUCO30. This is of course because overall both

EUCO27 and EUCO30 are projected to reduce emissions in-line with a 30% emission reduction in the ESR.

Distributional impacts

Table 8 shows the deficits or surpluses generated by each Member State for each of the three starting points over the whole period. This analysis uses the EUCO30 scenario to assess the impacts. As 2030 target the national targets based on GDP per capita are used as included in Table 1 (Option T1).

The surpluses and deficits in Table 8 look at the annual average surplus or deficit over the whole period (expressed as a % of 2005 emissions) as well as the total surplus or deficit in million tonnes over the period 2021-2030.

Table 8: Impact of starting point options on Member State surplus or deficit over the period 2021-2030 using the EUCO30 projection

Scenario	EUCO30					
Option	Sensitivity S2		S1		Sensitivity S3	
Starting point	2020 emissions		2016-2018 emissions		2020 targets	
	Surplus (+) or deficit (-)					
	annual average, 2021-2030, % 2005 emissions	Million tonnes 2021-2030	annual average, 2021-2030, % 2005 emissions	Million tonnes 2021-2030	annual average, 2021-2030, % 2005 emissions	Million tonnes 2021-2030
EU	0.1%	26	1.8%	511	3.3%	929
MS with net surplus	5.0%	550	3.7%	793	8.6%	1411
MS with net deficit	-3.0%	-523	-3.9%	-282	-4.0%	-482
LU	-16%	-16	-16%	-16	-22%	-22
SE	0%	1	2%	9	3%	14
DK	-6%	-24	-5%	-20	-8%	-31
IE	-14%	-68	-14%	-65	-19%	-92
NL	-9%	-101	-7%	-85	-12%	-140
AT	-4%	-25	-3%	-19	-3%	-19
FI	-1%	-3	2%	5	1%	4
BE	-7%	-57	-5%	-41	-9%	-70
DE	-1%	-62	1%	36	0%	-19
FR	-3%	-121	-1%	-36	-2%	-90
UK	2%	87	4%	167	6%	250
IT	-1%	-37	0%	2	1%	43
ES	4%	87	5%	126	8%	196
CY	0%	0	2%	1	4%	2
MT	3%	0	4%	0	6%	1
SI	5%	6	6%	7	13%	15
EL	15%	93	17%	106	27%	166
PT	9%	47	11%	56	21%	106

CZ	6%	37	8%	48	15%	98
EE	6%	3	8%	4	14%	7
SK	4%	9	5%	12	13%	33
LT	4%	6	6%	8	13%	18
LV	6%	5	8%	6	16%	14
HR	11%	19	12%	21	23%	42
HU	14%	64	16%	73	28%	130
PL	-1%	-11	0%	3	3%	45
RO	6%	48	7%	54	19%	144
BG	14%	38	17%	46	31%	85

Source: Commission calculations based on PRIMES and GAINS

Assuming all Member States would achieve emissions reductions similar to an emission profile as projected in EUCO30, Option S1 has 18 Member States with a surplus of 1% or more, 3 Member States in balance and 7 Member States with a deficit of 1% or more.

Sensitivity S2 has 15 Member States with a surplus of 1% or more, 4 Member States in balance and 9 Member States with a deficit of 1% or more.

Sensitivity S3 has 20 Member States with a surplus of 1% or more, 1 Member States in balance and 7 Member States with a deficit of 1% or more.

Most of the lower income Member States are in all options in surplus, which is in line with the spirit of the fairness based approach to 2030 target setting.

Overall the surpluses are biggest in case of sensitivity S3, with surpluses representing 8.6% of 2005 emissions on average for those Member States having surpluses. S3 clearly strongly advantages those Member States that overachieve their 2020 target while it results in higher gaps for typically those high income Member that are projected not to achieve their 2020 targets.

For S1 and S2, which are based on an emissions-based starting point, this strong advantage due to starting point and the distributional advantage towards low income Member States clearly decreases. However, it should be noted that even with S2, the most stringent case, most low income Member States will be able to achieve their target trajectory and even generate surpluses.

This is because they receive in relative terms more lenient 2030 targets based on GDP per capita.

This can most strongly be seen when comparing a target trajectory that uses starting point S1 (policy baseline) with the baseline projection without additional policies.

In case of the 2016 Reference projection 14 Member States with GDP per capita below EU average would be compliant over the whole period (BG, CZ, EE, EL, ES, HR, HU, LT, LV, MT, PT, RO, SI, SK). This would mean that typically the lowest income Member States could be compliant with the target trajectory over the period with no additional action beyond full implementation of current policies.

In case of the 2013 Reference scenario 8 Member States with GDP per capita below EU average would be compliant over the whole period (BG, EL, HR, HU, LT, MT, PT, RO)[48].

Finally, if the Member States own with existing measures projections are used to represent the no additional policy baseline, only 5 Member States (BG, CZ, EL, HU, PT) achieve compliance over the commitment period.

Overall this underlines that the target distribution based on GDP per capita, together with a starting point as in baseline policy option S1 (which allows in principle to generate some surplus early in the period), are very strong regarding fairness towards the low income Member States.

Instead most high income Member States, with the exception of the UK, clearly need to take additional action in line with or well above the cost efficient projections, such as EUCO30, to achieve the overall -30% target at EU level.

It should also be noted that Member States that have a deficit in 2030 (typically high income Member States, see also section 5.1.3), typically have a significantly smaller deficit if looked at over the full 10 year period. This is for option S1 as well as for both sensitivities. This is because of course any divergence between target and cost efficient potential tends to increase over time. This is important when assessing impacts and challenges related to target, which are not purely a 2030 point target, but have to be achieved over the period.

For instance Luxembourg had a gap of 30% in 2030 the EUCO30 projection with a target based purely on GDP per capita. But if looked at over the period, this is rather on average annual gap of 22% in case of sensitivity S3, smaller in the early years of the period 2021-2030 and increasing towards 30% towards the end. This gap reduces to 16% in case of option S1.

Similarly for all other Member States with a deficit in 2030 projected in the EUCO30 scenario in 2030, this reduce by around half or more when looking at the gap over the period, rather than only in the year 2030.

See annex 8.6 for a table similar as Table 8 with Member States results but then assessed using the EUCO27 projections, showing by and large the same impacts.

A final consideration regarding distributional impacts concerns those Member States which were allowed to increase emissions in 2020 compared to 2005, and received accordingly an increasing target trajectory from 2013 to 2020[49].

With option S1 that uses as starting point average emissions of 2016-2018, if these Member States were in a situation of increasing emissions between today and 2020, they

[48] See also Box 1 and Box 2 in section 1.3 for further information on why different scenarios projecting existing measures may differ.

[49] Countries with an increasing Annual Emission Allocation for the period 2013-2020 are BG, CZ, EE, HR, HU, LT, LV, PL, PT, RO, SI, SK. While also the MT target allows for emission increases between 2005 and 2020, its actual Annual Emission Allocation 2013-20 is decreasing, due to emission growth in the period 2005-2010.

would immediately experience a shortage in 2021, even though their target trajectory up to 2020 would allow emission increases.

This can be perceived as a particular distributional impact. The WEM projections indicate that eight of the MS with positive target in 2020 expect without additional measures to be in a situation that emissions in 2020 will be above 2015 (in the 2016 EU Reference scenario no Member State is projected to be in this situation).

If such a distributional impact is to be mitigated, one could create a buffer by increasing for the Member States concerned the ESR allocation for the period starting in 2021, with an amount equal to the increase in ESD allocations over the period 2017-2020 compared to their average allocation in the period 2016-2018. This represents the allowed increase in emissions these MS had over the period from where the starting point is defined, until 2020. Even if emissions of these Member States in this period would increase at a rate equal to their target trajectory increase, they would not immediately have a negative impact in 2021. They would have a buffer early in the period that allows them to put policies in place to catch up with the target trajectory resulting from option 1 for the period after 2020 that uses 2016-2018 as a starting point.

Table 9: Impact of an additional buffer under option S1 recognising that for some Member States Annual Emission Allocations increase up to 2020

	2020 target vs 2005	Increase allocation 2021-2030 equal to allocation increase period 2017-2020 compared to average allocation 2016-2018	
		Million AEAs	% of 2005 emissions, annually over the period 2021-2030
MS with an increasing AEA in the period up to 2020		39.1	0.7%
BG	20%	1.6	0.6%
RO	19%	10.9	1.4%
LV	17%	0.5	0.7%
LT	15%	2.2	1.6%
PL	14%	7.5	0.4%
SK	13%	2.2	0.8%
HR	11%	1.1	0.6%
EE	11%	0.1	0.3%
HU	10%	6.7	1.4%
CZ	9%	4.4	0.7%
SI	4%	0.2	0.2%
PT	1%	1.7	0.3%

Taking into account the current Annual Emission Allocations[50], this buffer would be 39 million, as such not majorly impacting the overall surplus. Under the EUCO30 projection, assuming 2030 targets are met, it would increase the surplus from 511 to 550. For the Member States involved, it would increase allocation on average over the 10 year

[50] According to Decisions 2013/162/EU and 2013/634/EU.

period 2021-2030 by an equivalent equal to 0.7% of their 2005 emissions, but with differences between Member States depending of their original target trajectory up to 2020.

With sensitivities S2 or S3, Member States with an increasing target up to 2020 would in principle not experience an immediate negative impact if they would increase emission in the period from now up to 2020. Of course the more emissions would increase by 2020, the more efforts would need to be done later on to get to target in 2030.

Conclusion: The analysis of the option S1 to start from recent 2016-2018 emissions and the sensitivity analysis confirm that continuation of a similar methodology as the existing one using recent historic emissions to set the starting point would be appropriate.

Using as starting point the 2020 emissions (sensitivity S2) would in principle ensure best that the target in 2030 is met. Under a normal reduction trajectory towards 2030 no net surplus will build up in the sectors covered by the current ESD at the EU level. But this would also create a very tight market with a need for almost all surpluses at Member State level to be transferred directly to those Member States that are developing deficits. This would require a perfect market with all willing to sell any surplus at any time. This is an unlikely situation in reality and thus probably difficult to accept for those Member States that need to acquire AESs over the period to be in compliance.

Using 2020 targets as starting point (sensitivity S3) would flood the market with a large surplus of AEAs early on in the period. This in particular reduces the incentives to actually take action over the period and increase the risk of not achieving the 2030 target of -30%. In the worst case result no additional action would be taken beyond the Reference projections, reducing the surplus back to zero 2030.

While constraining the allocation of those Member States that achieved over-compliance in the period 2013-2020, it would not lead to an unfair allocation, given that low income Member States clearly benefit majorly from the continuation of the target approach that sets targets based on GDP per capita.

On the other hand, if Member States with increasing targets up to 2020 are concerned that their emissions may start increasing up to 2020 before they succeed in putting policies in place to reduce emissions in line with their 2030 target, a buffer could be introduced that recognises that they have an increasing target trajectory between 2016 and 2020. This buffer would see total allocation increase by 39 million.

The annual gap between target and emissions, for those Member States that are projected not to achieve their target in 2030 in a cost efficient projection, is typically significantly smaller over the period, than in 2030, with deficits gradually building up over time. Therefore the challenge to achieve the target should also be looked at over the period, rather than only in 2030.

5.3. Assessing options for the one-off ETS/non-ETS flexibility

Following guidance by the European Council, the new flexibility mechanism from the ETS towards the non-ETS, has to be devised as a one-off, limited mechanism, decided before 2020, that preserves predictability and environmental integrity.

To ensure predictability for the carbon market there has to be certainty about the volume of allowances concerned that will be transferred from the ETS , sufficiently in time so

that market participants in the ETS can take this into account sufficiently beforehand. Therefore it is important to do so before 2020.

It is a flexibility available for eligible Member States but with a limit. It is them who will need to decide before 2020 if and how much they want to make use of this limited flexibility. But once the choice is made it is in principle an irreversible, one-off transfer that will reduce the allocation with certainty in the ETS over the period 2021-2030. It will reduce the amount of allowances available in the ETS for auctioning for those Member States that make use of it, and increase the amount of allocation in the sectors covered by the current ESD for these same Member States.

At the same time the mechanism has to preserve environmental integrity. In principle the transfer from the ETS has no impact on the total amount of allowed emissions in the EU and should thus ensure environmental integrity. But it may impact the timing of such emissions and interact with the Market Stability Reserve in the ETS[51].

Under the MSR, each year 12% of the surplus of allowances is transferred in the MSR provided the surplus is higher than 833 million allowances. If the surplus in the ETS would drop below 400 million allowances, then the MSR would start releasing allowances to the ETS market.

Normally any transfer of allowances from the ETS to the sectors under the current ESD will lower the amount of allowances available for the ETS. These transferred allowances would be deducted directly from the number of allowances which would otherwise be auctioned and thus reduce the auctioning revenues for those Member States using the one-off flexibility. It would reduce the surplus in the ETS, thus reducing the amount of allowances being transferred to the MSR (as long as the MSR is building up). This lower amount of allowances in the MSR subsequently lowers the total supply of allowances that can be returned to the ETS when the MSR may release allowances back into the ETS, making it thus more stringent in the mid to longer term once this return to market would occur.

Instead it increases the supply of AEAs for the period 2021 – 2030, and thus reduces the incentives to reduce emissions in the ESR up to 2030. This could adversely impact the achievement of the -30% target by 2030 . Therefore the one-off flexibility will need to be limited if the concern is to achieve the required reductions in the ESR by 2030.

This section will focus on assessing this limit. The total limit will be a result of the number of Member States that are eligible as well as the maximum amount of access to allowances that can be transferred.

5.3.1. Determining limits for eligibility and amount of access

Eligibility

With regard to eligibility the European Council gave clear guidance that the new one-off flexibility mechanism between the ETS and sectors under the current ESD should only be available to those Member States with a reduction target significantly above both the EU average and their cost effective reduction potential.

[51] Decision EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC

Furthermore it states that this flexibility can also be applied on Member States that did not have free allocation for industrial installations in 2013. Malta is the only country which qualifies for this. Malta already has the lowest per capita emissions in the ESD, and its 2030 target based on GDP per capita would result in emissions per capita of around or below 2 tonnes. This is roughly half of the EU average by then (see also Figure 10). Together with the fact that it is the most densely populated Member State, Malta sees its mitigation target as potentially challenging. Allowing access to this one-off mechanism takes account of this specific circumstance.

To establish which other Member States are eligible, the assessment needs to see which Member States have a target significantly above EU average as well as a target that is significantly above their cost effective reduction potential. This is in principle a similar exercise than done for the discussion on any adjustments on 2030 targets based on cost efficiency concerns as assessed in section 5.1.

On this basis DE, FR and UK would not be in a position that they have a significant cost efficiency challenge and thus they would not have access to the one-off flexibility.

Instead certainly IE and LU would have a large gap and they clearly should have access to the one-off flexibility with targets set at GDP per capita.

For NL, BE, AT, DK eligibility can be considered, but access to it should probably be put at a level below that of IE and LU (see below the section on the amount of access).

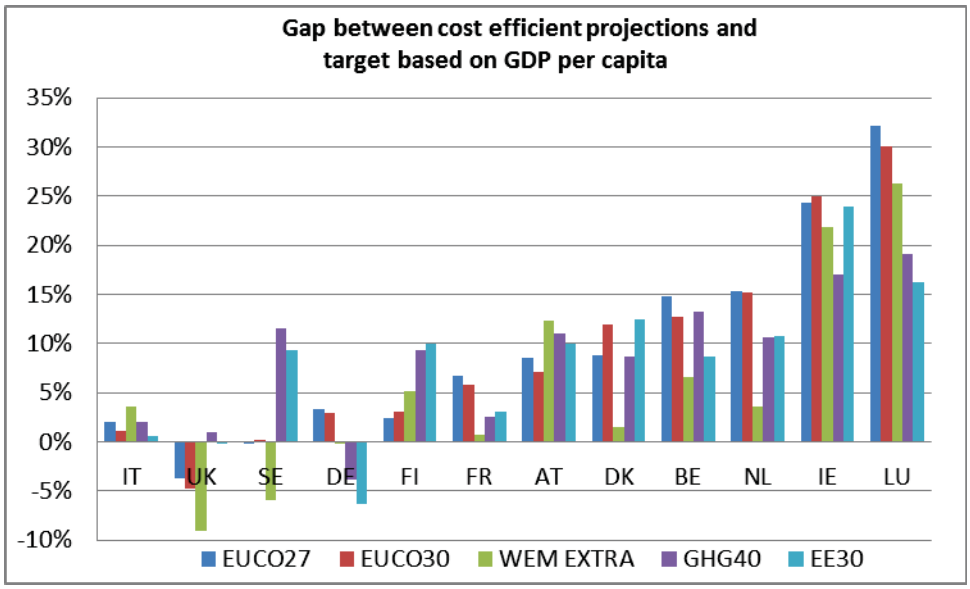
For FI and SE eligibility could be considered for the same reasons they were differentiated as group in section 5.1.2, e.g. as a matter of precaution for the situation that the relatively high emission reductions of the most recent scenarios would not materialise.

For the remainder of this section it is assumed allowing also SE and FI access to the one-off flexibility, but just as NL, BE, AT and DK at a level below that of IE and LU.

There is one Member State, IT, with a target above EU average, but which was not included in the assessment in section 5.1.2 because it is not a Member State with a GDP per capita above EU average. Italy's target at -33% (see Table 1) is 3 percentage points above the average EU target. Figure 14 below expands the assessment of section 5.1.2 to include IT. From this it can be seen that if emission reductions are projected cost efficiently across the EU, Italy rather falls under the category of Member States that has a limited gap, like DE, FR and UK, and thus would not have access to the one-off flexibility.

Overall achievement of higher energy savings would not alter this picture.

Figure 14: Gap in 2030 between GDP-based targets and cost-efficient emission reductions for all Member States with a target above -30%



Source: Commission calculations based on PRIMES, GAINS, Eurostat and EEA 2015

Amount of access

The one-off flexibility is foreseen to address cost-efficiency concerns with regard to emission reductions in the sectors under the ESR. This is also the case for the option to adjust 2030 targets for high income Member States, as discussed in section 5.1.5.

So the level of access to the one-off cannot be seen in isolation from other policy choices that will also impact cost efficiency concerns.

To assess what level of access can be appropriate, Table 10 below looks into the gap over period for eligible Member States, using as target trajectory starting point 2016-2018 emissions while differentiating the target trajectory end point in 2030 between the two options that see target adjustment within the group of high income Member States (options T2 and T3).

Table 10: Access to the one-off flexibility, assessing who has a considerable gap over the period after target adjustment in 2030, using the EUCO30 projection

% of 2005 emissions	Average annual gap/deficit (-) or surplus (+)over the period 2021-2030 (emissions as in EUCO30 projections)	
	T2: Limited target adjustment in the group of high income Member States	T3: high target adjustment in the group of high income Member States
LU	-15.7%	-15.7%
SE	2.1%	2.1%
DK	-4.9%	-2.7%
IE	-8.7%	-6.5%
NL	-5.5%	-3.3%
AT	-1.5%	0.7%
FI	1.5%	1.0%
BE	-3.6%	-1.4%

What is clear is that the LU and IE gaps over the period stand out, even after a 2030 target adjustment. For NL, BE, and DK the gap remains at around 4% and more on an annual basis over the period, in case of option T2. This still represents a large gap in 2030 itself, with the deficit building up gradually over the period. It becomes smaller in option T3 but remains a deficit over the period for these countries. The exceptions are FI and SE who for both target trajectories, and assuming the more recent projections, would see no deficits and also AT would potentially in option T3 see no more deficit.

See annex 8.6 for a table similar as Table 10 with Member States results, but then assessed using the EUCO27 projections, showing by and large the same impacts.

5.3.2. Assessment of impacts

Two options will be assessed with in each case IE and LU having more access to the one-off flexibility than the other eligible Member States. One option has limited access and one has large access. The option with large access will allow a level of access that in principle closes to a large extent the remaining gaps in combination with a large target adjustment equal to T3 and the options with limited access would see half of these levels:

- Baseline option O1, no one-off flexibility
- Policy option O2, one-off flexibility for those eligible with low access limits:

  - LU, IE have a limit equivalent to 4% of 2005 emission per annum

  - NL, BE, AT, DK, FI, SE, MT have a limit equivalent to 2% of 2005 emission per annum

- Policy option O3, one-off flexibility for those eligible with high access limits:

  -LU, IE have a limit equivalent to 8% of 2005 emission per annum

  - NL, BE, AT, DK, FI, SI, MT have a limit equivalent to 4% of 2005 emission per annum

For Malta, which in all five cost efficient GHG reduction projections shows a surplus, and not a gap, it is assumed that access is limited in a similar manner as for FI and SE, as a precautionary measure for any challenges it may see due to its particular situation.

Table 11: Options for limits on access for the one-off flexibility from ETS for eligible Member States

	Maximum amount of one-off flexibility for the whole period 2021-2030, million tonnes		
Option	O1	O2	O3
LU	0	4	8
IE	0	19	38
NL	0	24	47
BE	0	16	31
AT	0	12	23
DK	0	7	15
FI	0	7	14
SE	0	9	17
MT	0	0.2	0.4
Total	0	97	194

Environmental impacts

For effort sharing sectors

The impact of the one-off flexibility on environmental integrity in the sectors covered by the current ESD relates to the additional emission allocations in these sectors over the period 2021-2030.

Under option O2, which would only give a relative small access to those countries which are deemed eligible for this mechanism, the maximum amount entering these sectors would be limited to 97 million tonnes over the period 2021-2030 (see Table 11). This represents over a 10 year period on average the equivalent of around 0.35% of 2005 ESD emissions annually. This would still increase the surplus in the system by 19% to 609 million (see Table 12).

This amount would double to 194 million in option O3, starting to have a more serious impact on the surplus, increasing by almost 40% to 707 million. This would already start to cause a more considerable risk to achieve the target in 2030.

As a sensitivity it was also assessed what would happen if other Member States with a target above EU average but not found eligible to the one-off, would have access (FR, DE, UK and IT). This is done by adding two sensitivities to the assessment in Table 12. Even if limited on an annual basis to the equivalent of 2% of 2005 emissions, this would have major impacts on the potential available surplus, increasing it to almost a billion AEAs. Clearly this is incompatible with environmental integrity of the system and leads in theory to a situation that an emission profile as in Reference, i.e. without additional policies, would be compliant with the 2021-2030 target.

Table 12: Impact on the build-up of a surplus or deficit in the sectors in the current ESD over the period 2021-2030 of different options for limits to access to the one-off flexibility

Options for limit access one-off flexibility	EU surplus (+) or deficit (-) over the period 2021-2030 with the EUCO30 projection (million tonnes)
O1	511
O2	608
O3	705
	Additional sensitivities
O2 but also FR, DE, UK and IT 2% access limit	927
O3 but also FR, DE, UK and IT 4% access limit	1343

In the ETS

The one-off transfer in principle impacts both the surplus and the number of allowances placed in the Market Stability Reserve over the period 2021 to 2030. The design modalities of the one-off transfer determine the balance between these impacts. A late transfer from the ETS into the ESR, i.e. beyond the time the MSR rules result in annual feeds of allowances into the MSR, mainly results in a higher reduction of the surplus. A front-loaded transfer of the ETS into the ESR conversely would have the opposite effect, leading to fewer allowances being placed in the MSR and a smaller impact on the surplus (for more detailed information on how the one-off flexibility interacts with the MSR, see annex 8.9).

Whatever the timing of the transfer from the ETS to the ESR, the total change to the overall number of ETS allowances is the same, but the inter-temporal impacts on surplus in the ETS and MSR can differ. Front-loading of the one-off transfer may have an impact on the functioning of the MSR, possibly cutting the period of MSR feeding short by a year. Alternatively, if it is required that the one-off transfer is deducted from the ETS surplus in the year when it is used for compliance with national ESR targets[52], it is expected to be more neutral with regard to the functioning of the MSR, i.e. not to reduce the amount of allowances to be fed into the MSR. This is due to the expectation that Member States benefitting from the one-off transfer will effectively experience more significant shortages in effort sharing sectors only in later years.

Distributional impacts

For effort sharing sectors

The one-off flexibility mechanism is aimed at Member States with a target well above EU average that is particularly challenging, as well as MT. If these Member States would decide to use it fully, it would in principle reduce any possible deficit and increase the overall surplus in the system (assuming of course that all Member States would continue to take all actions in-line with a cost efficient achievement of targets across the EU).

[52] According to MSR rules allowances are taken into account for the surplus indicator until they are surrendered for emissions.

Table 8 represents the maximum impact of the one-off flexibility on the gap over the period if used to the full by Member States.

While Luxembourg could not benefit from the target distribution, it clearly can benefit from this flexibility, even though it would require them to forego a considerable share of the auctioning revenues.

Option O3 would of course have the biggest impact but would clearly over-compensate the eligible countries in case of a high 2030 adjustment T3, with only LU still in a deficit.

Option O2 would close most of the remaining gaps when used in combination with a high 2030 adjustment, but not if done in combination with a limited 2030 adjustment T2.

What is clear is that any redistribution impacts in the ESR cannot be looked at only in isolation and need also to be assessed in conjunction with the other options, which will be done in section 6.

Table 13: Impact of the one-off flexibility for those that have a considerable gap over the period, using the EUCO30 projection

% of 2005 emissions	EU surplus (+) or deficit (-) over the period 2021-2030 with the EUCO30 projection (million tonnes)					
	T2			T3		
Options	O1	O2	O3	O1	O2	O3
LU	-15.7%	-11.7%	-7.7%	-15.7%	-11.7%	-7.7%
IE	-8.7%	-4.7%	-0.7%	-6.5%	-2.5%	1.5%
NL	-5.5%	-3.5%	-1.5%	-3.3%	-1.3%	0.7%
DK	-4.9%	-2.9%	-0.9%	-2.7%	-0.7%	1.3%
BE	-3.6%	-1.6%	0.4%	-1.4%	0.6%	2.6%
AT	-1.5%	0.5%	2.5%	0.7%	2.7%	4.7%
FI	1.5%	3.5%	5.5%	1.0%	3.0%	5.0%
SE	2.1%	4.1%	6.1%	2.1%	4.1%	6.1%

See annex 8.6 for a table similar as Table 13 with Member State results but then assessed using the EUCO27 projections, showing by and large the same impacts.

In the ETS

Under the ETS, the distributional impacts are proportional to the number of allowances that are transferred. For those Member States making use of the flexibility the amount of allowances they auction is reduced. The impact of the use of the one-off flexibility on the auctioning amounts also depends on the relative size of the ETS and ESR, as well as on the redistribution of allowances for auctioning in the ETS.

This can be seen in Table 14, with Malta only losing a bit less than 3% of its auctioning volume if it would use to the maximum its one-off flexibility equivalent to annually 2% of 2005 ESD emissions. This is because Malta has in relative terms an ETS sector that takes a much larger share of total emissions than for the EU average, and Malta benefits from the redistribution in the ETS and does not contribute to it like the other Member States eligible for the one-off flexibility. On the opposite side there is LU, where the ETS

sector covers less than 20% of overall emissions, and thus where maximum use of the one-off flexibility would consume a large portion of auctioning volumes.

Table 14: Estimated size of one-off flexibility expressed as share of auctioning volumes over period 2021-2030 with maximum use of one-off flexibility

Share of auctioning volumes over period 2021-2030 with maximum use one-off flexibility		
Options	O2	O3
LU	>40%	>80%
IE	20-40%	>40%
NL	<10%	10-20%
BE	<10%	10-20%
AT	<10%	10-20%
DK	<10%	10-20%
FI	<5%	<10%
SE	10-20%	20-40%
MT	<5%	<5%

It should be noted that the numbers shown in Table 14 do not take into account any additional reduction in auction volumes as a result of the placement of allowances in the Market Stability Reserve, reducing further the amounts available for auctioning.

For Member States not (eligible for) using the one-off transfer it would be beneficial if lower amounts are placed in the reserve, because this would lead to an increase in the number of allowances for auctioning.

Economic impacts

For effort sharing sectors

The one-off flexibility basically can increase supply for AEA transfers if Member States that don't need it would still opt to use it because they need to decide on it before the period starts, but it is unlikely that these high income Member States will be typical AEA sellers. On the other hand it can actually decrease supply if those Member States willing to sell decide to reduce their emissions less as in the cost efficient projections because they see fewer opportunities for transfers, as such increasing the risk that the EU overall will not achieve the -30% reduction.

But it certainly does reduce the shortages for those with an expected gap and thus will reduce demand for trading.

The impact on reduction of demand is highest of course with option O3. In combination with option T2 demand reduces more than in combination with option T3, because in option T2 most of the demand comes from Member States eligible for the one-off flexibility, while with option T3 this demand decreases and actually the demand increases from DE and FR, two countries contributing to the target adjustment and having no access to the one of flexibility.

Table 15: Development of Member States with a deficit and potential demand for AEAs, taking into account different options for starting point and one-off flexibility

MS with a deficit (potential buyers) over the period 2021 -2030 (million tonnes) (EUCO30 projection)	Options 2030 target adjustment	
Options one-off flexibility	T2	T3
O1	-235	-201
O2	-156	-135
O3	-89	-101

In the ETS

Use of the transfer from the ETS is likely to decrease the amount of auction revenues in the EU ETS for those eligible Member States that choose to make use of the one-off flexibility. This can lead to lower auction revenues being available for climate and energy measures. It could also reduce funds available for the compensation of indirect carbon costs of industry as a result of increased electricity prices.

There may be an impact due to changes in the carbon price, even though this is expected to be proportional to the overall reduction in the available supply of allowances. The overall cap or limit on the number of allowances in the ETS is some 15.5 billion allowances in 2021-2030. This means that while the flexibility would result in a reduction of auctioned allowances; this is limited in scale when compared to the overall number of allowances on the market.

Depending on the eligibility and amount of access, the allowances to be taken out of the EU ETS will have a differing impact on the power sector and on energy intensive industry which fall under the ETS. Installations in the power sector have to buy all allowances needed for compliance on the carbon market, and a decrease of the available supply would impact the carbon price. Any such impact will depend on the volume of allowances and the interaction with the Market Stability Reserve. A smaller impact on industry is expected, since the proposal for revision of the EU ETS foresees the continuation of free allocation to industry. Any potential price impact would therefore affect mainly those allowances which are purchased on the market while at the same time being offset by a higher value of free allocation.

Finally, lower auction volumes by those Member States opting to make use of the one-off transfer could be partially counterbalanced by any increase in the carbon price which could lead to more revenues from auctioning being available for climate and energy measures in other Member States.

Conclusion: The one-off transfer could in theory reduce mitigation costs for eligible MS, but would lead to diverse impacts both in ETS and in effort sharing sectors. For the latter sectors, access to the one-off flexibility needs to be based on the need for AEAs for compliance looking at the potential deficits over the whole period and taking into account the 2030 target adjustment. For instance if this 2030 target adjustment is high, it is not necessary to also give access to a high level of the one-off flexibility. Overall it will increase the risk of not achieving the -30% target because it will increase the surplus and thus at the same time increase the risk that Member States don't take the necessary action to achieve the 2030 targets (and thus reduce the surplus towards the end of the period).

Therefore a limited access to the one-off seems more appropriate than a large access to the one-off.

In the ETS, it can lead to either a decrease in the number of allowances placed in the MSR or a reduction of the surplus.

5.4. Assessing options for the integration of LULUCF

The Impact Assessment on agriculture and LULUCF assessed the limited mitigation potential for the agriculture sector as well as the potential for LULUCF to contribute to the mitigation effort, ensuring such actions are truly additional and benefit the overall net LULUCF sink in the EU.

Agriculture is expected to reduce emissions less than other sectors by 2030. For the 2030 framework impact assessment[53] projections with higher levels of energy efficiency typically saw agricultural non-CO2 emissions be reduced by less than 30%, with the lowest reduction projected at -19% compared to 2005. The projections for the 2050 low carbon economy roadmap saw these emissions go down by around 20% by 2030[54]. The Impact Assessment for agriculture and LULUCF indicated that the impacts on agriculture production even at levels of -20% may be considerable though impacts are significantly abated with lower reduction levels of -15% as well as in cases in which public resources are specifically channelled to meet the mitigation effort in the sector.

The more recent EUCO27 scenario sees a lower need for reductions in agriculture than the scenarios used for the 2030 framework impact assessments. It sees agriculture non-CO2 reductions by 2030 in the order of only 10% below 2005 emissions and the EUCO30 scenario sees limited need for additional action for non-CO2 emissions beyond the baseline (EU Reference scenario 2016)[55] if also an energy savings level of 30% can be achieved while overall reduction in the ESR are kept at 30%.

If agriculture and other non-CO_2 emissions would reduce more than in the Reference scenario, and at the same time 30% energy savings would be achieved, then there could potentially be overachievement of the target in the ESR, and thus also of the at least -40% economy wide target compared to 1990.

Thus, depending on the Member State, i.e. the relative size of its sectors in the ESR and the ambition of its overall ESR target, reducing emissions can be more challenging for those countries that have a large share of agriculture emissions. Similar to the assessment in section 5.1.2, Figure 7, if larger amounts of reductions need to come from the energy sector, then typically less overall emission reductions will be achieved in those countries with the largest share of agriculture sectors in the ESR emissions.

To enable the land sector to contribute, it is proposed to allow a limited amount of LULUCF credits for compliance in the ESR. This access has to be limited, because potentially the supply in the LULUCF sector can still turn out to be large, even bigger than the around 972 million of additional reductions needed over the period 2021-2030

[53] SWD(2014)15
[54] SEC(2011) 288 final
[55] The non-CO2 emissions in the ESD in the 2016 Reference scenario decrease already by 26%, much higher than in the 2013 Reference where they only decreased by 15%. The main reasons are updated inventory guidelines that result in larger reductions in historic emissions in the waste sector and the implementation of the F-gas regulation that is already consistent with long term decarbonisation objectives.

compared to the Reference (see Table 5). In order not end up in a situation that no additional effort is needed within the ESR beyond the EU 2016 Reference scenario, a clear limit needs to be placed on the amount of LULUCF credits entering the ESR.

The level of access will be linked to the size of the agriculture sector in the ESD. This recognises that countries with a large agriculture sector potentially face a much stronger constraint in achieving their reduction target, with certainly less impact on overall reductions of actions undertaken to reduce energy emissions in the ESR. Still, all Member States should have access in order to stimulate the preparation of an integrated strategy for reducing emissions for all sectors using land.

The impact assessment for Agriculture and LULUCF looks in more detail into the rules necessary to ensure LULUCF mitigation action is real and additional, as well as what the specific impacts are in the agriculture and land use sectors. The impact assessment also examines the degree to which action may be used to provide flexibility, i.e. the conversion of mitigation in the LULUCF sector into credits that can be used for any shortfall in the ESR, notably to compensate for any challenges related to mitigation in the agriculture sector. This section will analyse what the utilisation of such credits would mean for the ESR at large.

If all LULUCF mitigation would be able to enter the ESR, even if a Member State would not need it for its own compliance, it would increase the total supply in the market and thus increase the supply for AEA transfers. This would further reduce any incentives coming from the transfer flexibility itself for additional emission reductions to create AEAs available for transfers.

Therefore LULUCF credits are assumed to enter the ESR to the extent that a Member State would need it to achieve their own ESR target, but not beyond that. Such credits are intended to stimulate real and additional action in the LULUCF sector for those Member States that have challenges related to the achievement of its overall non-ETS target, closely linked to the size of its agriculture sector in the ESR.

This approach should ensure sufficient incentives remain to decarbonise the sectors within the ESR, while taking into account specific concerns related to the lower mitigation potential in the agriculture sector. LULUCF credits generated in the LULUCF sector that are not needed for compliance in the ESR by a Member State can remain in the LULUCF sector and can be traded in the LULUCF sector.

The table below presents the option assessed in relation to the distribution, Member State by Member State, of the limits on LULUCF credits entering the ESR, which is in total equivalent to 280 million tons over the period 2021-2030 (see also Impact Assessment for agriculture and LULUCF on a further assessment on the level of this flexibility).

In this option a Member States is granted a level of access to LULUCF credits for possible use in the ESR that corresponds to its share of agriculture non-CO2 emissions in the ESD. The limit is expressed as percentage of agriculture non-CO2 emissions.

Table 16: Distribution of LULUCF credit limit on the basis of the share of agriculture non-CO2 in the ESD

	Share of agriculture non-CO2 emissions in ESD 2008-2012*	Average annual limit of LULUCF credits as a % of annual 2008-2012 agriculture emissions	Total limit of LULUCF credits over the period 2021-2030 in million tonnes**	Average annual limit of LULUCF credits as a % of annual 2005 ESD emissions)
EU	**16%**	**6%**	**-280**	**1.0%**
IE	40%	15%	-26.8	5.6%
LT	28%	15%	-6.5	5.0%
DK	27%	15%	-14.6	4.0%
LV	25%	15%	-3.1	3.8%
RO	24%	7.5%	-13.2	1.7%
BG	21%	7.5%	-4.1	1.5%
FR	20%	7.5%	-58.2	1.5%
EE	20%	7.5%	-0.9	1.7%
FI	18%	7.5%	-4.5	1.3%
ES	18%	7.5%	-29.1	1.3%
SE	16%	7.5%	-4.9	1.1%
CY	16%	7.5%	-0.6	1.3%
EL	16%	7.5%	-6.7	1.1%
PT	16%	7.5%	-5.2	1.0%
NL	15%	7.5%	-13.4	1.1%
SI	15%	7.5%	-1.3	1.1%
PL	15%	7.5%	-21.7	1.2%
HU	14%	3.75%	-2.1	0.5%
SK	14%	3.75%	-1.2	0.5%
UK	13%	3.75%	-17.8	0.4%
HR	13%	3.75%	-0.9	0.5%
AT	13%	3.75%	-2.5	0.4%
BE	13%	3.75%	-3.8	0.5%
DE	13%	3.75%	-22.3	0.5%
CZ	11%	3.75%	-2.6	0.4%
IT	10%	3.75%	-11.5	0.3%
MT	8%	3.75%	-0.03	0.3%
LU	7%	3.75%	-0.25	0.2%

* Rounded to the nearest percentage
** Calibrated to match 280 million tonnes

Source: Table based upon distribution key of proportion of ESD using National inventories (Mar 2016)

Beneficiaries with the highest relative access to LULUCF credits are IE, LT, DK and LV because of their high shares of agriculture emissions. These Member States potentially are allowed to use per annum on average the equivalent of around 4% or more of its 2005 ESD emissions, with IE having a limit the equivalent of 5.6% of 2005 ESD emissions. The group of Member States with low agriculture shares would potentially be allowed to use per annum on average the equivalent of less than 0.5% of its ESD emissions.

Environmental impacts

If a Member State decides to compensate any shortfall in its ESR target with LULUCF credits, assuming that the Member States can effectively generate these credits in the LULUCF sector, then the reduction in the ESR itself will be below the reduction target.

Taking into account that the use of LULUCF credits can be banked within the period, and assuming maximum use of LULUCF credits up to the full 280 million credits, then this could potentially cover an underachievement of the ESR target in 2030 of roughly 2 percentage points[56].

This should not pose an environmental concern for the non-ETS as a whole as long as linking the two sectors leads to real additional action in the LULUCF sector and generates corresponding increases in the net LULUCF sink. As LULUCF credits will be generated by efforts made primarily in agriculture, this flexibility will also drive a more integrated development of the agricultural sector in response to climate obligation, with larger environmental co-benefits.

Moreover, in the longer term it does allow to gradually develop the path to balancing of emissions (post-2050) as foreseen in the Paris Agreement

But a clear limit to LULUCF credits will also be needed to prevent undermining overall efforts in the ESR sectors.

This flexibility option should be mainly directed towards those Member States that have real difficulty to achieve the ESR targets domestically, recognising in this context the specific situation of the agriculture sector.

The actual amount of LULUCF credits eventually being used in the ESR will depend on many factors, such as:

- Would Member States prefer to achieve their target in the ESR or will they rather want to invest or even step up LULUCF activities and generate credits that they can use in the ESR?
- If Member States would have a deficit, to what extent would Member States rely on existing flexibilities between Member States when they cannot achieve their target in the ESR?
- To what extent will those that are entitled to use the one-off flexibility from the ETS to the ESR effectively use it?

As Member States have different options at their disposal to accomplish ESR compliance, it is not possible to predict with full accuracy how many LULUCF credits will be used in the ESR.

If in the extreme case, emissions in all Member States fell short of their target, and assuming that none used the one-off flexibility, then up to 280 million LULUCF credits would be used fully.

[56] See Table 16, on average over the period option L2 allows the equivalent per annum of 1% of 2005 emissions. Assuming that in 2021 nothing would be used of this credit limit and that then gradually in a linear increasing manner all LULUCF credits would be used for compliance by 2030, resulting in 2030 in a LULUCF credit use equivalent to maximum 2%.

On the other extreme, if emissions in all countries were reduced as modelled in the EUCO30 scenario and thus achieved the -30% target already in the ESR (at least at the overall EU level), if a large target adjustment was foreseen for high income Member States (T3) and access to the one-off would be used to the maximum (O3), then the need for LULUCF to compensate for potential deficits in the ESR would be as low as 74 million.

Nevertheless, even in this scenario, maintaining national ceilings of LULUCF credits that would sum up to 280 million LULUCF at EU28 level would ensure Member States an appropriate level of choice on how to combine different flexibilities. This would in particular be of importance if baseline emission reductions don't materialise as modelled in the EUCO30 scenario.

Distributional impacts

Actual use of the LULUCF flexibility in the ESR will be highly dependent on what the eventual real reductions will be in each Member State and to what extent they would use other flexibilities.

The table below looks at the use by high income Member States only and what the impact is of the use of LULUCF credits and the potential target adjustments and new flexibilities introduced.

If high Income Member States will not reduce emissions beyond Reference, and use LULUCF credits in part to comply with their target, next to the use of transfers between Member States, than we see an inflow of 151 million LULUCF credits into the ESR, with only UK not needing to use it.

Instead, if high income Member States will not reduce emissions in the ESR in line with the EUCO30 projections then they only use 98 million LULUCF credits, with also DE, FI, FR, SE, UK not using their LULUCF credits while LU, DK, IE, NL, AT and BE would potentially use it to the maximum limit.

If a large target adjustment would be agreed (T3), then the use of LULUCF credits might increase, because notably FR and DE would see a deficit that is increasing in the ESR and thus potentially an increased use of LULUCF credits by them (assuming they do not use existing flexibilities between Member States), while such a target adjustment would still see deficits in LU, IE, NL and BE that would potentially be covered by a maximal use of their LULUCF credits.

When these countries have access to a high amount of one-off flexibility and decide to use it to the maximum (O3), then the potential use of LULUCF credits would decrease in these high income Member States below their limit, with the exception of LU and the NL.

Table 17: Use of LULUCF credits by high income Member States, impact on distribution of use depending on choice of flexibilities using the EUCO30 projection

Million ton	Reference	EUCO30	EUCO30	EUCO30
	T1	T1	T3	T3
	O1	O1	O1	O3
All High Income Member States	151	98	128	74
LU	0.2	0.2	0.2	0.2
SE	5	0	0	0
DK	15	15	10	0
IE	27	27	27	0
NL	13	13	13	0
AT	2	2	0	0
FI	5	0	0	0
BE	4	4	4	0
DE	22	0	16	16
FR	58	36	58	58
UK	0	0	0	0

See annex 8.6 for a table similar as Table 17 with Member States results but then assessed using the EUCO27 projections, showing by and large the same impacts.

When looking at the EUCO27 and EUCO30 scenarios almost no low income Member State makes use of LULUCF credits for compliance in the ESR. But the WEM-EXTRA scenario is more conservative, with CY, ES, IT, LV, MT, RO and SK also using LULUCF credits to achieve compliance in the ESR.

Economic impacts

The use of LULUCF credits, as well as the use of the one-off flexibility typically reduces the need for any other transfers between Member States. If high income Member States would reduce emissions in-line with the EUCO30 scenario, then demand for credits or transfers could be as high as 282 million units (in case of the EUCO27 scenario this is 319 million units). Instead with the adjustment of targets and the maximum use of the one-off flexibility, the maximum use of LULUCF credits by these countries would decrease to levels below 100 million.

Of course this also assumes that ESR emissions are effectively reduced to -30% as in the EUCO27 and EUCO30 projections. In real life emissions might reduce less if for instance Member States with LULUCF credits for use in the ESR for compliance decide to reduce emissions in the ESR itself less.

Conclusion: Access to LULUCF credits can help to face any challenges seen with achievement of ESR targets, in particular for those Member States with a higher share of agriculture emissions. Overall it is expected that especially high income Member States with the highest overall targets will make most use of it, but also lower income Member States can benefit from it if emissions are not reduced as projected.

5.5. Assessing policy options for enhanced flexibilities

The assessment is divided into two parts: inter-temporal flexibility and inter-Member State flexibility.

5.5.1. Inter-temporal flexibility

In the *policy baseline option F1*, unused AEAs may be banked and used in subsequent years within the ESR compliance period[57]; AEA allocations from the following year may be "borrowed" to cover the current year's emissions up to a limit of 5%. Additional flexibility is available to Member States for the years 2013-2014 under the current ESD in the event of "extreme meteorological conditions"; in such cases a Member State can request an increased borrowing limit which may be granted by the European Commission on a case-by-case basis. Banking and borrowing activities within the period are accounted for in the Union Registry where compliance is monitored and checked by the European Commission.

Policy option F2 would consist of an increase in permitted borrowing to 10%, reduced to 5% from 2026 and onwards (i.e., a limit of 5% for borrowing from the subsequent year to cover any deficit in 2026 and onwards).

Environmental impacts

Option F2 would allow time for Member States to respond to any unexpected lack of availability of either domestic abatement or AEAs from other Member States by introducing additional policies to secure further abatement in the later years of the period and thus compliance with the 2030 target. On the other hand, compared to the baseline, this option could increase the risk of non-compliance for individual Member States in later years of the commitment period if substantial borrowing takes place early in the period.

Distributional impacts

Because of a higher level of allowed borrowing in the first part of the compliance period, *option F2* might delay or reduce any demand for AEA transfers from Member States that are expected to have a shortage of AEAs over the period and could thus lead to lower or delayed stimulus for transfers compared to the *baseline option F1*.

Economic impacts

Option F2 would enhance the flexibility for Member States compared to the baseline option F1 in managing the use of AEAs over the whole commitment period to cover any shortage in specific years. It may enable Member States greater time to introduce new mitigation policies with a longer lead-in time but with long-term cost-efficiency. This option could thus help alleviate compliance costs over the whole period for some Member States. However, allowing Member States to borrow at higher levels, rather than make up a shortfall in allocations through purchases from other Member States, could lead to less use of cost-effective abatement potentials in other countries.

[57] Member States can also cancel any surplus AEAs after the annual compliance check if they want.

Option F2 would also remove the need for any administrative procedures related to additional requests from Member States for increased borrowing in the case of extreme weather events and therefore reduces the administrative burden.

In conclusion, both option F1 and F2 imply quite a high degree of inter-temporal flexibility, so both of them will be included in the option packages in section 6.2.

5.5.2. Inter-Member State flexibility

When assessing policy options for inter-Member State flexibility, it needs to be considered to what extent existing flexibility instruments should be enhanced in order to stimulate further transfers of AEAs between potential "seller" and buyer" countries. As the analysis in the previous sections demonstrate, this will to a large extent depend on what would be the expected demand from a limited number of high-income Member States after applying the policy options for targets and new flexibilities described.

There are two types of enhancement that could be considered for AEA transfers. The first approach would consist of the facilitation of AEA transfers between potential "seller" and "buyer" countries, for example by using a central place. Issues of particular relevance in designing this type of flexibility include the timing of transfers, whether participation is voluntary or mandatory, and the nature of the trading place.

The second type of enhancement is to link AEA transfers to additional mitigation action in Member States. Such action could be project-based (e.g., similar to joint implementation under the Kyoto Protocol) or programme-based (such as green investment schemes[58]). Project-based and programme-based[59] mechanisms are based on the same principle as AEA transfers but involve some means of identifying and monitoring specific mitigation activities in a "host Member State", from which part of the emission reductions would be transferred in the form of AEAs to a "buyer Member State", in return for funding to provide the activities with an incentive to proceed.

The policy baseline option F1 is to keep in the ESR the existing "hands-off" approach for AEA transfers in the ESD as described in Section 4.5 with no further enhancement. As under current rules it would be up to Member States to decide if, when and how they should transfer any AEAs. Transfers of up to 5% of national annual emission allocations (before the annual compliance checks) and any volume of surplus allocation (after compliance checks)[60] between Member States are possible, with no required interference or facilitation by the European Commission or any other third parties.

The other options are described in section 4.5 and include:

- Option F3: Central information site
- Option F4: Central market place for AEA transfers

[58] Green investment schemes (GIS) were used by some Member States under the Kyoto Protocol's first commitment period. Set up by the host countries, GIS earmarked funds from the sale of emission allocations under the Kyoto Protocol for use in climate mitigation activities to ensure environmental integrity of international emission trading.

[59] In a programme-based approach a Member State would promote emission reductions in certain sectors or through specific actions under the ESD rather than through individual projects. Parts of any emission reductions would be transferred in the form of AEAs to a buyer or investor Member State.

[60] Any resulting AEA transfers have to be reported to the Commission by 15 January of the following year.

- Option F5: Mandatory auctioning

For all AEA transfer options considered here the quantitative limit for selling AEAs before the compliance check would be the same as for borrowing[61].

Environmental impacts

Key criteria for environmental impacts is to what extent the policy option contributes to environmental effectiveness by achieving Member State and EU emission reduction targets, and whether it provides incentives for additional emission reductions.

The policy baseline option F1 with bilateral transfers allowed at any time provides sufficient flexibility to a Member State willing to resort to this option to ensure its compliance with the ESR targets in a timely manner.

Options F3 and F4 are similar to the baseline option in this respect.

Option F5 could help individual Member States to close any compliance gap but it would also restrict the compliance options for those Member States that would have to make part of their surplus AEAs available to others through auctioning.

Environmental integrity will also depend on what the revenues from such transfers will be spent on in Member States. Earmarking of the revenues from the sales of AEAs for investments in further emission reductions, sustainable energy or other environmental protection would help reaching EU climate and energy policy objectives.

Distributional impacts

The policy baseline option F1 could have distributional impacts depending on the extent to which Member States would engage in AEA transfers, where those Member States selling AEAs would gain additional revenue.

Options F3 and F4 are similar to the baseline in this respect.

With respect to project-based activities (which could occur in any of options F1, F3 or F4), in theory, projects would be most attractive in those countries where reduction costs are the lowest and so investments in additional emission reductions would be directed to them. There would be a flow from countries with high abatement costs to countries with lower abatement costs, which also tend to be Member States with lower-than-average GDP per capita. This is in line with the objective to enhance cost-efficiency and fairness across the EU. Additional emission reduction projects could also provide benefits in terms of increased local employment and income.

It should be noted that potential investor countries might be influenced by other factors than short-term cost-efficiency when considering whether to invest in additional mitigation action and might therefore chose to do it at home or in a country with other incentives or favourable conditions (i.e., not necessarily where mitigation costs are lowest) for engaging in emission reduction projects. The actual distribution of any such projects across the EU in terms of countries and sectors is therefore difficult to predict.

[61] In the current ESD a 5% limit applies for both borrowing and AEA transfers before compliance has been checked.

Option F5 would have distributional impacts as Member States would have to make some of their surplus AEAs available for transfers through auctions. This could benefit those Member States in need of additional AEAs if they could purchase AEAs at a lower cost than additional reductions at home, but would limit the choice for Member States generating surplus AEAs.

Economic impacts

The main criteria are the cost-effectiveness (including transaction and administrative costs) of meeting EU-wide and individual Member State targets and the potential for developing a liquid market for AEAs, including transparency of AEA transfers.

The policy baseline option F1 gives full flexibility to Member States in choosing when and how to engage in AEA transfers and time to assess the costs and benefits of other flexibility options and compliance strategies. However, it is not fully transparent or satisfactory in providing price information as transfers are only reported and made public ex-post. This makes the market less predictable. While this approach would avoid the need for costs to fall on the EU level, it may lead to inefficient results.

Also in option F3 Member States would have flexibility in using AEA transfers but would have to choose a central place for sharing information on their willingness to engage in transfers. This option could contribute to more efficient transfers thanks to more transparent and timely information. The information place could be a simple web-based tool with access to Member States operated by the Commission or another European institution. The costs of setting up and running such a facility would be relatively modest.

An even lower administrative cost would be an arrangement where Member States would report regularly to the Commission over the period, thus not allowing for real life information updates but nevertheless providing useful information on the intentions to engage in transfers per Member State and thus also paving the way for subsequent transfers.

Option F4 creates greater incentives for trading and would provide a stronger price-setting function compared to the baseline. Even if this would be a voluntary market place it could potentially be attractive for selling Member States to get an early indication of price for AEAs and could be used as benchmark for other bilateral transfers. It could also offer a more effective way of identifying cost-efficient abatement potentials identified across the EU.

For option F5 the regulatory and administrative burden related to the establishment of a central auctioning place would be considerably higher compared to the baseline where there is no designated trading place for AEA bilateral transfers. It is difficult to assess the costs and procedures that would be needed, but taking the ETS auction platform which is jointly procured between the Commission and most Member States as a benchmark, it is clear that setting up a parallel auction platform for AEAs would imply very considerable costs, legislative risks and administrative burden. It should also be noted that the ETS platform, thanks to very large volumes generates substantial revenues for the auction platform that finances its operation. That would not be the case for an AEA trading platform as it would have much lower volumes.

A benefit of option F5, if it would function, is that it could create a price-setting mechanism. The auction price could then be used as benchmark for other (bilateral)

transfers and provide some certainty for Member States engaging in transfers. It would also address the issue of market liquidity through making a part of surplus AEAs available to Member States at auctions. However, a significant disadvantage of this option is that creating auctions with so few market actors risks generating very small volumes and unstable price outcomes. It also creates high risks for gaming as Member States would be both buyers and sellers on the same market. Forcing Member States to sell off AEAs they think they may need later in the period will impact on Member States' own planning and is expected to lead to strong negative reactions from the concerned Member States. The utility of such a compulsory auctioning for the buying Member States would also depend on the compliance option chosen. For example, compliance checks every five years would only allow for ex-post auctioning after five and ten years and would therefore make the idea of a central auction place less attractive, since setting up such a system to be used twice over a ten year period would lead to high administrative costs and difficulty to maintain knowledge. Overall, the practical and political drawbacks with mandatory auctioning overweigh any positive impact.

Conclusion: All three policy options F3, F4, and F5 could enhance inter-Member State flexibility, but it is deemed that F5 too much infringes Member States' right to plan and manage their own resources, and therefore will not be included in the possible option packages. F4 would be feasible, but it would imply quite significant regulatory and administrative costs, for a limited and very uncertain benefit. It is therefore not included in the assessment of option packages.

5.6. Assessing policy options for administering compliance

The three policy options for compliance presented in section 4.6 are assessed below.

Environmental impacts

Thanks to the continued annual reporting and publishing of GHG emissions, feedback on Member State and EU progress towards their targets would be ensured for all options and a Member State will have sufficient information on emissions to design and implement any additional mitigation action in time for meeting their obligations under the non-ETS.

With continued annual emission limits and compliance requirements a strong incentive for being on track with the linear trajectory towards the 2030 targets will remain for Member States. This is important in order to ensure that Member States are not tempted to postpone actions that may be necessary but politically more challenging to implement.

For these reasons option C2 with biennial compliance checks would not or only marginally change the environmental effectiveness compared to the policy baseline option C1 with annual checks.

For option C3 the risk of Member States not complying could be somewhat higher compared with annual checks as the control will be performed for five years at a time. However, thanks to annual emissions reporting, and a close follow-up by the Commission on Member States' progress towards their targets, this risk should be manageable as incentives for compliance similar to the existing system will be maintained. Member States' progress towards their 2030 targets would be monitored every year as part of the progress report published by the Commission. This procedure complements the compliance checks by providing early warning in case Member States are lagging behind with their obligations.

Distributional impacts

Less frequent compliance checks could in theory delay and reduce the frequency of AEA transfers. This could lead to weaker incentives for making AEAs available through additional mitigation action in Member States with lower emission reduction costs as any surplus AEAs would be available later (and less frequently) compared to the baseline option. Although option C2 is not likely to influence this much relative to the baseline, option C3 could have such an effect. However, as discussed below, this impact is uncertain.

Economic impacts

Regular compliance checks are needed to confirm with certainty whether surplus AEAs are available for transfers and to stimulate a liquid market for AEAs. However, AEAs can be traded at any point in time (even if the actual transaction of AEAs would take place later), and thus also before compliance checks have been performed.

Policy option C2 is not likely to lead to any significant economic impacts with respect to AEA trades compared to the policy baseline, in terms of overall cost-efficiency.

At first sight it may appear that option C3 with two compliance checks in the compliance period would be less efficient from an EU perspective compared to the policy baseline option because it could reduce the incentive for early AEA trading. However, as explained above, it is not likely to have this effect, because trade can take place anytime.

Continued annual reporting of emissions will help Member States identifying any demand for additional AEAs and make transfer agreements in advance of the compliance check, also in the case of option C2 and C3 with checks every 2 and 5 years, respectively. Member State can decide on any need to buy or possibility to sell AEAs on the basis of their annual reporting and regular updates of emission projections. It is therefore difficult to assess the actual impact of less frequent compliance checks on liquidity as they would not necessarily have a significant effect on the timing of transfers, provided annual reporting will continue as proposed.

It should also be considered that the compliance checks also incur administrative costs, mainly because of the requirements of the inventory review, especially on EU-level for the Commission and the European Environment Agency (EEA).

The policy baseline option C1 continuing with annual checks and inventory reviews has the highest administrative costs for Member States and the Commission. The cost for the Commission (including the EEA) of the current system for reviewing emission inventories and checking compliance is in the order of 650.000 EUR per year, while the annual costs for all 28 Member States taken together is estimated to be in the order of 500.000 EUR per year. These costs include administration of other reporting obligations under the ESD, which are separate from the emissions reporting and compliance check[62].

Policy option C2 would alleviate the administrative burden on both the Commission and the Member States of organizing the review every year as emission inventories for two years can be easily reviewed at the same time. The total administrative costs over the

[62] Source: *Supporting study for the Evaluation of Decision No. 406/2009/EC (Effort Sharing Decision)*, Ricardo Energy & Environment with Trinomics and Vito, December 2015

whole commitment period would be lower compared to the policy baseline. Some of the reduced costs would be offset by the fact that the checks would be performed for two years (instead of one year) each time, which would require more effort in terms of person-days needed per check. All things considered, a reasonable estimate of the total costs over the whole commitment period, including for the Commission, the EEA and Member States, for this option would be 60-70% of the total costs for the policy baseline option or in the order of 690.000 to 800.000 euro per year.

The costs for option C3 would be lower than for the policy baseline option, and also lower than for option C2. However, some of the reduced costs would be offset by the fact that the inventory reviews every 5 years would have to be more extensive with respect to the checks and controls than the annual inventory reviews under the current system in the policy baseline option. The inventory reviews and compliance checks would also be more work-intensive as they would cover five years of activity (instead of one year) and would be more demanding in terms of quality assessment and control[63]. Overall the total costs for this option over the whole commitment period are estimated to be in the order of 40-50% of those for the policy baseline option.

Other impacts

Policy option C3 would in effect synchronise the current ESD compliance cycle with the foreseen LULUCF 5-year accounting and compliance cycle when the amount of any LULUCF credits available for compliance as described in section 5.4 would be determined. Furthermore, it would also align the EU compliance cycle with the international Paris implementation cycle which foresees a global stocktake every five years, starting in 2023. For example, results from the EU compliance check in 2027 would be available in time for the global stocktake 2028.

As mentioned earlier, the experience so far from administering an annual compliance cycle under the current ESD suggests that it is difficult to complete the whole cycle from the submission of emission inventories to the final compliance check in the Union Registry within the same year. This makes the current system unpractical. The policy baseline option C1 has also the highest administrative burden of the alternatives assessed here. Therefore, this option is not considered for the comparison of options in Chapter 6.

With respect to businesses in general and SMEs in particular there are no reporting obligations for enterprises under the ESD and the proposal would not change this situation (see also annex 8.3).

Conclusion: The current system of annual reporting of emission under the ESD is well established and widely supported. Annual reporting with continued annual emission limits and compliance requirements are important to ensure Member States' progress towards their 2030 obligations. Less frequent compliance checks would reduce the administrative burden and align the ESR compliance cycle with that of the LULUCF and also with the international cycle under the Paris Agreement. Maintaining the current reporting system but switching to compliance checks every 5 years would reduce total administrative costs by 50-60 percent or in the order of 5.750.000 to 6.900.000 EUR for the period 2021-2030.

[63] Because the longer time between the inventory reviews in option C3 (five years instead of one or two years), the results of previous reviews would be less useful when checking the consistency and quality of the submitted emission inventories. For these reasons an inventory review every 5 years is estimated to cost two to three times more than an inventory review performed every year.

6. HOW DO THE OPTIONS COMPARE?

The main policy options assessed relate to the potential methods for setting national targets in line with an overall reduction of 30% in the non-ETS compared to 2005 by 2030 and to allow for flexibility in a manner that is fair, takes into account cost-efficiency concerns and ensures environmental integrity. On the basis of the extensive analysis of the individual options in Section 5, section 6 provides a comparison of the options and a summary analysis covering all elements through the combination of options and the trade-offs presented therein in terms of effectiveness, efficiency and coherence. It does this separately for targets and target level related flexibilities which cannot be considered in isolation (section 6.1) and for other flexibilities and compliance which are options relevant regardless of the target related choices (section 6.2).

6.1. Comparing and combining the approaches to 2030 target setting, starting point, one-off flexibility and access to LULUCF credits

The European Council confirmed that the EU has to reduce emissions by 30% in 2030 compared to 1990 in the non-ETS sectors to contribute to the at least 40% economy wide by 2030 GHG target compared to 1990.

The European Council also gave guidance for effort sharing, i.e. how to distribute the targets among EU Member States, confirming a distribution based on GDP per capita as the appropriate method to address fairness, while asking to look into additional options to address cost efficiency concerns for high income Member States. As the assessment in section 5 points out, indeed a number of high income Member States would see a big gap between 2030 targets based only on GDP per capita, and reductions typically associated with EU wide cost-efficient reduction projections.

To address this the European Council asked to look at redistributing the GDP per capita based 2030 targets within the group of high income Member States to reflect cost efficiency in this group, to use to a limited extent a newly created one-off flexibility from the ETS for those countries with particularly high and challenging targets, and to integrate LULUCF into the 2030 framework, recognising in particular the lower mitigation potential of the agriculture and land use sector.

The impact of these options cannot only be assessed in isolation. This section looks at the impact of combinations of these options. Combination 1 represent a combination of options that does not take into account these cost efficiency concerns, while combination 2 and 3 do take it into account:

Combination 1 (T1, O1, L1): This combination represents the baseline options and does not specifically address cost efficiency concerns for those countries that are typically projected to have a large gap between targets based on GDP per capita and cost efficient emission reduction projections. The 2030 target is simply based on GDP per capita (option T1), there is no one-off flexibility from the ETS into the ESR (option O1) and there is no access to LULUCF credits for compliance in the ESR (option L1). All remaining deficits and surpluses would need to be balanced by intra-MS flexibilities.

Combination 2 (T2, O2, L2): This combination addresses cost efficiency concerns for those countries that are typically projected to have a large gap, but does so in a moderate way.

The 2030 targets are adjusted[64] by increasing the target for DE, FR, and UK by 1%, while reducing it for AT, BE, DK and NL by 3% and for IE and LU by 9% (option T2). The one-off flexibility would be available for all high income Member States except DE, FR and UK and limited to a total amount just below 100 million tonnes (option O2).

Access to LULUCF credits is allowed. Overall the amount is assumed to be limited to maximum 280 million credits over the period 2021-2030 (option L2). This access is distributed to Member States on the basis of their share of agriculture non-CO2 emissions in the ESD.

Combination 3 (T3, O3, L2): Similar to Combination 2, but addresses cost efficiency concerns for a number of high income Member States in a more maximalist way.

2030 targets are adjusted[65] by increasing the target for DE, FR, and UK by 2% and for FI and SE by 1%, while reducing it for AT, BE, DK and NL by 7% and for IE and LU by 13% (option T3). The one-off flexibility is available as in combination 2 but with an increased amount to just below 200 million (option O3). Access to LULUCF credits for compliance in the ESR is as in combination 2 (option L2).

Comparing combinations at Member State level

Table 18: Member State impacts of Combinations 1 and 2

	Annual average deficit (-) or surplus (+) over the period 2021-2030 (as % 2005 emissions)			
Projection used	EUCO30			
2030 Target Adjustment	No	Yes, T2		
One off flexibility	No		Yes, O2	
LULUCF credits (if needed)	No			Yes, L2
Combination	**Comb. 1**			**Comb. 2**
LU	-15.7%	-15.7%	-11.7%	-11.4%
SE	2.1%	2.1%	4.1%	4.1%
DK	-5.5%	-4.9%	-2.9%	0.0%
IE	-13.6%	-8.7%	-4.7%	0.0%
NL	-7.2%	-5.5%	-3.5%	-2.4%
AT	-3.2%	-1.5%	0.5%	0.5%
FI	1.5%	1.5%	3.5%	3.5%
BE	-5.3%	-3.6%	-1.6%	-1.1%
DE	0.8%	0.2%	0.2%	0.2%
FR	-1.0%	-1.5%	-1.5%	0.0%
UK	4.0%	3.5%	3.5%	3.5%

In Combination 1 (see second column Table 18), where no specific measures are taken to address cost efficiency concerns, LU and IE would have particular large gaps over the period between cost efficient projections and their targets. Their average annual deficit over the period would be larger than 10% of 2005 emissions, with increasing amounts

[64] Before application of the maximal range of targets from 0 to -40% compared to 2005.
[65] Before application of the maximal range of targets from 0 to -40% compared to 2005.

towards 2030. This is very large. Also DK, NL, AT and BE would have considerable average annual deficits over the period.

Combination 1 is hence not consistent with the objectives of this initiative and not coherent with the 2030 framework agreed by the European Council. It is presented only as baseline option for comparative purposes.

With the introduction of a redistribution of the 2030 target according to option T2 (see third column Table 18), the gap reduces for all Member States except LU.

For LU, the benefit from target redistribution is small compared to the benefit it receives from the fact that targets are capped at maximal -40%, due to its particularly high GDP per capita. Similarly also Denmark benefits only in a limited way, with its target being reduced from -40% to -39%[66].

But in the other concerned Member States, AT, BE, IE and NL the target correction of 3% would have a substantial impact on the deficit over the period. It would reduce by a quarter to half for all of them.

Instead for those Member States seeing increases in their target by 1% (DE, FR, and UK) impacts remain limited.

The one-off flexibility further reduces cost efficiency concerns in the group of high income Member States. Assuming eligible Member States use the one-off flexibility to the maximum and assuming they achieve the same cost efficient reductions as in the EUCO30 projections, then the deficits over the period could already reduce to very low levels for AT (see fourth column Table 18). Even for Ireland the deficit could reduce to levels one third of the deficit compared to option T1.

Of course, making use of this one-off flexibility to the maximum limit has also a cost attached in the form of foregone ETS auctioning revenues for these Member States.

Finally the use of LULUCF credits can further reduce the pressure on the remaining gap (see fifth column Table 18). In principle the LULUCF limit, defined as a % of 2008-2012 agriculture non-CO2 emissions is big enough for IE and DK to eliminate domestically any remaining gap. Of course this outcome would depend on them effectively mobilising sufficient additional actions that really enhance the sink in their country sufficiently (see also LULUCF and agriculture Impact Assessment).

Also FR, which does not benefit directly from any of the measures to address cost efficiency can use LULUCF to compensate its gap (be it a limited one). Instead BE and NL, even if the LULUCF credits limit is used to the fullest, would still see a gap, be it a significantly reduced one in relative term. Of course this gap can be further closed by the use of transfers between Member States.

The only country that sees a remaining large gap is Luxembourg, mainly due to it very high GDP per capita level, as well as the fact that it benefits potentially less from the LULUCF credits given its small agriculture sector in relative terms. But in principle there should be sufficient supply available for transfer in the ESR to cover LU needs.

[66] Without the application of a maximum range, DK would have received a target equal to -42%. In option T2 this is reduced with 3% resulting in a target of -39% for DK. But of course after application of the maximum range, it only results in a reduction of 1% for DK, from -40% to -39%.

In the above assessment of Combination 2, Member States that are eligible for the one-off flexibility, are assumed to use this to the maximum limit. In reality Member States might choose to use other combinations of flexibilities, with for instance less use of the one-off flexibility and more use of LULUCF credits or more use of the existing flexibilities.

But this would overall not change the assessment that the target adjustment and the foreseen flexibilities in Combination 2 address cost efficiency concerns for the group of high income Member States.

Table 19 below gives the impact for the high income Member States of Combination 3, which caters much more explicitly for cost efficiency concerns for some in this group. Already the introduction of a high redistribution of targets (option T3) together a higher one-off flexibility (O3) would reverse in all beneficiary countries, with the exception of LU, the gap over the period 2021-2030 into a surplus (assuming of course they would all achieve reductions as in the EUCO30 projections and if they use the one-off flexibility to the maximum).

MS contributing to the target adjustment (FR, DE) come now out worse than all Member States benefiting from the adjustments except LU, of course assuming all adjustments are used to the maximum. DE, FR and UK would actually end up with 2030 targets more ambitious than IE, NL, AT, and BE, even though they have lower levels of GDP per capita than these Member States benefiting from the adjustments.

Table 19: Member State impacts of Combinations 1 and 3

	Annual average deficit (-) or surplus (+) over the period 2021-2030 (as % 2005 emissions)			
Projection used	EUCO30			
2030 Target Adjustment	No	Yes, T3		
One off flexibility	No		Yes. O3	
LULUCF credits (if needed)	No			Yes, L2
Combination	**Comb. 1**			**Comb.3**
LU	-15.7%	-15.7%	-7.7%	-7.4%
SE	2.1%	2.1%	6.1%	6.1%
DK	-5.5%	-2.7%	1.3%	1.3%
IE	-13.6%	-6.5%	1.5%	1.5%
NL	-7.2%	-3.3%	0.7%	0.7%
AT	-3.2%	0.7%	4.7%	4.7%
FI	1.5%	1.0%	5.0%	5.0%
BE	-5.3%	-1.4%	2.6%	2.6%
DE	0.8%	-0.3%	-0.3%	0.0%
FR	-1.0%	-2.1%	-2.1%	-0.5%
UK	4.0%	2.9%	2.9%	2.9%

Overall it is unlikely that Combination 3 will be seen as overall fair and balanced approach to address cost efficiency, which puts a question mark on its effectiveness. Instead Combination 2 may be seen as more balanced.

For similar level of detail as in Table 18 and Table 19 for all Member States, see annex 8.7, including the impacts when using the EUCO27 scenarios which give by and large the same impacts.

Comparing combinations at EU level

Table 20 below gives an overview of the impacts on the need for inter Member State AEA transfers in case of combination 2. Without any measures that address cost efficiency concerns in the non-ETS, overall demand of higher income Member States would be the equivalent of 282 million AEAs. With the introduction of the adjustment of the 2030 targets, impacts on demand are limited. It rather leads to a shift in which Member State has demand, making it more balanced in relative terms between Member States.

With the introduction of the one-off flexibility and the use of potential LULUCF credits net demand decreases to low levels of 49 million. This assumes of course that Member States with a gap at least achieve the projected cost efficient reductions and that there is availability in Member States where needed of LULUCF credits up to the allowed limits for compliance in the ESR by the Member State.

In real life certain Member States may select to use less of the one-off flexibility or not be able to generate sufficient LULUCF credits, or simply not be able to reduce emissions as projected in the cost efficient projections. This may mean more transfers will be needed as estimated in Table 20.

Table 20: Impacts of combination 2 on AEA transfer demand

Projection used	EUCO30			
2030 Target Adjustment	No	Moderate target adjustment		
One off flexibility			Moderate one-off flexibility	
LULUCF Credits				Limited LULUCF credits
Overall net demand for AEA transfers	-282	-235	-156	-49

The above table only looks at combination 2. Combination 3 further reduces demand and shifts any remaining demand towards DE and FR and not anymore from other high income Member States.

With demand for transfers by higher income Member States potentially decreasing, it increases the risk that the -30% reductions target in 2030 will actually not be met. It might give the wrong incentives to typically lower income Member States, not willing to invest to overachieve their target, knowing that there is anyway potentially less demand for this supply, and thus indirectly resulting in the EU not meeting its -30% target.

This is expressed in the build-up of a surplus which is actually a risk for the achievement of the -30% target in 2030, if it gets too large, and hence the effectiveness of the approach. Member States might decide to use some of this surplus to achieve targets later in the period, thus actually not meeting overall the -30% reduction target.

For LULUCF credits this does not matter, as long as any credit entering the ESR is associated with real additional actions in the LULUCF sector. But this does matter for the

impact of the starting point and the one-off flexibility. For the starting point it is seen as appropriate to start from average 2016-2018 emissions. For the one-off flexibility it is important to limit it in size.

Overall Combination 2 is somewhat more prudent option compared to Combination 3. If emissions effectively are reduced to -30% by 2030 it would still see a surplus building up (excluding LULUCF credits) of around half a billion allowances by 2030 (see Table 21).

It is difficult to assess if this is too high a surplus and resulting in a real risk not to achieve the -30% target. It is important to note that Member States also need some margin in the ESR. Just as the ETS, they cannot function without a surplus. It allows Member States to feel comfortable about achieving their target and it allows them to offer any surplus as AEA transfers to other Member States, while not being worried about their own target achievement is subsequent years. A system with annual compliance cannot function if constantly on the verge of being in non-compliance.

Furthermore this surplus is in relative terms well within the range envisaged as acceptable for the good functioning of the ETS market where the Market Stability reserve aims on a surplus in the ETS market within a range for 400 to 833 million allowances.

Finally it is also important to note that the proposal is coherent with both a 27% and a 30% energy efficiency target. The higher the energy efficiency improvements achieved are, the lower is the risk of not achieving the ESR reduction target.

Table 21: EU wide impacts of combination 2 on overall scarcity

Projection used	EUCO30			
2030 Target Adjustment	No	Moderate target adjustment		
One off flexibility			Moderate one-off flexibility	
LULUCF Credits				Limited LULUCF credits
Impact on build-up of a possible surplus over the period 2021-2030	511	509	606	714

6.2. Comparing and combining the approaches related to existing flexibilities and compliance

In this section two different combinations of the policy options assessed for enhancing existing flexibility instruments (section 5.5) and administering compliance (section 5.6) are compared.

The analysis in the previous section of Combinations 2 and 3 shows the net demand for additional AEAs after adjusting targets for cost-efficiency concerns and applying the new flexibilities (one-off flexibility and limited use of LULUCF credits) could be relatively small over the period 2021-2030 (Table 20) and would come mostly from a small group of high-income Member States. At the same time the potential surplus of AEAs could be expected to be sufficient to meet this demand (Table 21). This is certainly the case if overall the EU would achieve an energy efficiency target of 30%. Member States could

therefore use AEA transfers as a complementary option to the new flexibilities for achieving their targets under the non-ETS.

As pointed out earlier, the system for AEA transfers in the current ESD already has a high degree of flexibility for Member States. Nevertheless, it remains important to improve the availability of and access to information to increase the efficiency of transfers.

Against this backdrop, the appropriate solution would be a limited enhancement of the existing instruments and rules while increasing *transparency* regarding Member States' intentions to engage in AEA transfers. More transparency was also mentioned as an important issue by many Member States in the stakeholder consultation. Therefore policy option F3 is the preferred option chosen for both combinations as it would enhance information on planned and concluded AEA transfers to the Member States and to the public.

Combination 4 (F2, F3, C2): This combination enhances Member States flexibility with respect to managing their AEAs over the compliance period by increasing the limit for borrowing (option F2) and increases transparency of AEA transfers (option F3). It also simplifies and reduces the costs of administering compliance by introducing biennial checks instead of annual ones (option C2).

Combination 5 (F1, F3, C3): This combination enhances transparency of AEA transfers (option F3), but further simplifies and reduces the costs of administering compliance with checks every 5 year (option C3). However, it maintains the current 5% limit for borrowing (option F1).

For both combinations annual reporting and compliance with annual limits would be maintained. As explained in section 5.6, this should ensure environmental *effectiveness* by providing a strong incentive for Member States to be on track with the linear trajectory towards the 2030 targets. With annual reporting and publishing of Member States' emission trends and projections, the Commission would have the necessary instruments for warning any Member State lagging behind its reduction target trajectory. Both combinations would be compatible with international reporting obligations under the Paris Agreement.

With respect to *efficiency*, in both combination of options the annual reporting of emissions annual reporting and regular updates of emission projections will help Member States identifying any demand for additional AEAs and make any necessary transfer agreements in advance of the compliance check.

An important point to consider with respect to *coherence* is the interaction of LULUCF and the ESR and the possibility to use LULUCF credits for ESR compliance. An advantage of combination 5 is that it makes the ESR compliance system more consistent with LULUCF. For LULUCF a five-year period for checking compliance would be more appropriate with respect to its accounting system and how LULUCF credits for ESR compliance would be generated. For these reasons, combination 4 with compliance checks every second year would be difficult to implement.

Another advantage of combination 5 is that it could more easily be synchronised with the five-year stock-taking cycle set out in the Paris Agreement.

In conclusion, combination 5 is considered a well-balanced solution with respect to efficiency, environmental effectiveness and coherence with other parts of the 2030 framework, in particular LULUCF policies, and would therefore be suggested as the preferred combination.

7. HOW WOULD ACTUAL IMPACTS BE MONITORED AND EVALUATED?

As concluded in section 5.6 and 6.2 on administering compliance, the monitoring and evaluation of this initiative in 2021-2030 would in principle follow the same rules and procedures already established in the current ESD for the commitment period 2013-2020.

Monitoring of progress and assessing compliance is based on a comprehensive framework of monitoring, reporting and verification (MRV) laid down partly in the ESD itself and partly in the Monitoring Mechanism Regulation[67] (MMR) and its implementing provisions. Member States are obliged to annually report their greenhouse gas emissions to the European Commission. The MMR and ESD also require Member States to report every second year on national policies and measures implemented in order to achieve their targets under the ESD and on their emission projections.

To ensure that the compliance assessment relies on accurate and verified data, the GHG emissions inventories submitted by Member States are reviewed by the Commission with support by the European Environment Agency as laid down in the MMR. The review includes the annual quality assurance and quality control of Member States greenhouse gas emissions inventories. A team of technical review experts co-ordinated by the Agency checks the transparency, accuracy, consistency, comparability and completeness of the submitted inventories.

The annual compliance assessment is performed by the Commission by comparing the reported and reviewed emissions with the annual emission limits under the ESD. Before the compliance check, Member States can make use of the flexibility instruments (e.g., banking and borrowing, AEA transfers from other countries) to close any gap between their actual emission and emission limits for a particular year.

If a Member State would still not be in compliance after applying the flexibility instruments, a deduction from its emission allocation of the following year equal to the excess emissions (in tonnes of carbon dioxide equivalent) multiplied by an abatement factor of 1.08 is applied.

In order to align the GHG emissions inventory review cycle in the 2021-2030 commitment period with the ambition cycle agreed under the Paris Agreement, the review and compliance check with annual limits could be organised every 5 years. The Commission would organise two compliance controls of Member states' GHG emissions inventories, in 2027 (to check annual compliance for the years 2021-2025) and in 2032 (for the years 2026-2030). This procedure would also ensure that the compliance assessment is aligned with accounting and compliance under the proposed regulation on the inclusion of LULUCF in the 2030 climate and energy framework, and would allow for using any LULUCF credit for compliance with the non-ETS target.

[67] Regulation (EU) 525/2013 of the European Parliament and the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC.

To ensure strict monitoring of Member States' progress towards their 2030 targets, in addition to the compliance checks with legally binding consequences, Member States' progress towards their 2030 targets will be monitored every year as part of the progress report published by the Commission under Article 21 of the MMR and integrated in the Energy Union Report.[68] This procedure will complement the compliance checks by providing early warning in case Member States are lagging behind with their obligations and provides a means of naming and shaming. Should the progress report show that a Member State is not on track for a specific year during the compliance period, it will be obliged to submit to the Commission a corrective action plan including the actions to be taken by the Member State in order to ensure compliance with its obligations together with the timetable for implementation. The Commission may issue an opinion on the corrective action plan.

In conclusion, the strict MRV and compliance cycle as defined under the current ESD will be maintained in the proposal for the period 2021-2030 with the only difference that the organisation of the review of emissions inventories and the compliance check will be made every 5 years instead of annually. In the stakeholder consultation some environmental NGOs were concerned that moving from annual to less frequent compliance checks would weaken compliance. However, the fact that annual compliance is maintained, together with the strengthened monitoring provisions and the annual progress reports, will provide a robust early warning system. Overall this should ensure that Member States take the necessary action to meet their obligations.

A review of the level of ambition is recommended to be performed in 2023 in order to enable the EU to effectively participate in the stocktaking process laid down in Article 14 of the Paris Agreement. The review will allow considering also experience from the current ESD legislation, including the use and effectiveness of the existing flexibility instruments. This will be important given that the ESD still is at a relatively early stage of its implementation.

[68] The report will present Member States' progress towards their obligations under the Energy Union and its governance system.

8. ANNEXES

8.1. Annex 8.1: Procedural information

8.1.1. Organisation and timing

The Directorate-General (DG) for Climate Action was leading the preparation of this initiative and the work on the impact assessment in the European Commission.

An inter-service steering group (ISG), jointly chaired by DG Climate Action and the Secretariat-General was established in January 2015 for preparing this initiative, following the 2014 October conclusions of the European Council on the 2030 climate and energy policy framework for the European Union and the adoption of the Commission Work Programme for 2015.[69] The ISG met 7 times in the period from March 2015 to July 2016.

An indicative roadmap for the initiative *Effort Sharing Decision in 2030 Climate and Energy Policy Framework* was adopted in March 2015.

8.1.2. Consultation of the Regulatory Scrutiny Board

The Regulatory Scrutiny Board received the draft impact assessment report on 29 April 2016 and following the Board meeting on 31 May 2016 issued a positive opinion on 2 June 2016[70]. It gave five recommendations how to adjust the impact assessment report, which have been addressed as follows:

In response to the first recommendation to better assess the performance of the current framework, a clearer explanation of the current framework has been provided and comparisons with initial projections and a breakdown of current performance per sector and Member State has been added (section 1.2.2 and annex 8.11).

In response to the second recommendation, the scope of the initiative and its link with subsequent initiatives has been clarified (sections 1.1, 1.3, and 3.4).

In response to the third recommendation, the guidance given by the European Council in its October 2014 conclusions and its links to objectives and the choice of options has been further explained and made more explicit in general in the text, notably in the introduction of section 4. Also the role and meaning of environmental integrity has been clarified (e.g. in sections 1.3 and 3.2).

In response to the fourth recommendation, it is explicitly indicated that the "no additional policy" baseline is basically the situation as projected in the EU Reference scenario 2016 (as well as the 2013 Reference and the Member States' own With Existing Measures Scenarios). The expected impact of no additional policy (the non-achievement of the

[69] The following DGs and services were invited to the Steering Group: Secretariat General (SG), Legal Service (SJ), Agriculture and Rural Development (AGRI), Competition (COMP), Economic and Financial Affairs (ECFIN), Energy (ENER), Environment (ENV), Internal Market, Industry, Entrepreneurship and SMEs (GROW), Joint Research Centre (JRC), Mobility and Transport (MOVE), Regional and Urban Policy (REGIO), Research and Innovation (RTD), Taxation and Customs Union (TAXUD), Trade (TRADE).

[70] SEC(2016) 339

GHG reduction goal) as well as key assumptions of the Reference scenario and relevant differences with the EU Reference scenario 2013 which was used for the 2030 framework impact assessment and with national GHG emission projections have been explained in the main text.

With the European Council confirming to continue after 2020 'the methodology to set the national reduction targets for the non-ETS sectors, with all the elements as applied in the Effort Sharing Decision for 2020', this impact assessment primary aims to look at policy options that start from continuing the current ESD and on this basis to look at determining targets and the related flexibilities in the ESR. Therefore to make meaningful comparisons of policy options, the "policy baseline" is assumed to be a continuation of the ESD with all its features, but translated to the period 2021-2030, and assuming a target in 2030 equal to -30% compared to 2005 (section 1.3, box 1 and 2, section 4, section 5).

In response to the fifth recommendation to clarify the impact of the targets for individual Member States, additional Member State detail has been added in section 5.1.4 and 5.2, notably on how different baseline projections which represent existing measures only, impact the outcomes.

With regard to presentation, Figure 5 has been added to illustrate the intervention logic, i.e. the chain of problems, objectives and options. The presentation of impacts has been reviewed with regard to shortening options. Given that the modelling outputs are often important to understand the concrete policy options assessed, they continue to be presented in the main text where this is the case.

The relevant stakeholder views with regard to the Effort Sharing Decision are presented in the report, notably in section 4.

8.1.3. Evidence and external expertise used

The quantitative assessment of future impacts in the EU is consistent with the analysis undertaken for the 2030 framework proposal. The Commission contracted the National Technical University of Athens, IIASA and EuroCare to model EU scenarios. The energy system and CO_2 emission modelling is based on the PRIMES model. The non-CO_2 GHG emission modelling is based on the GAINS model. Agricultural non-CO_2 emissions are assessed with the CAPRI modelling framework. For model-based evidence see also section 8.4.

A supporting study for the evaluation of the implementation of the Effort Sharing Decision (see section 1.2.2) was carried out in 2015 for the Commission by a group of external consultants led by Ricardo Energy & Environment.[71]

[71] *Supporting study for the Evaluation of Decision No. 406/2009/EC (Effort Sharing Decision)*, Ricardo Energy and Environment with Trinomic and Vito.

8.2. Annex 8.2: Stakeholder consultation

8.2.1. Introduction

8.2.1.1. Process and quantitative results of the public consultation

The European Commission organized a public consultation[72] on the continuation of the current Effort Sharing Decision (ESD)[73] in the period 2021-2030. The public consultation focused on:

- enhancing the existing **flexibility mechanisms** to ensure overall cost efficiency;
- **monitoring, reporting** and **compliance;**
- the approach to setting the **national greenhouse gas reduction (GHG) targets** in the ESD;
- **complementary EU-wide action** to achieve the reduction targets;
- **capacity building and other support** to implementation at national, regional and local level.

It also asked for further evidence and studies on implementation of the ESD until 2020 at Member-State level and at regional level (see at the end of this document the complete questionnaire and a list of studies and references received from stakeholders).

The consultation was open to everyone, but received responses in particular from national governments[74], regional and local authorities, EU-wide trade associations and NGOs. It complemented the earlier Consultation on the Green Paper on a 2030 framework for climate and energy policies in 2013. The latter had highlighted that the key challenge for the ESD is how to share the efforts and how to strengthen it (conclusions of this consultation relevant to the 2030 ESD are summarized in section 8.2.7). The public consultation consisted of a questionnaire in English with six main questions that combined multiple choices with space limited to 4 000 characters to explain the choices made.

The European Commission also consulted Member States in four meetings of the Climate Change Committee Working Groups held in 2015. At a consultation workshop in April experts from different Member States discussed different options for enhancing the existing domestic flexibility mechanisms in the Effort Sharing Decision in the period after 2020 (banking and borrowing, trading between Member States, auctioning, project-based mechanisms). At a meeting in late June the Commission gave an overview of Member States contributions to the public consultation on this topic. And at two meetings in September further discussions were held on enhancing existing flexibility instruments and on reporting and compliance, respectively.

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[72] Open 12 weeks, from 26 March until 18 June 2015, on the EU Survey website (http://ec.europa.eu/clima/consultations/articles/0025_en.htm). The consultation on the future design of the ESD was carried out in parallel with the consultation *"Addressing greenhouse gas emissions from agriculture and land use, land use change and forestry in the context of the 2030 EU climate and energy framework"* (http://ec.europa.eu/clima/consultations/articles/0026_en.htm).

[73] Decision 406/2009/EC on the effort of Member States to reduce their GHG emissions to meet the Community's GHG emission reduction commitments up to 2020 (Effort Sharing Decision, ESD).

[74] Many Member States stressed the preliminary nature of the views expressed.

This report follows the structure of the six main questions in the consultation questionnaire. The individual stakeholder submissions can be downloaded on the consultation website[75].

Figure 15: Stakeholders profiles – Based on 114 replies

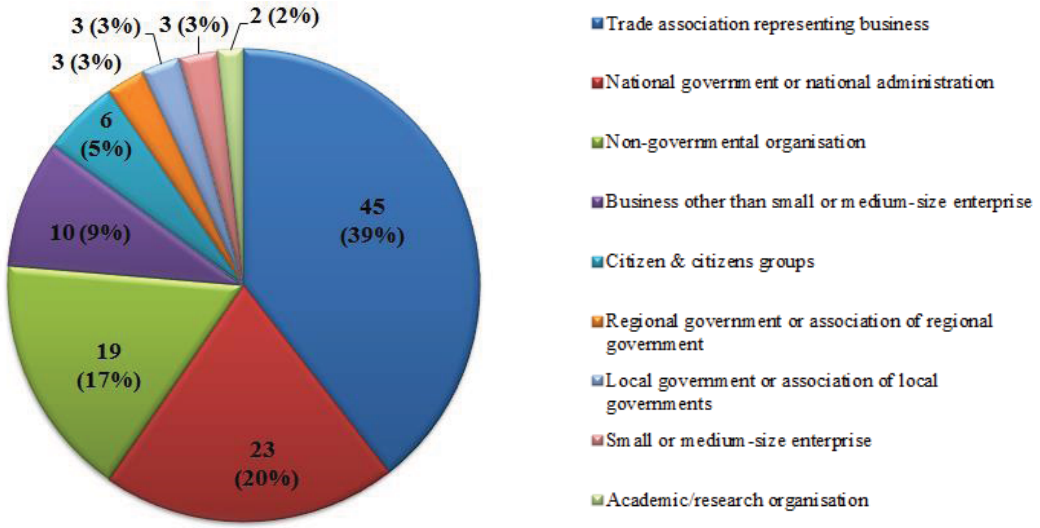
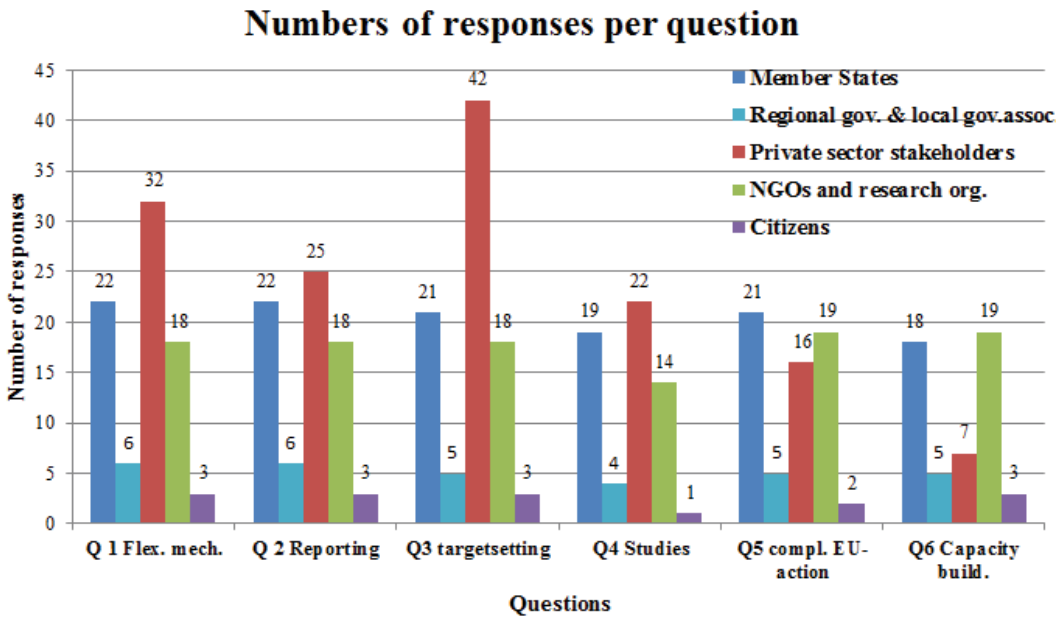


Figure 16: Number of responses per question by stakeholder group[76]



[75] http://ec.europa.eu/clima/consultations/articles/0025_en.htm

[76] The Norwegian stakeholders are not included, "Private sector stakeholders" comprise trade associations, and enterprises of all sizes.

8.2.1.2. Stakeholders' participation in the public consultation

The Commission received 114 formal replies from a broad spectrum of stakeholders from 28 Member States (see Figure 15).[77] Apart from Member State governments, the consultation had a strong participation from the private sector, with 41% of overall replies from European and national industry associations and around 11% from individual enterprises. 16% of the replies came from non-governmental organizations (NGOs) mostly European environmental organizations. Local and regional governments or associations representing them accounted for 6% of the replies. Private citizens and research institutions represented 5% and 2%, respectively[78]. Figure 15 illustrates the distribution of respondents by sector and type of organisation. Figure 16 shows how many of each stakeholder group responded to the different questions.

8.2.2. Enhancing existing flexibility mechanisms

Member States, regional and local governments[79]

22 Member States, all three regional governments, one local government association and one local government responded to this question. Though many Member States signalled that it is difficult to form a firm position on future flexibility mechanisms due to limited experience with the current ESD, there was a strong request for enhanced flexibility (enhancing transfer of Annual Emission Allocations (AEA) between Member States (requested by 16 Member States), higher rate of borrowing (requested by 10 Member States). A majority of Member States, as well as the three regional governments and the local governments that responded, requested more transparency with regard to transfer of AEA among Member States and a mechanism for setting AEA reference prices in a transparent manner. However, two Member States did not want to disclose the prices of bilateral transactions.

Banking and borrowing. Three Member States were in favour of continuing the current provisions for borrowing (up to 5% from the following year). 10 Member States were in favour of permitting a higher rate of borrowing than the current 5%. Their main argument was that to reach the more ambitious 2030 targets in a cost-efficient way more flexibility is needed, in particular for borrowing in the early phase of the 2021-2030 period, to give Member States the time they need to prepare AEA transfers among Member States. However, reflecting the risk that higher borrowing may lead to an "AEA-debt crisis", six Member States proposed a higher borrowing limit in the beginning of the period, and a lower limit towards the end. Sweden opposed higher borrowing, highlighting the need for implementing strict long-term EU mitigation policies in the ESD sectors. Estonia and Latvia proposed to permit borrowing not only from the following, but from any year of the period.

AEA transfers among Member States. Member States stressed that a mechanism for enhanced transfer of AEA among Member States must serve cost-effectiveness, be simple, provide transparent information on the AEA market, not have high administrative costs, ensure a liquid AEA market, provide additional and certain GHG reduction investment for sellers and reliable GHG reductions for buyers, and not compromise

[77] Also the government of Norway and two Norwegian stakeholders responded to the public consultation. Except for being included in Figure 15, they are not covered in this report.
[78] 8% of all respondents expressly requested their contribution to be treated confidentially.
[79] As several Member States have submitted their contributions confidentially it is not possible for all statements to list the supporting Member States.

environmental integrity and achieving individual and EU ESD targets. Though many Member States signalled that it was difficult to form a firm position on AEA transfers due to limited experience with the current ESD, 16 Member States wanted to enhance the transfer of AEAs between Member States. One Member State stated that it does not expect to engage in transfers of AEAs.

The majority of participating Member States were open to different options, such as auctioning, trading platforms and project-based mechanisms (PBM), which could even be established in parallel or sequentially. Several Member States with GDP/capita above average were concerned that Member States with a large potential for cheaper reductions will not exploit this potential, or not transfer their surplus AEA, leaving others with expensive domestic reductions. Four high-income Member States asked for mandatory mechanisms that ensure supply of AEAs to create a liquid market. Other Member States opposed mandatory mechanism, and a minority even raised doubts if an AEA market would work, as it would have only few participants (the Member States). Four Member States were against mandatory auctioning, and two were against a trading platform.

The following table gives an overview of the Member States positions on the different options for AEA transfers among Member States:

Table 22: Synopsis of Member State responses to question 1 on flexibility options

Options proposed by Member States	Nr of MS in favour or open to it	Nr of MS doubtful or against it
Annual auctioning, including	16, of which:	
- mandatory auctioning of surpluses	4	4
-voluntary auctioning of surpluses	4	
Trading platform	10	2
EU-wide project-based mechanisms, of which	11	3
- extended to programmes	2	
- AEAs also to be owned by private actors	2	2

Private sector stakeholders[80]

20 out of 45 trade associations responded to the questions on flexibility mechanisms, out of the 17 EU-wide trade associations, six responded. Across the board they stressed the need for transparency with regard to prices, timing and volume on any such exchange, as this would permit private actors to engage in GHG reduction actions, and to know how

[80] EU-wide trade associations, national trade associations, companies and SMEs.

national governments balance domestic action with financing action in other Member States.

Banking and borrowing. Reasoning that borrowing may be "used as a licence to postpone action" and not to make the necessary investment in low-carbon technologies, three trade associations linked to the energy efficiency and renewable energy sectors requested to forbid borrowing. In contrast, four other associations representing SMEs, conventional small-scale agriculture, and conventional energy sectors, were in favour of permitting a higher than 5% level of borrowing, as this would favour cost-effective mitigation and account for emissions from agriculture that are highly dependent on unpredictable weather conditions.

AEA transfers among Member States. Trade associations were divided. Those active in energy efficiency and renewables in high-GDP per capita Member States feared that AEA exchange among Member States could channel potential investment in domestic GHG reductions to other countries, leaving the huge potential for increasing energy efficiency buildings, transport and industry in "rich" Member States untapped. Instead of AEA transfers they requested ambitious domestic GHG reduction and energy efficiency targets. Others encouraged enhanced AEA transfers to avoid high mitigation costs. An Irish trade organisation requested mandatory auctioning of surpluses to feed the AEA market.

NGO and research organizations

18 (out of 19) NGO and research organizations responded to this question. All that responded were generally supportive of the concept of cost-effective action, but differed on the implications for flexibility mechanisms. Among the positive aspects of flexibility mechanisms stressed were that they can serve as a tool to minimize overall opportunity costs for mitigation; stimulate EU Member States to exceed their targets to save or sell AEAs; drive decarbonisation in lower income Member States; and may involve the private sector (as project developers) leading to more mitigation actions.

However, many NGOs expressed doubts about the need for *additional* flexibility mechanisms and about the proposed framing of "cost-effectiveness". They argued that potentials for additional, cost-efficient actions exist across the non-ETS sectors, that the EU's 2030 target does not present a sufficiently ambitious pathway to 2030, and that a higher target (at least 41% end-use energy savings, a share of 45 % renewable energy and 60 % GHG reductions compared to 1990) can be reached in a cost efficient way. They also stressed that the understanding of cost-effectiveness must take into account the EU's long term climate goals: the most cost-effective way of delivering the transformational change needed to cut emissions by 80-95% by 2050 is likely to differ from the least cost way of meeting the 2030 target. Furthermore, the pursuit of the latter may have a negative impact on the former. Other key concerns were that flexibility mechanism must not delay mitigation action and increase the risk of non-compliance, and endanger environmental integrity.

NGO and research organisations strongly supported banking, stressing that it encourages early action. They worried that extensive borrowing rules open a loophole for countries to avoid action and delay the necessary investments. Accordingly, several requested to restrict borrowing. Though mostly *against* enhanced flexibility mechanisms, all NGOs agreed that there should be transparent reporting on AEA transfers, accessible to the public. Several NGOs questioned whether the existing flexibility mechanisms (other than banking) should continue. They argued that the existing option of AEA transfers among

Member States has not been used and has thus proven to be irrelevant for the current period (2013 - 2020). They also argued that enhanced flexibility could make Member States avoid investing in domestic mitigation measures, which may trap them into pathways which are inconsistent with the long-term energy and climate objectives of the EU. Eleven NGOs were in favour of a project based mechanism as it could involve the private sector (project developers) and may therefore lead to more mitigation actions - e.g. in the building sector – and build capacity in less prosperous Member States with a big cost-effective mitigation potential. The NGOs stressed the need to ensure the environmental integrity of such projects.

Citizens[81]

3 (out of 6) citizens/citizens groups responded to this question. They expressed the need for urgent action. Most responses also displayed a lack of understanding and mistrust of the concept flexibility mechanisms.

8.2.3. Monitoring, reporting and compliance

22 out of 22 Member States responded to this question. Eight Member States were in favour of annual reporting with biennial compliance checks. Seven preferred to keep the current system of annual reporting and annual compliance checks. Three Member States preferred biennial reporting and biennial compliance checks. Five Member States preferred other options, and two did only make general comments. Thus 16 Member States were in favour of annual reporting, and 18 in favour of at least biennial compliance checks. Two Member States proposed only one compliance check at the end of the period (thus in 2030).

Table 23: Synopsis of Member States responses to question 2 on compliance:

Options:	a) Keep it as it is: Annual reporting and annual compliance checks with existing corrective action	b) Annual reporting with biennial compliance checks with existing corrective action	c) Biennial reporting with biennial compliance checks and enhanced corrective action	d) Other (with explanation).	No option selected, but comments made
Nr of supporting MS	5 (7) (2 more MS were supportive but with reservations)	8 (1 also open to c, 1 also open to "less frequent compliance checks" in general)	3 (1 also open to b)	5 (2 supporting annual reporting cycle with some additions; 2 proposing compliance check only in 2030)	2

[81] The few citizens that participated in the consultation did not respond to all questions. As a consequence, their views are only included in this report when they made clear statements on the respective questions.

General comments were that there is limited experience with the current reporting and compliance checks; there was uncertainty regarding LULUCF, which is by nature strongly affected by external factors such as extreme weather events and thus requires longer compliance cycles; and how the Paris Agreement will affect ESD monitoring, reporting and verification (MRV). Luxembourg and Malta requested that a common approach and monitoring, reporting and verification system should be put in place for the two work streams, GHG emissions and energy policies, aiming at reducing fossil energy consumption.

Arguments of Member States in favour of option a) were that annual accounting and reporting have worked well under the Kyoto Protocol; that they are best to guarantee environmental integrity and helps planning for when to react with measures to deviations from the target trajectory, in particular if flexibility mechanisms are enhanced. Other arguments in favour were that they prevent inconsistencies as reporting, compliance checks and corrective actions all occur on an annual basis; that they offer the best opportunity to develop a functioning AEA market (while biennial compliance checks would limit the frequency of AEA exchanges).

Arguments of Member States in favour of option b) were that annual reporting permits Member States to assess themselves if they are "on target" and is demanded by the UNFCCC anyway, but that biennial compliance checks would significantly reduce the administrative burden and would still allow for an adequate preparation of the measures. Other arguments in favour were that they could be done in the same year as the requested reporting on policies and measures and on projections, thus better accounting for these policies, measures and projections; would still safeguard compliance and environmental integrity (in contrast to less frequent compliance checks); could smoothen the variability of emissions due to specific economic or meteorological circumstances.

Member States in favour of option c) argued that biennial reporting with biennial compliance checks and enhanced corrective action reduces the administrative burden. They did not make concrete proposals, though, what enhanced corrective action should look like. Member States that had selected d) “Other" explained that *"an intermediate scenario with 2 or 3 checks in the whole period"* could be an option; less frequent compliance checks should be discussed, depending on what kind of flexibilities are included in the 2030 framework and how LULUCF is dealt with.[82]

Private sector stakeholders

25 private sector stakeholders responded to this question, including six out of 17 EU-wide trade associations, and three (out of 13) companies. Among those that did respond, option a) clearly emerged as the preferred option (selected by four EU-wide trade associations, six national trade associations, and two companies). Two EU-wide trade associations selected option b. None selected option c. The trade associations in favour of option a) argued that annual reporting aids transparency and liquidity of trading and complements annual reporting under the ETS. Laxer rules may result in Member States not taking the necessary measures and lose sight of investments needed. In particular for buildings, delaying action to cut emissions in the existing building stock risks locking in and limiting the reduction potentials and jeopardizing the chance for this sector to reach

[82] Sweden requested "Robust compliance measures [that] ensure all member states reach their national targets, also in a situation where the EU collectively reaches its common target.", while France was against enhancing corrective measures.

the need for a 88%-91% GHG reduction by 2050; with biennial compliance checks, possible non-compliance would only be exposed and corrected too late. The trade associations in favour of option b) argued that "excessive" reporting & monitoring should be avoided. The trade associations in favour of option d) "Other" stated that a one-year delay in reporting – as in the EU ETS – would be ideal.

NGOs

18 out of 19 NGOs and research organisations responded to this question. Eight out of 11 EU-level NGOs and five out of six national NGOs requested option a "Annual reporting and annual compliance checks with existing corrective action". The NGOs in favour of option a) argued that it ensures that countries are on track with meeting their target, and that it is necessary to bring all Member States on the path of a low carbon economy in 2050 and to avoid stranded investments in infrastructures that are not in line with the 2050 objectives. The NGOs that had selected d) "Other" were also in favour of annual reporting and compliance checks, but stressed that there should be enhanced corrective action and biennial reporting of greenhouse gas emission projections and policies and measures in the 2021-2030 period, in line with the current rules as set out by the Monitoring Mechanism Regulation.

8.2.4. How to reflect cost-effectiveness in a fair and balanced manner when setting national greenhouse gas reduction targets

21 out of 22 **Member States** responded to this question. Member States broadly confirmed the Council Conclusions of October 2014 that the new ESD targets should continue to be set based on GDP per capita and adjusted for the Member States with a GDP per capita above the EU average, to reflect cost-effectiveness. Six of eight Member States with a GDP per capita above EU average declared that the projections in the EC impact assessment concerning the 2030 framework for climate and energy policies[83] are a good starting point to assess cost-effectiveness. A group of six Member States explicitly endorsed a Belgian proposal to determine 50% of the target using GDP per capita and 50% using cost-effectiveness figures from the EC impact assessment. Finland stressed that the adjustment of GDP per capita based reduction targets for Member States with above EU average should not raise reduction targets for Member States with cost–efficiency potential below the GDP per capita based target. Italy pointed out that it expects to be only just below average EU GDP per capita and thus would regard as unfair, if it were to be completely cut off from the adjusted targets option for above-average GDP per capita Member States. A few more Member States asked for sector-specific concerns to be reflected in their target. These concerns were mainly related to transport, agriculture and the integration of LULUCF into the ESD.

Regarding the limited one-off flexibility between the European Emissions Trading System (ETS) and ESD responses remained general. A number of potential beneficiaries explicitly support this option while another group emphasized its limits. There was consensus that a one-off flexibility option should not compromise the functioning and environmental integrity of the ETS. With regard to the potential beneficiaries in the group of high-income Member States, Austria, Finland, and the Netherlands did not want it to be seen as the primary instrument to address cost-effectiveness concerns. Malta would rather see this not as a one-off, but ‘two step’ tool with a revision half-way

[83] Commission Staff Working Document SWD 2014/15, section 5.9, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014SC0015

through the trading period. Lithuania asked for the one-off flexibility to be accessible to all Member States (which was not part of the European Council Conclusions). France and Hungary asked for a two-way flexibility between the ETS and ESD. Latvia rejected the idea of a one-off flexibility.

Five out of six **regional governments and local government associations** responded to this question. All five were sceptical about using ETS allowances to achieve ESD targets – this should not be the primary tool to ensure cost-effectiveness.

42 (out of 58) **private sector stakeholders** responded to this question. Most of them agreed with the GDP per capita approach and a cost-effectiveness adjustment for countries with a GDP per capita above EU average. EUROCHAMBRES and its national member associations, however, preferred to only use cost-effectiveness and not GDP per capita as dominant criterion. Also the European Association of Crafts and SMEs (UEAPME) highlighted cost-effectiveness and suggested that the national ESD targets should take into account the marginal costs of the additional emission reductions compared to a lower level target. The European Farmers and Agri-Cooperatives (Copa-Cogeca) suggest a new policy regime used for agricultural emissions based on intensity- or efficiency-targets rather than national ESD-targets.

Concerning the proposed one-off flexibility mechanism between the ETS and ESD, the numbers of advocates and opponents were fairly balanced. Both groups agreed that this flexibility must not distort the ETS in its current functioning; it should only be a last resort. Many organizations confirmed the wording stipulated in the European Council Conclusions that predictability and transparency have to be ensured, and cost-effectiveness and environmental integrity to be guaranteed. Several stakeholders proposed more concrete ideas how these conditions can be met.

All **NGOs and research organisations** responded to this question. Concerning the cost-effectiveness criterion for the above-average GDP per capita countries, Climate Action Network asked it to be based on the additional costs-effective potentials of those Member States necessary for reaching the target based on the EC's Impact Assessment. A larger group of NGOs agreed that to set the right incentives, the 2021 starting point for each Member State should be the lowest of 1) the 2020 target, 2) the average of 2016-2018 emissions, or 3) the projected 2020 emissions for each Member State. A starting point solely based on the average 2016-2018 ESD emissions would favour Member States whose emissions are above their 2020 target and would penalize so-called early movers.

The majority of NGOs and think-tanks were opposed to a limited one-off flexibility mechanism for environmental integrity and fairness reasons. They feared a delay of action in ESD sectors both in higher and lower income Member States while additional abatement in the ETS would be uncertain. Instead governments should rather spend their resources on mitigation in the ESD sectors with many co-benefits such as jobs, cleaner air, and improved public transport. In case ETS allowances would be allowed for achieving national ESD targets, it should only be used as a last-resort option. Many NGOs proposed concrete restrictions on scope, volume, and timing of transfers. Sandbag recommended a single economy-wide burden-sharing system for distributing allowances to Member States under both the EU ETS and the ESD. Most stakeholders in this group also stressed the need for transparency to allow for public understanding and scrutiny.

8.2.5. Complementary EU-wide action

21 out of 22 **Member States** responded to this question. 17 Member States asked for the scope of EU action to be enhanced. Four said the current scope is sufficient. However, a few Member States interpreted "EU-wide action" not as *new* EU legislation and policies, but as improving and better implementing existing policies and measures. Also the **regional governments** and local governments requested that the scope of EU action be enhanced. Member States in favour of additional EU-wide action stressed that the ambitious 2030 and 2050 climate policy targets necessitate more radical changes than the 2020 targets, as well as early investment. This again necessitates EU-wide action complementing the ESD. They stated that measures applied collectively are not only more effective, but also avoid distortions of competition within Europe.

These Member States argued for additional EU-wide action in several policy areas, including transport, financing, energy and agriculture.

Eight Member States stressed the need for strong EU policies to promote energy efficiency and reduce energy demand in the **transport sector**; to promote the use of low-carbon fuels and propulsion systems, to facilitate a modal shift, and to reduce the demand for transport overall. Member States argued that EU regulations for CO_2 emission standards for cars and vans have proven to be a highly effective way of improving fuel efficiency and encouraging vehicle manufacturers to bringing low-emission vehicles to the market. Tighter EU-regulation in the period to 2030 will be crucial also for reaching ambitious national transport emission targets.

Seven Member States also emphasized the need for action with respect to **financing and taxation**, including:

- making climate-friendly choices easier and cheaper, by assuring finance and tax system underpin the efforts and not act counterproductively, through a comprehensive set of tax measures for a green budget reform, for level playing field across the EU (or Eurozone);
- assessing the effectiveness of Energy Taxation Directive and State Aid rules;
- ensuring all EU and European funds, as well as indirect funds such as environmentally harmful subsidies are steered towards making long term climate targets possible to reach.

Czechia and Sweden also requested a price on carbon also in the non-ETS sectors.[84]

Five Member States underlined that EU policies and instruments are needed as a cost-effective way to tap into the large potential for increased, profitable energy efficiency in buildings, products, industrial processes, heating and cooling. Among their arguments were that following the "energy saving first"– principle reduces the pressure on Member States to invest in further electricity generation infrastructure and plants, freeing investment in decarbonizing other areas of the economy. Belgium requested a harmonized quality framework to assess energy saving investments. Apart from a general request to support the promotion of renewable energy, several Member States focused their comments on biofuels and biomass, asking to review the appropriateness of existing criteria to address sustainability criteria from crop biomass to biomass from the forestry

[84] Sweden noted that *"An important part of the Swedish climate strategy is to put a price on carbon dioxide emissions. Without this possibility our work becomes severely more difficult."*

or waste sectors and propose new or dedicated criteria if required. These criteria should apply across all relevant parts of EU legislation, including ESD.

Four Member States requested to better align the Common **agricultural policy** with climate policy. Member States also requested that the Commission and public institutions follow highest standards in their functioning with regard to following green public procurement and reducing their own carbon footprint.

Member States cautious about additional EU-wide action stressed that measures must not affect the competitiveness of Member States and their economies vis-à-vis non-EU countries without equivalent climate change mitigation commitment. They emphasized their right to choose their own energy mix and the best policies and measures to address local needs.

The **local government associations** stressed that the role of the local level *as "key actors in implementing climate actions in the non-ETS sector"* should be supported.

Private sector stakeholders (Trade associations, business, SME) disagreed about this question and responded as illustrated in the table below:

Table 24: Synopsis of private stakeholder responses on the ESD scope

Stakeholder group	a) The current scope is sufficient	b) The current scope should be enhanced.	No response
European Associations	5	8	4
National trade associations	13	10	2
Companies and SME	0	9	1

Stakeholders in favour of additional EU-wide action and legislation stressed that a mandatory EU target for energy efficiency, with clear national targets, would support Member States' emission reduction in ESD sectors and would generate jobs, growth and GHG emissions reductions in one stroke, as well as provide certainty for the concerned sectors. They also asked for removal of harmful subsidies, and a CO2-price signal in non-ETS-sectors to create a level playing field with the ETS sectors. In the absence of an EU-wide carbon tax, Member States should at least be given clear design rules for national carbon taxes, so that tax regimes are converging rather than diverging. Also stronger monitoring and control for vehicle efficiency and building performance standards were requested. Stakeholders against additional EU-wide action argued that the main EU-tools for the 2020 energy and climate policy (ETS Directive, the Energy Efficiency Directive, and the Renewables Directive) are overlapping, a lack of coordination between Member States creates additional overlaps and distortions. The Commission should thus focus on monitoring the implementation by Member States of existing legislation, to better harvest their potential.

All **NGOs and research organisations** responded to this question. All demanded that the current scope of EU-wide action and legislation be enhanced. They stressed that the ESD for 2020 has shown that in many Member States ESD targets alone were not sufficient to drive energy efficiency improvements. They requested EU legislation and measures to strengthen the Member States' long-term strategies in the key sectors

building, transport, agriculture and waste, providing planning certainty, lower low-carbon technology-costs as well as jobs, economic growth, energy security, better air quality and reduced environmental damage. The EU's 2030 energy savings target should be increased to 40%[85], and a binding GHG reduction target for the transport sector be introduced[86]. The EED's 3% renovation rate should be extended to *all* public buildings, and financial policies be adapted, including removal of environmentally harmful subsidies, and introduction of carbon taxes.[87]

8.2.6. Need for EU-organised capacity building and other support to implementation at national, regional and local level

18 out of 22 **Member States** responded to this question. They stressed that the EU should further facilitate a better sharing of best practices among Member States in the 2021-2030 period, with a focus on the regional and local level, as emissions covered by the ESD were mostly influenced at these administrative levels. The current support for Member States when applying for EU funding should continue after 2020. Most of them found past ESD capacity building very useful, such as a series of regional workshops facilitating the exchange of experiences and good practice organised by the European Commission. Member States also suggested capacity building support for monitoring and reporting at a sector level, for example for transport and agriculture; an EU communication strategy for energy efficiency of buildings, renewable energies, better land use, as climate-friendly agriculture; and modelling with high geographical resolution the effects of inaction in Member States. Hungary asked for more capacity building for establishing an AEA greening system as part of the flexibility mechanisms. The UK expressed that any additional action could and should be implemented within agreed EU budgets, as European Structural and Investment Funds (ESIF) uptake for energy efficiency remains low, more guidance should be provided on Low Carbon Plans and successful application.

Five **Regional governments and local government associations** responded to this question**:** Climate Alliance and Energy Cities stressed that the local level is crucial for reaching the 2030 targets and that cities and local authorities should be better integrated in policy making from the outset. They demanded that Horizon 2020 and technical assistance facilities continue to support the developing of Sustainable Energy Action Plans for Covenant of Mayors cities., including their energy and ambition in Europe's climate and energy policies.

Seven **private sector stakeholders** responded to this question. They underlined the importance of the exchange in the context of ESIF and Covenant of Mayors activities. The European Insulation Manufacturers Association (EURIMA) asks for support to governments in understanding the interactions between related directives, e.g. between the Energy Efficiency Directive and Energy Performance for Buildings Directive, which would facilitate the implementation of more effective national polices and measures, and avoid lock-in effects. The Commission's country reports in the European Semester should elaborate guidance on cost-effective energy efficiency potentials. The European

[85] A co-ordinated response by NGO-networks and umbrella-NGOs.
[86] NGOs stressed that 25% of all transport is of the urban variety and also the most conveniently substitutable with cycling and public transport.
[87] Although land use, land use change and forestry (LULUCF) was addressed in a separate, parallel public consultation, NGOs expressed views on LULUCF also in the 2030 ESD consultation.

Association of Crafts and SMEs asks for capacity building for local SME organisations on how to develop ESD implementation measures with public authorities.

20 out of 22 **NGOs and research institutions** responded to this question. They agreed that awareness needs to be increased about the benefits of national policies and measures to reduce emissions in the transport, buildings, agriculture and waste sector after 2020; that the European Semester reports should also recommend policies for meeting the 2030 climate goals, e.g. requiring the phasing-out of environmentally harmful subsidies, e.g. for company cars. Some demanded that there should be an annex to the ESD, listing best practices per sector, for Member States to include them in their national plans. Member States also saw a need for mobilizing public and private funding for technical assistance in energy efficiency. They stressed that GHG-reduction projects at community-level can facilitate capacity- and governance-building in low-GDP-per-capita Member States with a big cost-effective mitigation potential.

8.2.7. Appendix 1: Consultation on the Green Paper on a 2030 framework for climate and energy policies relevant - key conclusions relevant to the 2030 ESD

On 27 March 2013, the European Commission adopted a Green Paper on "A 2030 framework for climate and energy policies". Key points made by stakeholders in the Green Paper's public consultation relevant for the 2030 ESD were that

- to decarbonize in the most cost-efficient way a balance between EU wide instruments needs to be reached.
- the ETS allows for the fair distribution of efforts, so the focus should be on how to share the efforts for the Effort Sharing Decision (ESD) and how to strengthen it.

Member States

- generally agreed that the distribution of efforts should be decided based on national specificities and potential to incorporate certain technologies, including financial capabilities. A certain degree of flexibility should be persevered at national level to ensure the most cost-efficient decarbonisation path. Some proposed the introduction of flexibility measures for GHG emission reduction in different sectors.
- noted that it would be important also to consider past efforts to lower emissions. Generally, Member States and NGOs agreed that financing could be better provided through EU-wide instruments.

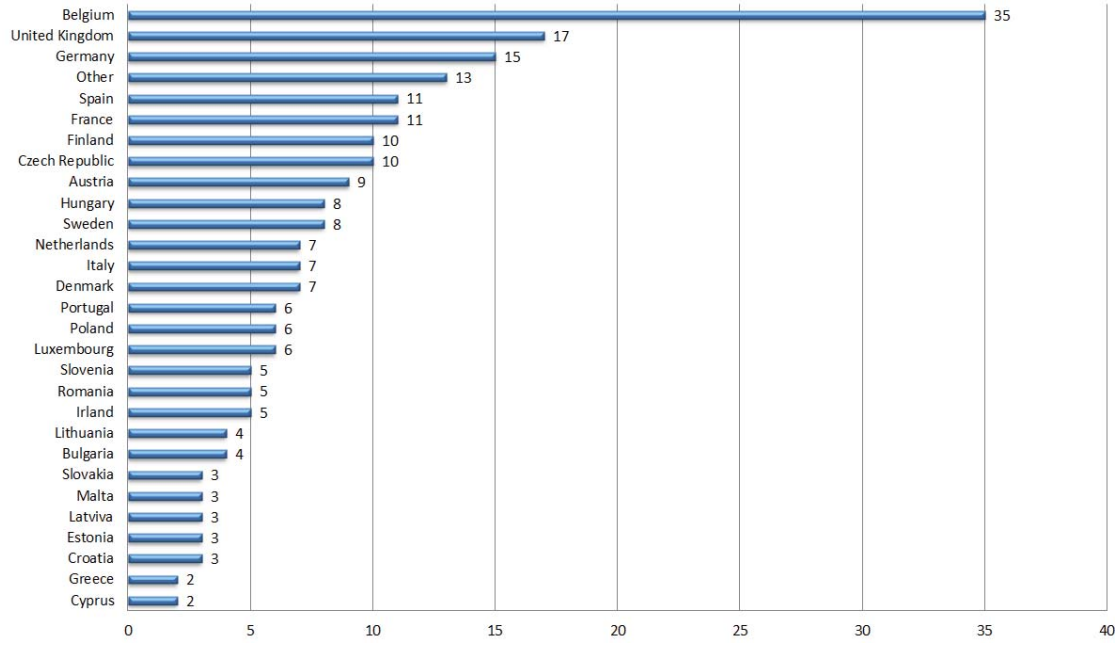
Stakeholders from the private sector and some local authorities argued for a target-sharing based on efforts by all Member States and the consideration of national GDP per capita to help ensure a fair distribution of efforts. A few utility companies proposed to distribute the efforts based on the share of absolute emissions expected in 2030. NGOs called for the setting of an ambitious legally binding target for the ESD and the provision of financing for Member States less able to act. NGOs also stressed that the highest potential countries also often have the least ability to act; hence the effort sharing should take into account ability to pay, and low marginal abatement costs. Trade unions emphasised the need for a reinforced ESD as an integral part of efforts until 2030. NGOs together with many trade unions, called for the cancellation of international credits under the ETS and the ESD (governing the non-ETS sectors) to instead focus on domestic action.

On future capacity building and financing instruments stakeholders agreed that the EU should facilitate climate- and energy-related investments. While some stakeholder requested innovative financial instruments, others noted that the existing ones are sufficient. There was an overall agreement that leveraging private investments is crucial. Several stakeholders noted that financing for economically weaker Member States should be provided. NGOs noted the need to address investments in areas that have smaller financial capabilities, such as Central and Eastern Europe. NGOs generally said that innovative financial instruments are needed to harvest the reduction potential under the ESD. Some suggested that the EIB introduces an NER-300-type instrument for the ESD. For energy efficiency, they proposed bundling different small projects to a large project to make them more attractive to investors. They also supported, together with non-energy intensive companies, the development of risk-sharing facilities, equity, loans and project bonds. Local authorities requested better information on how to combine various sources of funding.

8.2.8. Appendix 2: Geographical distribution of the 2015 ESD public consultation's respondents:

Figure 17 shows the geographical distribution of respondents by their country of residence or activity. Stakeholders could select more than one country.

Figure 17 Stakeholders by country



8.3. Annex 8.3: Who is affected by the initiative and how

The proposed policy primarily addresses Member States as institutional actors and thus mostly affects their national administrations. The practical implications of this initiative are related to two areas: reporting and monitoring compliance under the ESR, and, indirectly, implementation of national policies and measures for GHG emission reductions or other mitigation action.

As explained in section 7 of this impact assessment, reporting by Member States under the ESR in 2021-2030 would in principle follow the same well established rules and procedures as in the current commitment period. The only significant change resulting from the preferred combination of policy option in section 6.2 is that compliance checks and related GHG inventory reviews would be carried out every fifth year instead of annually. This means that the associated administrative burden and costs for monitoring compliance would be reduced both for Member States and the European Commission.

Another practical implication of the preferred option is the creation of a central site where offers and requests for AEA transfers would have to be notified by Member States selling or buying AEAs. This is similar to existing reporting obligations for Member States under the current ESD, and would not considerably increase their administrative burden compared to the policy baseline option, although reporting might become more frequent for those Member States engaged in such transfers. The information site would be web-based could be hosted by the European Commission or by an organisation contracted by it. The costs for hosting the site would be modest.

With respect to businesses in general and SMEs in particular there are no direct reporting obligations for SMEs or other enterprises under the ESD and the ESR proposal would not change this situation.

The practical implications for the Member States due to the implementation of national policies and measures in ESR sectors are difficult to assess and will depend on the measures chosen in each specific country. The experience of the implementation of the ESD until now is that national climate policies and measures affecting ESD sectors have been influenced by several factors, including EU and national measures for promoting energy efficiency and renewable energy. The concrete consequences of the ESR in terms of Member State action is therefore difficult to establish at this stage.

Possible costs for the private sector might arise from the implementation of such national policies but not as a direct effect of the ESR itself. Any effects on enterprises will depend on the specific measures chosen on national level. With respect to energy efficiency measures, which are expected to be an important part of such measures, see the impact assessment of the review of the Energy Efficiency Directive for further information. With respect to potential measures in agriculture and land use sectors, see the Impact Assessment for agriculture and LULUCF for further information.

8.4. Annex 8.4: Analytical models and model-based scenarios used in preparing the impact assessment.

8.4.1. Description of analytical models used

The model suite used for this impact assessment has a successful record of use in the Commission's climate and energy policy impact assessments – it is the same model suite as used for the 2020 climate and energy package as well as for the 2030 climate and energy policy framework. The models and their linkages are briefly described in the following subsections. Detailed model descriptions can be found on the DG CLIMA website[88]. Assumptions relevant for this impact assessment are described in section 8.4.2 on the EU Reference scenario and section 8.4.3 on policy scenarios.

The model suite covers the **entire energy system** (energy demand, supply, prices and investments to the future) and all GHG emissions and removals:

- **Emissions:** CO_2 emissions from energy and processes (PRIMES), CH_4, N_2O, fluorinated greenhouse gases (GAINS), CO_2 emissions from LULUCF (GLOBIOM-G4M), air pollution SO_2, NOx, PM2.5-PM10, ground level ozone, VOC, NH_3 (GAINS)

- **Emission reduction and removals:** structural changes and technologies in the energy system and industrial processes (PRIMES), technological non-CO_2 emission reduction measures (GAINS), changes in land use (GLOBIOM-G4M-CAPRI)

- **Time horizon:** 1990 to 2050 (5-year time steps)

- **Geography:** individually all EU Member States, EU candidate countries and, where relevant Norway, Switzerland and Bosnia and Herzegovina

- Impacts: on energy, transport and industry (PRIMES), agriculture, forestry and land use (GLOBIOM-G4M), atmospheric dispersion, health and ecosystems (acidification, eutrophication) (GAINS), macro-economy with multiple sectors, employment and social welfare

- **Split ETS-ESD/ESR:** the split is calibrated on the basis of the existing ETS-ESD scope for the period 2005-2050.

Related to this last element, to ensure modelling consistency over time, the scope of the ESD and ETS is kept constant over the time horizon 2005-2050 which means that historic ESD emission estimates need to be updated to reflect changes in the coverage in the ESD since 2005. These stem from the expansions in scope of the ETS, notably in 2013 the inclusion of some industrial process CO_2, N_2O and PFC emissions as well as the inclusion of RO, BG and HR in the ETS after 2005 (with no monitored ETS data available for 2005 to estimate the exact split ETS-ESD).

This recalibration of the historic split in 2005 ESD-ETS emissions, to take into account these scope changes afterwards, is based on an estimation method developed by the EEA[89], also taking into account most recent UNFCCC inventory submissions (for the

[88] http://ec.europa.eu/clima/policies/strategies/analysis/models/index_en.htm

[89] See the EEA ETS data viewer (http://www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer) and accompanying documentation. The underpinning methodology is described in Verena

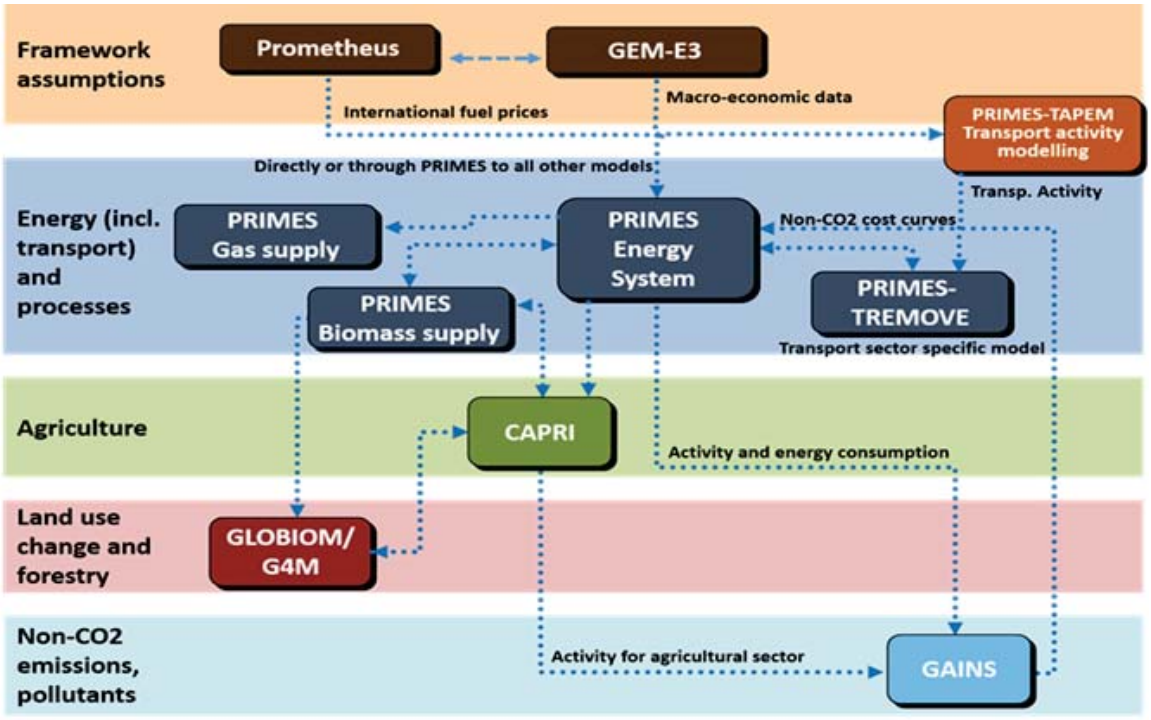
2016 Reference this was the inventory as submitted in 2015). This allows presenting a meaningful emission trend over time within the ETS and ESD sectors.

It can be noted that this approach is different from the approach in the ESD legislation for instance in relation to how the Member States AEAs were reduced due to extension of scope of the ETS in 2013, or how to cover for the impact of recent inventory changes. This leads to some differences in 2005 emissions between those used in the modelling exercise, and those resulting from using the 2020 AEAs and ESD targets set to calculate 2005 base year emissions. As a consequence, in the projections there is a slight overachievement of the -40% overall GHG reduction target compared to 1990 when the model projects fulfilment of the targets in the ESR of -30% compared to 2005 and ETS of -43% compared to 2005.

8.4.1.1. Overview of model inter-linkages

The models are linked with each other in formally-defined ways to ensure consistency in the building of scenarios, as shown graphically in Figure 18.

Figure 18: Inter-linkages between models



Source: E3MLab/ICCS

8.4.1.2.PRIMES

The PRIMES model is an EU energy system model which simulates energy consumption and the energy supply system. It is a partial equilibrium modelling system that simulates an energy market equilibrium in the European Union and each of its Member States. This includes consistent EU carbon price trajectories.

Graichen, Johanna Cludius, Sabine Gores: Estimate of historical emissions for stationary installations to reflect the current scope of the EU ETS (2013-20), ETC/ACM Technical Paper 2016/1, May 2016.

Decision making behaviour is forward looking and grounded in micro economic theory. The model also represents in an explicit and detailed way energy demand, supply and emission abatement technologies, and includes technology vintages.

The core model is complemented by a set of sub-modules, of which the transport sector module and the biomass supply module are described below separately in more detail. Industrial non-energy related CO2 emissions are covered by a sub-module so that total CO2 emissions can be projected. The model proceeds in five year steps and is for the years 2000 to 2010 calibrated to Eurostat data.

The PRIMES model is suitable for analysing the impacts of different sets of climate, energy and transport policies on the energy system as a whole, notably on the fuel mix, CO_2 emissions, investment needs and energy purchases as well as overall system costs. It is also suitable for analysing the interaction of policies on combating climate change, promotion of energy efficiency and renewables. Through the formalised linkages with GAINS non-CO_2 emission results and cost curves, it also covers total GHG emissions and total ESD sector emissions. It provides details on the Member State level, showing differential impacts across Member States.

PRIMES has been used for the analysis underpinning the Commission's proposal on the EU 2020 targets (including energy efficiency), the Low Carbon Economy and Energy 2050 Roadmaps as well as the 2030 policy framework for climate and energy.

PRIMES is a private model and has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens[90] in the context of a series of research programmes co-financed by the European Commission.

The model has been successfully peer reviewed[91], most recently in 2011[92]

8.4.1.3.PRIMES-TREMOVE

The PRIMES-TREMOVE Transport Model projects the evolution of demand for passengers and freight transport by transport mode and transport mean. It is essentially a dynamic system of multi-agent choices under several constraints, which are not necessarily binding simultaneously. The model consists of two main modules, the transport demand allocation module and the technology choice and equipment operation module. The two modules interact with each other and are solved simultaneously.

The projection includes details for a large number of transport means, technologies and fuels, including conventional and alternative types, and their penetration in various transport market segments. It also includes details about greenhouse gas and air pollution emissions, as well as impacts on external costs of congestion, noise and accidents.

PRIMES-TREMOVE has been used for the 2011 White Paper on Transport, Low Carbon Economy and Energy 2050 Roadmaps as well as the 2030 policy framework for climate and energy.[93]

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[90] http://www.e3mlab.National Technical University of Athens.gr/e3mlab/
[91] http://ec.europa.eu/clima/policies/strategies/analysis/models/docs/primes_model_2013-2014_en.pdf.
[92] https://ec.europa.eu/energy/sites/ener/files/documents/sec_2011_1569_2.pdf
[93] The model can be run either as a stand-alone tool (e.g. for the 2011 White Paper on Transport) or fully integrated in the rest of the PRIMES energy systems model (e.g. for the Low Carbon Economy and Energy

The PRIMES-TREMOVE is a private model that has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens [94], based on, but extending features of the open source TREMOVE model developed by the TREMOVE[95] modelling community. Part of the model (e.g. the utility nested tree) was built following the TREMOVE model.[96] Other parts, like the component on fuel consumption and emissions, follow the COPERT model.

In the transport field, PRIMES-TREMOVE is suitable for modelling *soft measures* (e.g. eco-driving, deployment of Intelligent Transport Systems, labelling), *economic measures* (e.g. subsidies and taxes on fuels, vehicles, emissions; ETS for transport when linked with PRIMES; pricing of congestion and other externalities such as air pollution, accidents and noise; measures supporting R&D), *regulatory measures* (e.g. CO_2 emission performance standards for new passenger cars and new light commercial vehicles; EURO standards on road transport vehicles; technology standards for non-road transport technologies), *infrastructure policies for alternative fuels* (e.g. deployment of refuelling/recharging infrastructure for electricity, hydrogen, LNG, CNG). Used as a module which contributes to a broader PRIMES scenario, it can show how policies and trends in the field of transport contribute to economy wide trends in energy use and emissions. Using data disaggregated per Member State, it can show differentiated trends across Member States.

8.4.1.4.PRIMES Biomass Supply

The biomass system model is linked with the PRIMES energy system model for Europe and can be either solved as a satellite model through a closed-loop process or as a stand-alone model.

It is an economic supply model that computes the optimal use of biomass/waste resources and investment in secondary and final transformation, so as to meet a given demand of final biomass/waste energy products, projected to the future by the rest of the PRIMES model. The biomass supply model determines the consumer prices of the final biomass/waste products used for energy purposes and also the consumption of other energy products in the production, transportation and processing of the biomass/waste products. The model also reflects the sustainability criteria currently in place and can be used for reflecting policies facilitating the use of renewable energy sources. After cross check of input data and draft results, results of the biomass supply model are used to ensure consistency between PRIMES, CAPRI and GLOBIOM bioenergy modelling.

2050 Roadmaps, and for the 2030 policy framework for climate and energy). When coupled with PRIMES, interaction with the energy sector is taken into account in an iterative way.

[94] http://www.e3mlab.National Technical University of Athens.gr/e3mlab/

[95] http://www.tmleuven.be/methode/tremove/home.htm

[96] Several model enhancements were made compared to the standard TREMOVE model, as for example: for the number of vintages (allowing representation of the choice of second-hand cars); for the technology categories which include vehicle types using electricity from the grid and fuel cells. The model also incorporates additional fuel types, such as biofuels (when they differ from standard fossil fuel technologies), LPG and methane fuels. In addition, representation of infrastructure for refuelling and recharging are among the model refinements, influencing fuel choices. A major model enhancement concerns the inclusion of heterogeneity in the distance of stylised trips; the model considers that the trip distances follow a distribution function with different distances and frequencies. The inclusion of heterogeneity was found to be of significant influence in the choice of vehicle-fuels especially for vehicles-fuels with range limitations.

The PRIMES biomass supply model is private and has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens[97].

8.4.1.5.GAINS

The GAINS (Greenhouse gas and Air Pollution Information and Simulation) model is an integrated assessment model of air pollutant and greenhouse gas emissions and their interactions. GAINS brings together data on economic development, the structure, control potential and costs of emission sources and the formation and dispersion of pollutants in the atmosphere.

In addition to the projection and mitigation of greenhouse gas emissions at detailed sub-sectorial level, GAINS assesses air pollution impacts on human health from fine particulate matter and ground-level ozone, vegetation damage caused by ground-level ozone, the acidification of terrestrial and aquatic ecosystems and excess nitrogen deposition of soils.

Model uses include the projection of non-CO_2 GHG emissions and air pollutant emissions for EU Reference scenario and policy scenarios, calibrated to UNFCCC emission data as historical data source. This allows for an assessment, per Member State, of the (technical) options and emission potential for non-CO_2 emissions. Health and environmental co-benefits of climate and energy policies such as energy efficiency can also be assessed.

The GAINS model is accessible for expert users through a model interface[98] and has been developed and is maintained by the International Institute of Applied Systems Analysis[99]. The underlying algorithms are described in publicly available literature. The source code is not disclosed. GAINS and its predecessor RAINS have been peer reviewed multiple times, in 2004, 2009 and 2011.

8.4.1.6.GLOBIOM-G4M

The Global Biosphere Management Model (GLOBIOM) is a global recursive dynamic partial equilibrium model integrating the agricultural, bioenergy and forestry sectors with the aim to provide policy analysis on global issues concerning land use competition between the major land-based production sectors. Agricultural and forestry production as well as bioenergy production are modelled in a detailed way accounting for about 20 globally most important crops, a range of livestock production activities, forestry commodities as well as different energy transformation pathways.

GLOBIOM covers 28 (or 50) world regions. The disaggregation of the EU into individual countries has been performed only recently.

Model uses include the projection of emissions from land use, land use change and forestry (LULUCF) for EU Reference scenario and policy scenarios. For the forestry sector, emissions and removals are projected by the Global Forestry Model (G4M), a geographically explicit agent-based model that assesses afforestation-deforestation-forest management decisions. GLOBIOM-G4M is also used in the Impact Assessment for agriculture and LULUCF to assess the options (afforestation, deforestation, forest

[97] http://www.e3mlab.National Technical University of Athens.gr/e3mlab/
[98] http://gains.iiasa.ac.at/models/
[99] http://www.iiasa.ac.at/

management, cropland and grassland management) and costs of enhancing the LULUCF sink for each Member State.

The GLOBIOM-G4M is a private model and has been developed and is maintained by the International Institute of Applied Systems Analysis[100].

8.4.1.7.GEM-E3

The GEM-E3 (World and Europe) model is an applied general equilibrium model, simultaneously representing the whole world economy, its major regions and the 28 EU Member States, linked through endogenous bilateral trade flows and environmental flows.

GEM-E3 aims at covering the interactions between the economy, the energy system and the environment. It is a comprehensive model of the economy, the productive sectors, consumption, price formation of commodities, labour and capital, investment and dynamic growth. The model is dynamic, recursive over time, driven by accumulation of capital and equipment. Technology progress is explicitly represented in the production function. It is updated regularly using the latest revisions of the GTAP database and Eurostat statistics for the EU Member States.

It is updated regularly using the latest revisions of the GTAP database and Eurostat statistics for the EU Member States.

The GEM-E3 model has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens[101], JRC-IPTS[102] and others. It is documented in detail but the specific versions are private.

The model has been used by E3MLab/ICCS to provide the macro assumptions for the Reference scenario and for the policy scenarios. It has also been used by JRC-IPTS to assess macroeconomic impacts of target setting based on GDP per capita.

8.4.1.8.PROMETHEUS

PROMETHEUS is a fully stochastic world energy model used for assessing uncertainties and risks associated with the main energy aggregates including uncertainties associated with economic growth and resource endowment as well as the impact of policy actions. The model projects endogenously to the future the world energy prices, supply, demand and emissions for ten world regions.

World fossil fuel price trajectories are used as import price assumptions for EU Reference scenario and for policy scenario modelling .

The Prometheus model is private and has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens[103]

[100] http://www.iiasa.ac.at/
[101] http://www.e3mlab.National Technical University of Athens.gr/e3mlab/
[102] https://ec.europa.eu/jrc/en/institutes/ipts
[103] http://www.e3mlab.National Technical University of Athens.gr/e3mlab/

8.4.1.9.CAPRI

CAPRI is an open source economic partial equilibrium model developed by European Commission research funds. Operational since more than a decade, it supports decision making related to the Common Agricultural Policy and Environmental policy related to agriculture based on sound scientific quantitative analysis.

CAPRI is only viable due to its pan-European network of researchers which based on an open source approach tender together for projects, develop and maintain the model, apply it for policy impact assessment, write scientific publications and consult clients based on its results. It has been the basis of numerous peer reviewed publications.

The model has been used to provide consistent agricultural activity projections for the EU Reference scenario 2016s. It is also used in the LULUCF impact assessment.

The CAPRI model is an open source model which has been developed and is maintained by Eurocare GmbH[104], JRC, and other partners of the CAPRI network.

8.4.2. The EU Reference scenario 2016

8.4.2.1. Scenario design, consultation process and quality assurance

Building an EU Reference scenario is a regular exercise by the Commission. It is coordinated by DGs ENER, CLIMA and MOVE in association with the JRC, and the involvement of other services via a specific inter-service group.

The Reference scenario 2016 (REF2016) has been developed building on a modelling framework including as core models PRIMES (PRIMES-TREMOVE for transport), GAINS and GLOBIOM-G4M and as supporting models GEM-E3, PROMETHEUS, PRIMES Biomass supply and CAPRI (see prior section for details).

For the REF2016, the model was calibrated on energy data up to year 2013 from Eurostat and other sources, and for agriculture and non-CO_2 emission data up to the year 2015.

Member States were consulted throughout the development process through a specific Reference scenario expert group which met three times during the development of REF2016. Member States provided information about adopted national policies via a specific questionnaire, key assumptions have been discussed and in each modelling step, draft Member State specific results were sent for consultation. Comments of Member States were addressed to the extent possible, keeping in mind the need for overall comparability and consistency of the results.

Quality of modelling results was assured by using state of the art modelling tools, detailed checks of assumptions and results by the coordinating Commission services as well as by the country specific comments by Member States.

REF2016 projects EU and Member States energy, transport and GHG emission-related developments up to 2050, given current global and EU market trends and adopted EU and Member States' energy, transport, climate and related relevant policies.

[104] http://www.eurocare-bonn.de/

"Adopted policies" refer to those that have been cast in legislation in the EU or in Member States (with a cut-off date end of 2014[105]). Therefore the binding 2020 targets are assumed to be reached in the projection. This concerns GHG emission reduction targets (both for the EU ETS as well as ESD sectors) as well as RES targets, including RES in transport.

However, policies which are not yet legally implemented, e.g. those necessary to implement the 2030 energy and climate framework, are not part of REF2016[106]. On this basis, REF2016 can help identify areas where the current policy framework falls short of reaching the EU's climate and energy objectives[107]. Notably, REF2016 shows that current policy and market conditions will deliver neither the 2030 targets nor the long-term 2050 80-95% GHG emission reduction objective.

REF2016 provides projections, not forecasts. Unlike forecasts, projections do not make predictions about what the future will be. They rather indicate what would happen if the assumptions which underpin the projection actually occur. Still, the scenario allows for a consistent approach in the assessment of energy and climate trends across the EU and its Member States.

The report "EU Reference Scenario 2016 - Energy, Transport and GHG Emissions - Trends to 2050"[108] describes the inputs and results in detail. This section summarises the main assumptions and results, especially those relevant for the Energy Union framework.

8.4.2.2. Main assumptions

The projections are based on a set of assumptions, including on population growth, macroeconomic and oil price developments, technology improvements and policies.

Macroeconomic assumptions

In REF2016, the population projections draw on the European Population Projections (EUROPOP 2013) by Eurostat. The key drivers for demographic change are: higher life expectancy, convergence in the fertility rates across Member States in the long term, and inward migration. The EU28 population is expected to grow by 0.2% per year during 2010-2030 (0.1% for 2010-2050), to 516 million in 2030 (522 million by 2050). Elderly people, aged 65 or more, would account for 24% of the total population by 2030 (28% by 2050) as opposed to 18% today.

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[105] In addition, amendments to two Directives only adopted in the beginning of 2015 were also considered. This concerns notably the ILUC amendment to the RES directive and the Market Stability Reserve Decision amending the ETS Directive.

[106] For the period after 2020, policies are included that are part of the EU *acquis*, as well as important investments that are part of Member States' national energy plans. For instance, ETS with the Market Stability Reserve is included in REF16, but not the Commission's proposal for a change in the linear reduction factor post-2020. New near-zero energy buildings after 2020 - as defined in the Energy Performance of Buildings Directive - continue to be built, as well as energy labelling continues. Member States also gave input on planned energy investments, particularly in nuclear energy.

[107] Each new update of the Reference scenario models the projected impact of policy adopted up to the relevant cut-off date. Therefore, differences between two consecutive Reference scenarios, e.g. between the one from 2013 and REF2016, can be explained by the implications of policies adopted in the meantime as well as by changed economic and technological trends.

[108] European Commission: EU Reference Scenario 2016 - Energy, Transport and GHG Emissions - Trends to 2050. Directorate-General for Energy, Directorate-General for Climate Action and Directorate-General for Mobility and Transport, July 2016 .

GDP projections mirror the joint work of DG ECFIN and the Economic Policy Committee, presented in the 2015 Ageing Report[109]. The average EU GDP growth rate is projected to remain relatively low at 1.2% per year for 2010-2020, down from 1.9% per year during 1995-2010. In the medium to long term, higher expected growth rates (1.4% per year for 2020-2030 and 1.5% per year for 2030-2050) are taking account of the catching up potential of countries with relatively low GDP per capita, assuming convergence to a total factor productivity growth rate of 1% in the long run.

Sectoral activity projections are derived in a consistent way from these macroeconomic assumptions, using the macro-economic modelling tool GEM-E3 as well as econometric estimates for global demand for energy intensive industries.

Fossil fuel price assumptions

Oil prices have fallen by more than 60% since mid-2014, to an average of around 40 $/barrel for Brent crude oil in the first four months of 2016. The collapse of oil prices has been driven by low demand and sustained oversupply, due in particular to tight oil from North America and to the decision of the Organization of Petroleum Exporting Countries (OPEC) countries not to cut their output to rebalance the market. REF2016 considers a gradual adjustment process with reduced investments in upstream productive capacities by non-OPEC countries. Quota discipline is assumed to gradually improve among OPEC members. Thus, oil price is projected to reach 87 $/barrel in 2020 (in year 2013-prices). Beyond 2020, as a result of persistent demand growth in non-OECD countries driven by economic growth and the increasing number of passenger cars, oil price would rise to 113 $/barrel by 2030 and 130 $/barrel by 2050. This price trend resulting from PROMETHEUS modelling is in line with other reference sources such as the 2015 IEA World Energy Outlook.

No specific sensitivities were prepared with respect to oil and gas price developments. Still, it can be recalled that lower fossil fuel price assumptions tend to increase energy consumption and CO_2 emissions not covered by the ETS. The magnitude of the change would depend on the price elasticities and on the share of taxation, like excise duties, in consumer prices. For instance, for transport, the changes would be limited (depending on the magnitude of the change in the oil price) due to the high share of excise duties in the consumer prices but they are still expected to lead to some higher energy consumption and CO2 emissions. They also tend to lead to lower overall energy system costs, as the increase in consumption is more than compensated by lower prices. Conversely, costs for emission mitigation could slightly increase. Different fossil price assumptions are unlikely to lead to significantly different impacts across Member States.

Techno-economic assumptions

In terms of technological developments, input assumptions are based on a wide range of sources[110], with estimates on technological costs across main types of energy equipment, from power generation to heating systems and appliances. In addition, it should be

[109] European Commission/ DG-ECFIN (2015) "The 2015 Ageing Report Economic and budgetary projections for the 28 EU Member States (2013-2060)", European Economy 3/2015.

[110] Those include, among others, the European Commission Joint Research Centre, notably for power generation costs or identification of Best Available Technologies, or MURE, ICARUS or ODYSSEE for the demand sectors.

recalled that the PRIMES model (and other models where relevant) take into account technological progress.

In terms of technological developments relevant to the transport sector, battery costs for electric vehicles and plug-in hybrids are assumed to go down to 320-360 $/kWh by 2030 and 270-295 $/kWh by 2050; further improvements in the efficiency of both spark ignition gasoline and compression ignition diesel are assumed to take place. In addition, the market share of internal combustion engine (ICE) electric hybrids is expected to increase due to their lower fuel consumption compared to conventional ICE vehicles.[111]

For the techno-economic assumptions in the projection of non-CO2 GHG emissions, see the detailed technical documentation[112]. In general, technological progress in this domain is strongly linked to regulation; hence Reference scenario assumptions are conservative.

Technology assumptions are based on extensive literature review and have been peer-reviewed by the Commission services, notably the Joint Research Centre of the European Commission.

Specific policy assumptions

Following the above described policy modelling approach, the key policies included in the REF2016 are[113]:

- The EU Emissions Trading System (Directive 2003/87/EC and its amendments) is fully reflected in the modelling, including the linear reduction factor of 1.74% for stationary installations and the recently adopted Market Stability Reserve.114

- The Effort Sharing Decision (406/2009/EC) is assumed to be implemented, i.e. ESD GHG emission reductions at EU level in 2020 need to reach at least -10% compared to 2005 levels. It turned out that no specific policy incentives in addition to adopted EU and national policies were needed to achieve the EU level target. National ESD targets need not be achieved domestically given the existing flexibilities (e.g. transfers between Member States).

- The Energy Efficiency Directive (EED) and the Energy Performance of Buildings Directive (EPBD) are reflected, including Member States' specific obligations as regards energy savings obligation and buildings codes.

- Ecodesign and Energy Labelling Directives and Regulations are also reflected.

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[111] The Reference scenario, by design, assumes the continuation of the current trends and policies without the implementation of additional measures. Hence, due to the absence of further policies, car manufacturers and industry are not expected to devote additional effort in marketing advanced vehicle technologies. The relatively low production of advanced vehicles, in the Reference scenario, is not expected to yield economies of scale which could potentially imply high reduction in battery costs as suggested by other sources. Such assumptions change in a decarbonisation policy scenario context.

[112] Höglund-Isaksson, L., W. Winiwarter, P. Purohit, A. Gomez-Sanabria (2016): Non-CO2 greenhouse gas emissions in the EU-28 from 2005 to 2050: GAINS 2016 Reference scenario, International Institute for Applied Systems Analysis (IIASA).

[113] For a comprehensive discussion see European Commission: EU Reference Scenario 2016 - Energy, Transport and GHG Emissions - Trends to 2050. Directorate-General for Energy, Directorate-General for Climate Action and Directorate-General for Mobility and Transport, July 2016.

[114] Decision EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC

- CO2 standards for cars and vans regulations (Regulation (EC) No 443/2009, amended by Regulation EU No 333/2014 and Regulation (EU) No 510/2011, amended by Regulation EU 253/2014); CO2 standards for cars are assumed to be 95gCO2/km as of 2021 and for vans 147gCO2/km in line with current legislation. Standards are assumed constant after 2020/2021.

- The Renewable Energy Directive (Directive 2009/28/EC) and Fuel Quality Directive (Directive 2009/30/EC) including ILUC amendment (Directive (EU) 2015/1513): achievement of the legally binding RES target for 2020 (including 10% RES in transport target) for each Member State, taking into account the use of flexibility mechanisms when relevant as well as of the cap on the amount of food or feed based biofuels (7%). Member States' specific renewable energy policies for the heating and cooling sector are also reflected where relevant.

- Directive on the deployment of alternative fuels infrastructure (Directive 2009/30/EC).

- The Waste Management Framework Directive (Directive 2008/98/EC) and in particular the Landfill Directive (Directive 1999/31/EC) which contribute to a significant reduction of emissions from waste.

- The revised F-gas Regulation (Regulation 517/2014) strengthens existing measures and introduces a number of far-reaching changes, notably limiting the total amount of the most important F-gases that can be sold in the EU from 2015 onwards and phasing them down in steps to one-fifth of 2014 sales in 2030, and banning the use of F-gases in many new types of equipment where less harmful alternatives are widely available.

- The impacts of the Reforms of the Common Agricultural Policy are taken into account, e.g. the milk quota abolition.

- Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP) for maritime transport.115

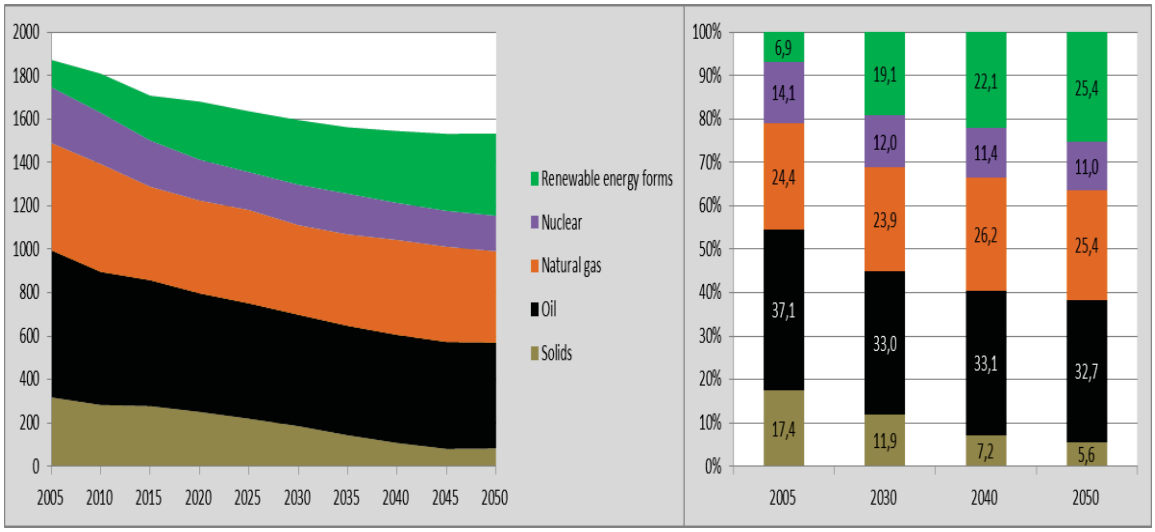
- Relevant national policies, for instance on the promotion of renewable energy, on fuel and vehicle taxation or national building codes, are taken into account.

8.4.2.3. Summary of main results of the 2016 Reference scenario

Figure 19 below presents the projected evolution of EU Gross Inland Energy Consumption. After the 2005 peak, energy consumption is projected to steadily decline until 2040, where it stabilises. Oil still represents the largest share in the energy mix, mostly because of transport demand. Solid fuels see a significant reduction in their share of the energy mix, while the biggest increase is for renewable energy. Natural gas and nuclear energy keep relatively stable shares in the energy mix.

Figure 19: EU28 Gross Inland Consumption (Mtoe, left; shares (%), right)

[115] IMO Resolution MEPC.203(62)

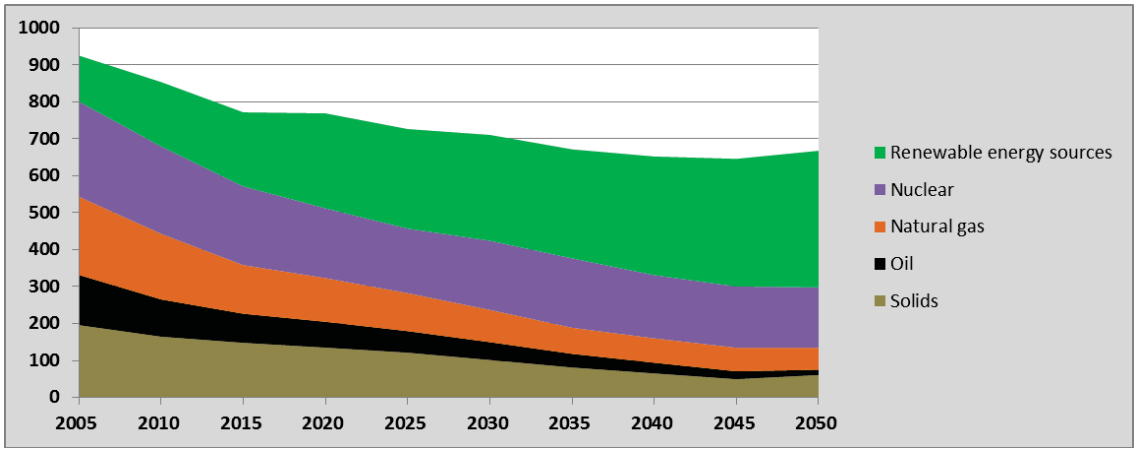


Source: PRIMES

Energy security

EU energy production (Figure 20) is projected to continue to decrease from around 760 Mtoe in 2015 to around 660 Mtoe in 2050. The projected strong decline in EU domestic production for all fossil fuels (coal, oil and gas) coupled with a limited decline in nuclear energy production is partly compensated by an increase in domestic production of renewables. Biomass and biowaste will continue to dominate the fuel mix of EU domestic renewable production, although the share of solar and wind in the renewable mix will gradually increase from around 17% in 2015 to 36% in 2050.

Figure 20: EU28 energy production (Mtoe)



Source: PRIMES

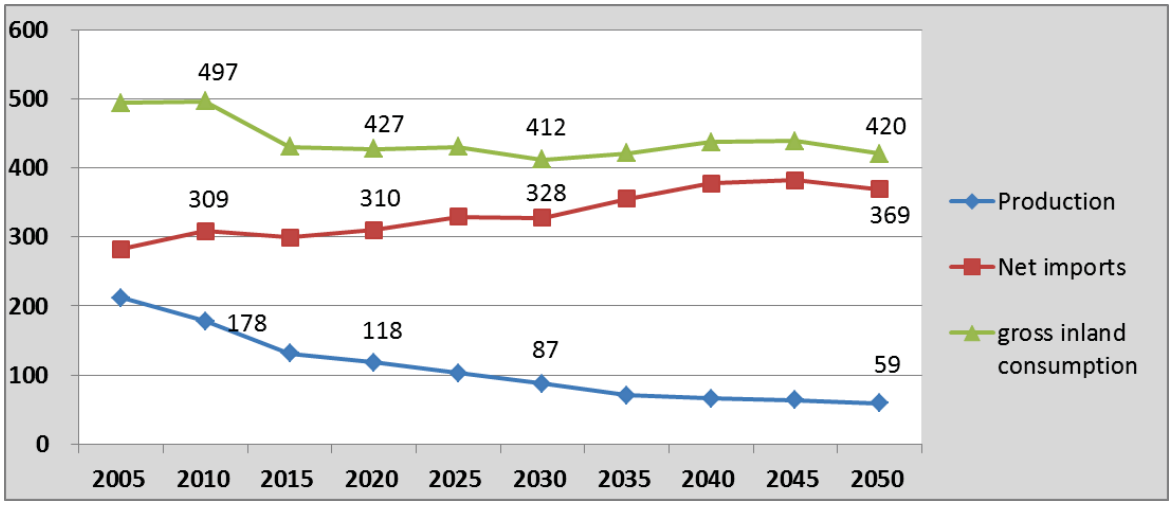
EU's import dependency shows a slowly increasing trend over the projected period, from 53% in 2010 to 58% in 2050. Again RES deployment, energy efficiency improvements and nuclear production (which remains stable) counteracts the strong projected decrease in EU's fossil-fuel production.

Solid imports as well as crude oil and (refinery) feedstock decline throughout the projection period, while oil products imports slightly increase. Natural gas imports

increase slightly in the long term reaching approximately 370 bcm[116] net imports in 2050. Biomass remains mostly supplied domestically, although the combination of increased bioenergy demand and limited potential for additional EU domestic supply leads to some increases in biomass imports post-2020 (from 11% of biomass demand in 2020 to about 15% in 2030 and beyond).

Up to 2020, the consumption of gas (The imported volumes of gas are projected to increase between 2015 and 2040 and then to stabilise in the long term, 15% above the 2010 net import level (from 309 bcm to 369 bcm, Figure 21) is expected to remain stable (at around 430bcm in gross inland terms). Net import dependency of natural gas registers an increase as domestic gas production continues its downward trend. Post 2020, a slight decrease in gross inland consumption of gas (412 bcm in 2030) is projected, as well as further reductions in indigenous production of gas. The imported volumes of gas are projected to increase between 2015 and 2040 and then to stabilise in the long term, 15% above the 2010 net import level (from 309 bcm to 369 bcm).

Figure 21: Gas - production, net imports and demand (volumes expressed in bcm)



Source: PRIMES

Internal energy market and investments

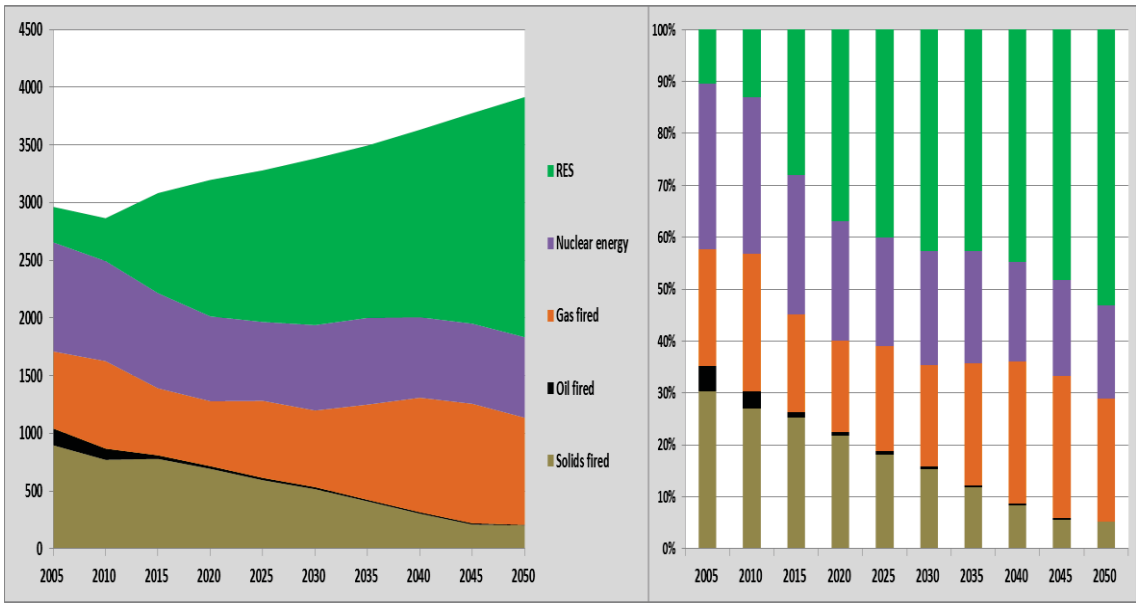
The EU power generation mix changes considerably over the projected period in favour of renewables (Figure 22). Before 2020, this occurs to the detriment of gas, driven by a strong RES policy to meet 2020 targets, very low coal prices compared to gas prices, and low CO_2 prices. After 2020, the change is characterised by further RES deployment, but also a larger coal to gas shift, driven mainly in anticipation of increasing CO_2 prices[117].

Gas therefore maintains its presence in the power generation mix in 2030 (at slightly higher levels in the long term compared to 2015). The share of solids/coal in power generation significantly declines, but not before 2020, to 15% in 2030.

[116] The conversion rate of 1 Mtoe = 1.11 bcm was used for natural gas, based on the BP conversion calculator.

[117] Carbon prices increase gradually from around 8€/tCO_2 in 2015 to reach 34€/tCO_2 in 2030. This takes into account the adopted Market Stability Reserve, but not a potential increase in the linear reduction factor, see footnote 1.

Figure 22: EU power generation (net) by fuel

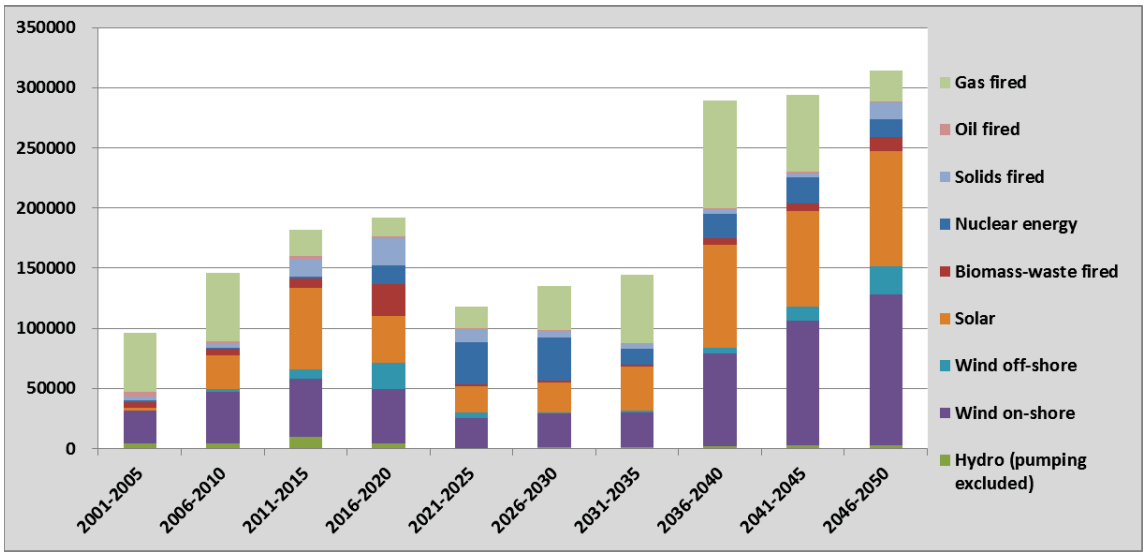


Source: PRIMES, Mtoe – left, shares – right

Variable RES (solar and wind) reach around 19% of total net electricity generation in 2020, 25% in 2030 and 36% in 2050, demonstrating the growing need for flexibility in the power system. Wind onshore is expected to provide the largest contribution. Solar PV and biomass also increase over time. Hydro and geothermal remain roughly constant. The share of nuclear decreases gradually over the projected period despite some life time extensions and new built, from 27% in 2015 to 22% in 2030.

Investment expenditures for power supply (Figure 23) increase substantially until 2020 driven by RES targets and developments, but slow down thereafter, until 2030, before increasing again from 2030 onwards notably due to increasing ETS carbon prices reflecting the combination of reinstated scarcity in the carbon market with the help of the Market Stability Reserve and a continuously decreasing ETS cap based on the current linear factor. New power plant investment is dominated by RES, notably solar PV and wind onshore. Nuclear investment mostly takes place via lifetime extensions until 2030 and in the longer term via new built, such as projected in, for instance, the UK, Finland, Sweden, France, Poland, and other Central European Member States. New thermal plant investment is mainly taking place in gas-fired plants.

Figure 23: Net power capacity investments by plant type (MWh – for five year period)

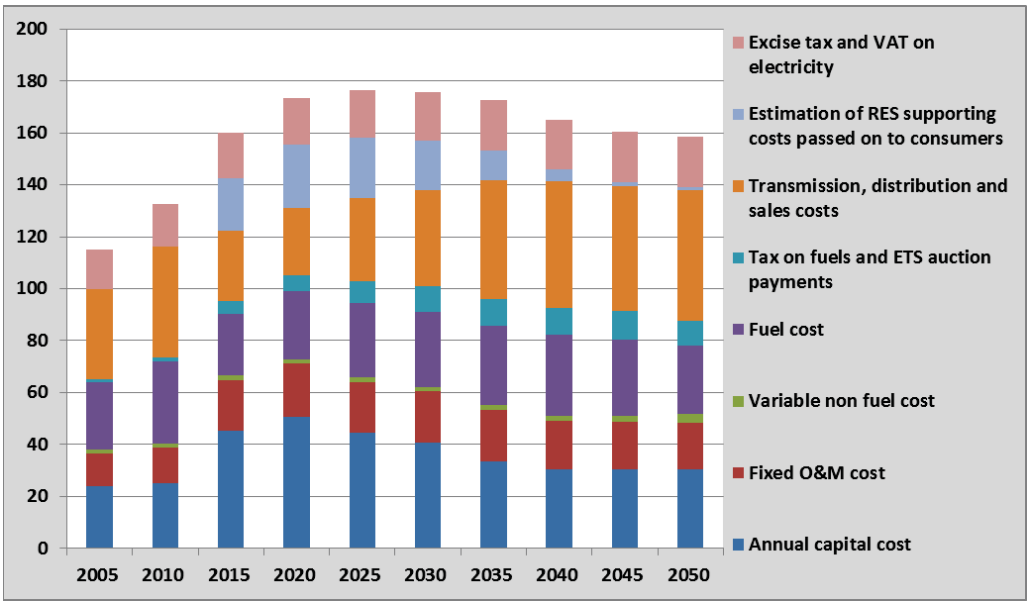


Source: PRIMES

Average electricity prices (Figure 24) steadily increase up to 2030 by about 18% relative to 2010 levels, stabilising around 20% in the long-term. The structure of electricity costs changes over time, with the capital cost component (generation and grid costs) increasing significantly in the short term. From 2030, the fuel cost component remains stable despite the increase in fuel prices, due to a decreasing share of fossil-fuel combustion. Transmission and distribution costs increase significantly in the longer term post-2030, partly linked to the need to cater for the increased presence of RES in the power generation mix.

As a result of the modelling, the carbon price is projected to increase, reflecting both the steadily decreasing ETS cap and the stabilising effect of the Market Stability Reserve. However, the increase in electricity prices due to ETS remains limited despite the significant increase in CO_2 price, as the share of carbon-intensive power generation decreases.

Figure 24: Decomposition of electricity generation costs and prices (Euro'13 MWh)



Source: PRIMES

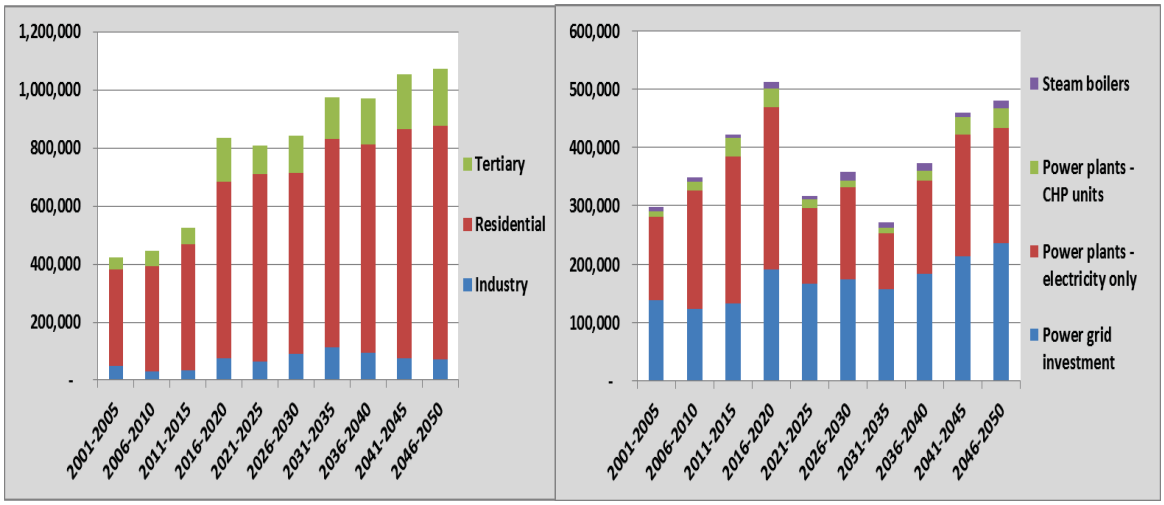
Electricity prices for households and services are projected to increase moderately in the medium term and to decrease slightly in the long term. Prices for industry on the contrary are stable or decrease over time as energy intensive industry maintains an electricity demand profile compatible with base-load power generation and bears a small fraction of grid costs and taxes. Taxes apply mainly on prices for households and services.

REF2016 shows increasing volumes of electricity trade over time. The flow between regions increases from 17% in 2015 to 26% in 2020, 29% in 2030 and then stays almost stable for the remainder of the projection period reaching 30% in 2050. Main drivers are intermittent RES power generation and the resulting balancing requirements. Trade is facilitated by the assumed successful development of the ENTSO-E Ten-Year Network Development Plan 2014[118] as well as pan-European market coupling and sharing of reserves and flexibility across Member States.

Investment expenditures in demand sectors (Figure 25– left hand side) over the projected period will be higher than in the past. They notably peak in the short term up to 2020, particularly in the residential and tertiary sectors, as a result of energy efficiency polices. Post-2020 they slightly decline until 2030, before increasing again to 2050. On the supply side (Figure 25– right hand side), investments peak towards 2020, followed by a decrease, notably explained by a decrease in power generation investments.

[118] Source https://www.entsoe.eu/major-projects/ten-year-network-development-plan/ten%20year%20network%20development%20plan%202016/Pages/default.aspx

Figure 25: Investment expenditures (5-year period) - demand side (left, excluding transport) and supply side (right)



Source: PRIMES

Transport investments (expenditures related to the turnover of rolling stock) steadily increase over time but maintain a relatively stable share of GDP.

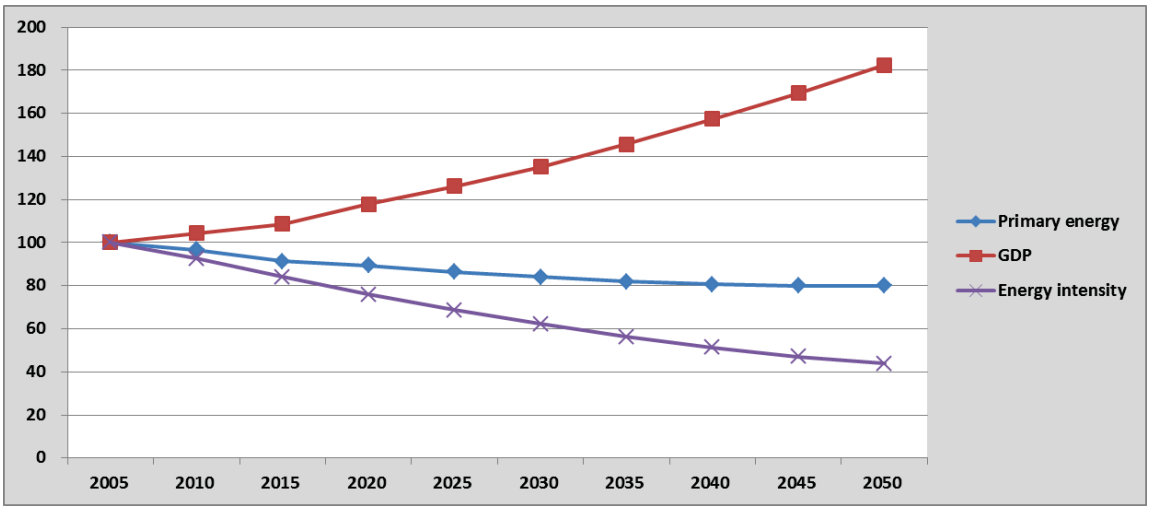
The relative weight of energy-related spending in households' expenditure[119] increases in 2020 compared to 2015 (7.5% compared to 6.8%), stabilising until 2030 before decreasing again until 2050 (6.1%).

Moderation of energy demand

In 2020, primary energy consumption decreases by 18.4% (relative to the 2007 baseline, i.e. how the target is defined), more than the sum of national Member States' indicative energy efficiency targets but still falling slightly short of the 2020 indicative EU energy efficiency target of 20%. In 2030, energy consumption is projected to decrease (again relative to 2007 baseline projections) by 23.9%. Primary energy demand and GDP continue to decouple (Figure 26), which is consistent with the trends observed since 2005. Energy efficiency improvements are mainly driven by policy up to 2020 and by market/technology trends after 2020.

[119] Share of energy system costs for the residential sector (fuel costs and annualised capital costs of energy related investment expenditures) in total households' consumption

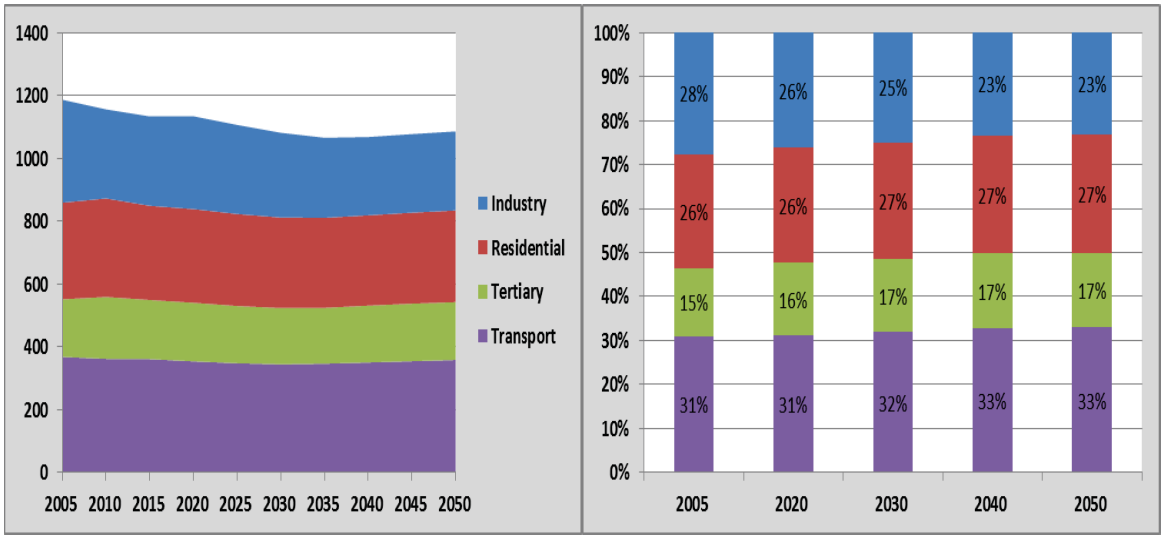
Figure 26: Decoupling of EU energy use and intensity from GDP (2005=100)



Source: Commission calculations based on PRIMES and GEM E3

The distribution of final energy consumption across sectors remains broadly similar to the current picture, all the way to 2050, with transport and the residential sector comprising the lion's share of final energy consumption (32% and 27% of final consumption, respectively, in 2030). Industry sees its share in final energy demand slightly decreasing, from 28% in 2005 to 23% in 2050, mostly due to improved energy efficiency in non-energy intensive industries. The tertiary (services and agriculture) sector keeps a stable share of about 17%.

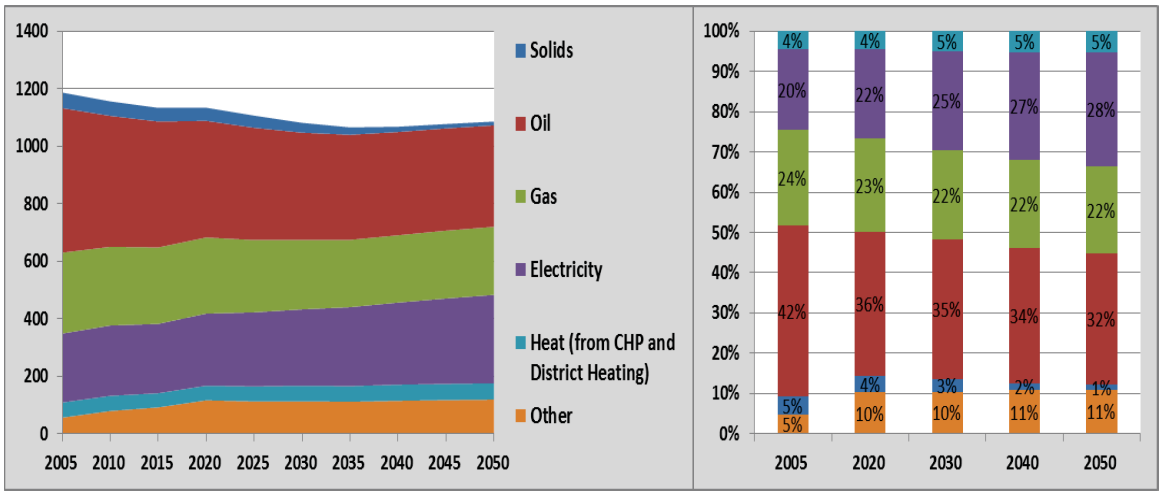
Figure 27: Evolution of final energy demand by sector (Mtoe – left, shares – right)



Source: PRIMES

With regard to the fuel mix in final energy, there is a gradual penetration of electricity (from 22% in total final energy use in 2010 to 28% in 2050). This is because of growing electricity demand as compared to other final energy use and to some electrification of heating (heat pumps) and to a limited extent in the transport sector. The potential of gas demand developments in, e.g. the transport sector, are not fully reflected in the Reference scenario, suggesting that additional policy incentives would be needed to trigger further fuel switching in the transport sector.

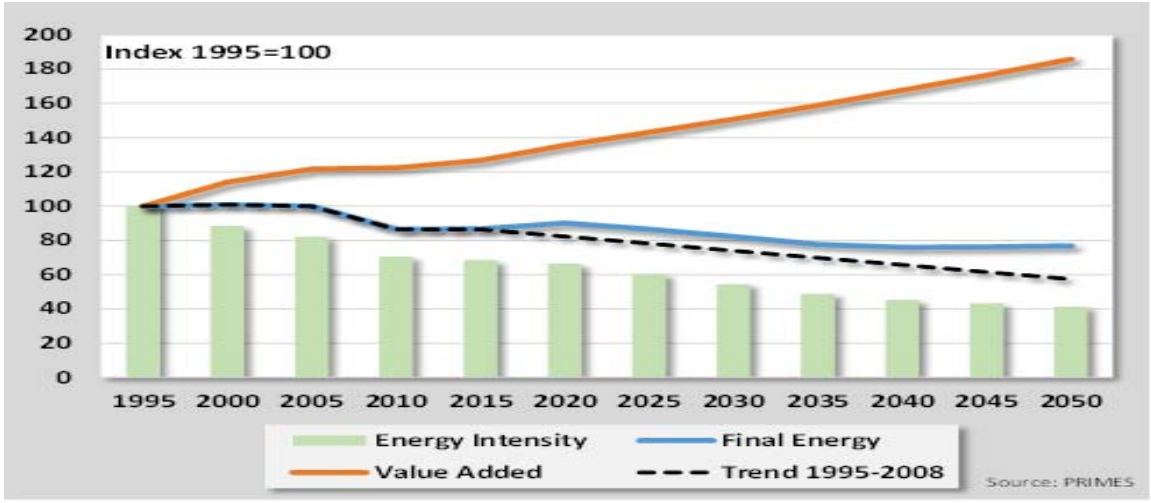
Figure 28: Evolution of final energy demand by fuel (Mtoe – left, shares – right)



Source: PRIMES

Energy intensity of the industrial sectors remains approximately constant in the medium term, as additional energy demand is due to the increase in production activity. In the long term however energy demand decreases, even though activity in terms of value added progresses. This is due to the energy efficiency embedded in the new capital vintages which replace old equipment and structural changes towards higher value added and less energy-intensive production processes, such as in iron and steel or non-ferrous metals.

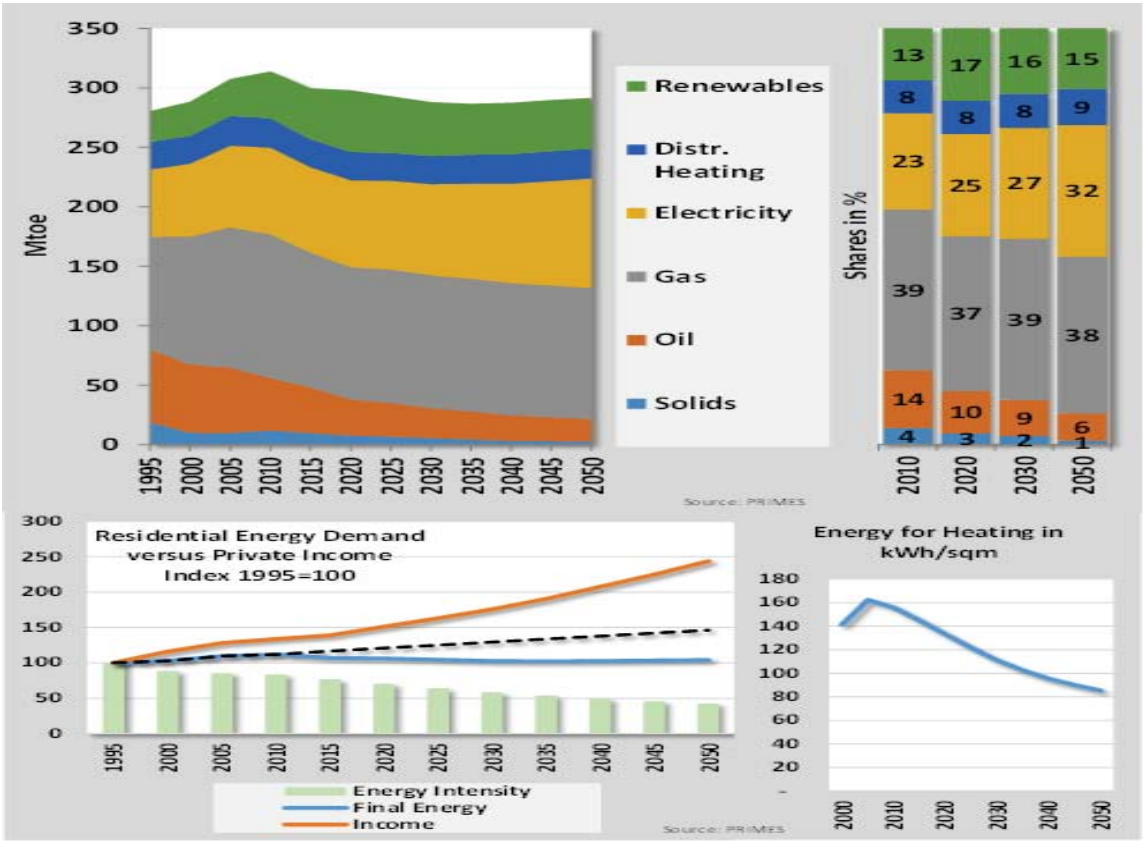
Figure 29: Industrial energy demand versus activity (value added)



Source: PRIMES

In the residential sector, energy demand remains below 2015 levels throughout the projection period. Energy demand decouples from income growth more than would be suggested by extrapolation of trends as the efficiency policies drive energy intensity improvements fast in the medium term; in the long term however the rate of improvements decreases due to the absence of additional policies.

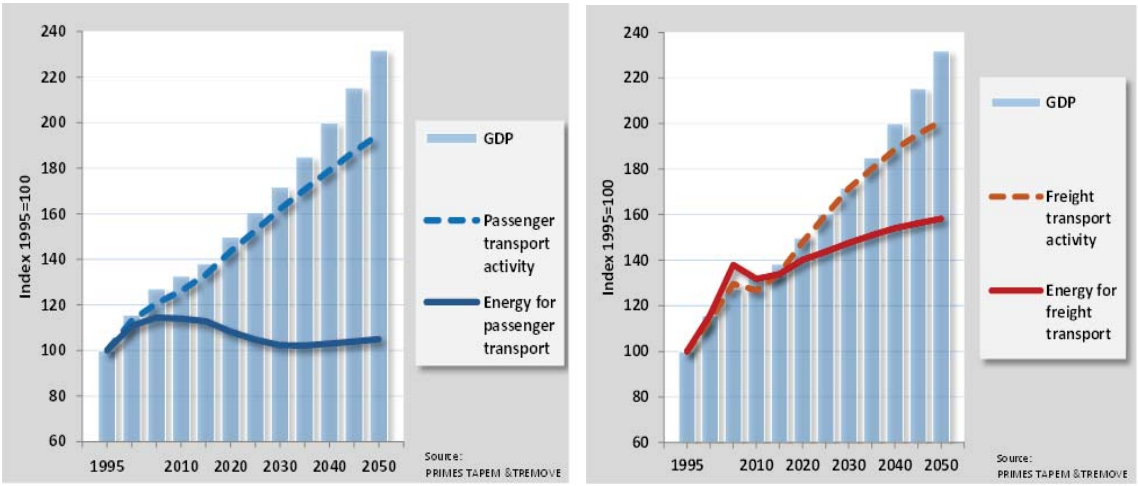
Figure 30: Final energy demand in the residential sector



Source: PRIMES

The activity of the transport sector shows a significant growth (Figure 31), with the highest increase in 2010 to 2030, driven by developments in economic activity. Historically, the growth of final energy demand in the transport sector has shown strong correlation with the evolution of transport activity. However, a decoupling between energy consumption and transport activity has been recorded in the past years. The decoupling between energy consumption and activity is projected to continue and even to intensify in the future.

Figure 31: Trends in transport activity and energy consumption



Source: PRIMES and GEM-E3; for aviation, passenger transport activity includes domestic, international intra-EU and international extra-EU aviation.

In REF2016, the binding energy and climate targets for 2020 will be met by assumption. However, current policy and market conditions will not deliver achievement of either the EU 2030 targets or the EU long-term 2050 decarbonisation goal.

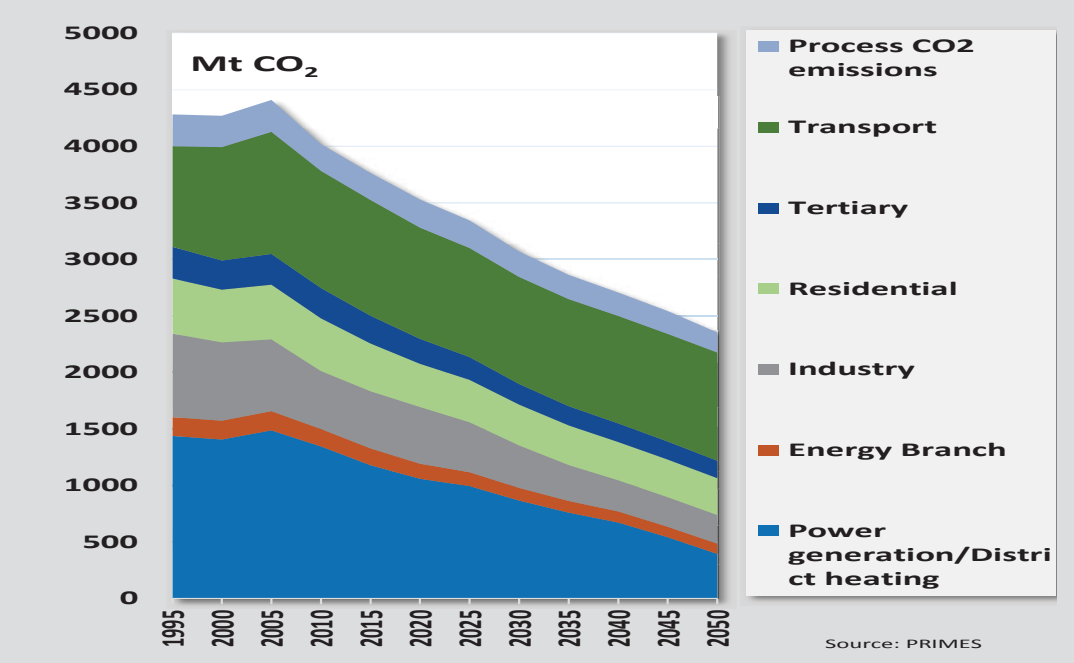
Total CO_2 emissions are projected to be 22% below 1990 levels by 2020. In 2030, CO_2 emissions reduce (relative to 1990 levels) by 32%. Most of these emissions are energy related, and this part also determines the overall trends. Non-energy related CO_2 emissions mainly relate to industrial processes, and remain rather stable. Land-use related CO_2 emissions are discussed below in the LULUCF section.

Emission reductions in the ETS sectors are larger than those in sectors covered by the Effort Sharing Decision (ESD) as current legislation implies a continuation of the reduction of the ETS cap with 1.74% per year over the projected period leading to a carbon price driving long term emission reduction. In the ESD sectors there are no further drivers beyond market forces (e.g. rising fossil fuel prices) and the continued impact of adopted policies such as CO_2 standards for vehicles or energy performance standards for new building to further reduce energy and consequently emissions.

CO_2 emissions can be decomposed in the components GDP, Energy Intensity of GDP and Carbon Intensity of Energy. The Energy Intensity of GDP component declines due to structural changes in the economy and increasing energy efficiency in all sectors. The decrease of carbon intensity of energy supply becomes an increasingly significant component over the period. This is mainly due to Renewable Energy policies in the short term and the ETS in the medium to long term.

On a sectorial level, CO_2 emissions decrease in all sectors between 2010 and 2050. Figure 14 shows a steep decrease in power generation, whereas emissions in the field of transport decrease at much slower pace, and the transport sector becomes the largest source of CO_2 emissions after 2030. Non-energy and non-land use related CO_2 emissions (e.g. industrial processes) reduce only slowly throughout the projection period; however they only represent a small share of total CO2 emissions.

Figure 32: Evolution of CO_2 emissions (Mt) by sector



Source: PRIMES

Decarbonisation: Renewable Energy

In 2020, the RES share in gross final energy consumption reaches 21% in 2020, while in 2030, it reaches 24%.

Renewable electricity is projected to increase (as a share of net power generation) from around 28% in 2015 to 36% in 2020, which implies an acceleration compared to observed trends today, in particular in a number of countries that are currently facing difficulties to meet their target. Further RES share increases are more limited until 2030 to reach 43%, as RES policies are phased out in the Reference scenario after 2020 and only most competitive RES technologies can emerge.

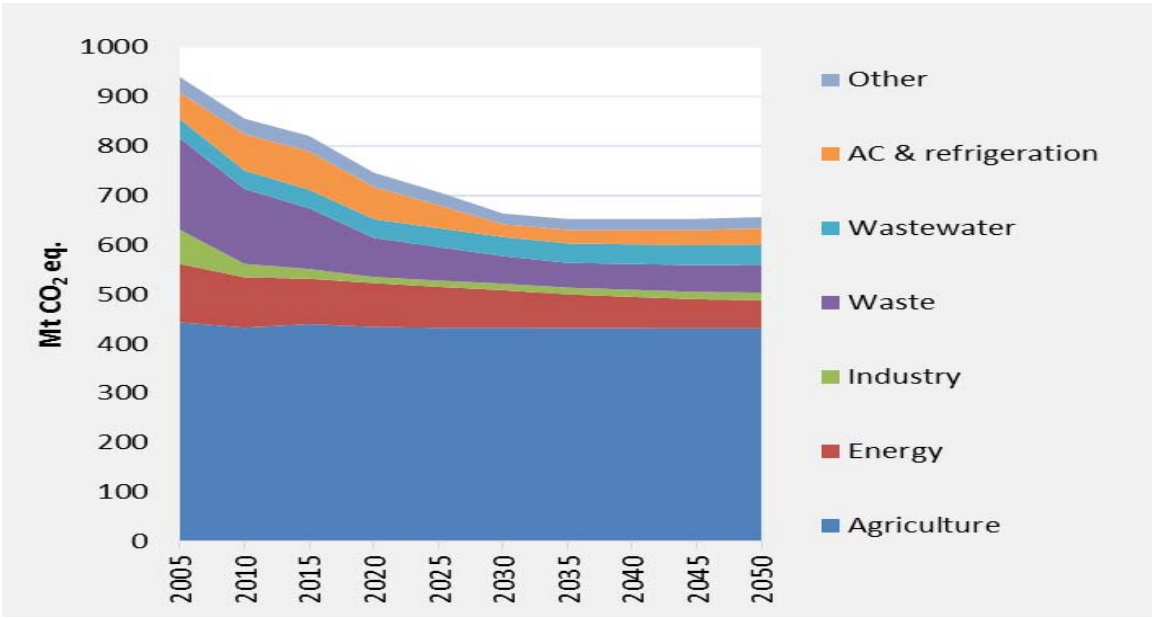
The RES share in heating and cooling increases from 17% in 2015 to 22% in 2020, reaching 25% in 2030. The use of RES in final demand for heating and cooling is the main driver of RES-H&C increase in the short term, but its contribution stagnates in the long term. In the long-term, RES in CHP and heat plants (e.g. district heating), as well some deployment of heat pumps, drive further increase of the RES-H&C share. Energy efficiency, implying lower demand for heat in all sectors, is also an important driver in the medium and long term.

The RES-T share reaches 11% in 2020. The development of bio-fuels is the main driver in the short term, but its contribution stagnates in the long term. The biofuel penetration is mainly driven by the legally binding target of 10% renewable energy in the transport sector (RES-T target). Projections also take into consideration specific Member States' mandatory blending obligations and tax incentives, as well as the ILUC amendment of the Renewables and Fuel Quality Directives and corresponding changes in RES-T target accounting rules. RES in electricity, combined with the relative increase of electricity use (albeit modest in share terms), is the main contributor to RES-T in the long term.

Non-CO2 GHG emission reduction

Non-CO_2 emissions (CH4, N2O and F-Gases) account currently (2013) for 18% of total EU GHG emissions (excluding LULUCF). They have decreased significantly (32%) between 1990 and 2013. They are expected to further decrease by 29% below 2005 levels in 2030 (-46% compared to 1990 levels), and to stagnate later on (Figure 33). CH_4 emissions – which have the largest share in this aggregate - are projected to decrease above average (33% due to declining trends in fossil fuel production, improvements in gas distribution and waste management) and N_2O emissions fall less than average (17%) until 2030, both remaining flat thereafter. F-Gases would reduce by half between 2005 and 2030, largely driven by EU and Member State's policies (i.e. the 2014 F-gas regulation and Mobile Air Conditioning systems directive). Except for a very minor fraction from some specific industries, non-CO_2 emissions fall under the ESD.

Figure 33: Non CO2 GHG emissions by sector



Source: GAINS

The non-CO_2 emission trends and their drivers vary by sector.

Agriculture is responsible for about half of all non-CO_2 GHG emissions and is expected to increase its share in total non-CO_2 until 2030. While the agricultural non-CO_2 emissions have reduced by 22% between 1990 and 2013, they are projected to roughly stabilize at current levels as a result of different trends which compensate each other, such as decreasing herd sizes (both of dairy cows and of non-dairy cattle) but increasing milk yields. Slightly reduced use of mineral fertilizer through improved efficiency (2% less in 2030 than in 2005) leads to corresponding reductions in N_2O emissions from soils. Improved manure management (e.g. through anaerobic digestion) also delivers minor emission reductions. The Common Agricultural Policy influences, inter alia, livestock numbers/intensities and the Nitrogen Directive and the Water Framework Directive impact on the use of fertilizer.

Waste is currently the second most important sector emitting non-CO2. There, a substantial reduction between 2005 and 2030 is expected (70%), strongly driven by environmental legislation, such as the Landfill directive and improvements in waste management as well as an update in inventory methodology of historic landfills that results in increased historic emissions and subsequent increased reductions of these emissions in the near to mid-term future. Also an increasing amount of CH_4 is recovered and utilised, thereby impacting on these trends towards lower emissions. After 2030, however, a moderate increase is projected, reflecting trends in economic development.

CH_4 and N_2O emissions from the **energy** sector (incl. transport) are expected to decrease by 36% from 2005 to 2030, and further 26% between 2030 and 2050. The main reductions come from less coal-mining and crude oil production in the EU, together with reduced emissions from power generation with fossil fuels. On the other hand, transport is expected to generate an increasing share of energy sector non-CO_2 emissions (N_2O from road transport being the most important contributor), growing from 12% in 2005 to 15% in 2030 and 20% in 2050 within the energy aggregate.

Emissions from **air conditioning and refrigeration** decrease by half from 2005 until 2030, also thanks to existing legislation (i.e. the new 2014 F-gas Regulation and the Mobile Air Conditioning systems Directive).

Most of the non-CO_2 emissions from **industry** – overall a minor non-CO_2 sector - are covered by the EU ETS (production of adipic and nitric acid, and of aluminium). The resulting incentive in combination with relatively cheap abatement options and (previous) national legislation cut emissions quite rapidly, to, in 2030, only a fifth of those in 2005. For the period after 2030 slight increases are projected in line with economic trends.

Emissions from the **wastewater** sector and remaining **other sectors** are projected to increase moderately in line with economic development over the whole period covered.

LULUCF emissions and removals

The EU28 Land Use Land Use Change and Forestry (LULUCF) sector is at present a net carbon sink which has been sequestering annually on average more than 300 Mt CO_2 over the past decade according to the UNFCCC inventory data[120]. In the Reference scenario 2016, the LULUCF sink is expected to decline in the future to -288 Mt $CO_{2\ eq}$ in 2030 from -299 Mt CO_2 eq. in 2005 and decreases further after 2030. This decline is driven partly by the increase in timber demand (partially a result of the increase in bioenergy demand that is expected in order to reach the Renewable Energy targets in 2020. It is the result of changes in different land use activities of which changes in the forest sector are the most important. Figure 34 shows the projection of the total EU28 LULUCF sink in the Reference scenario 2016 and the contribution from different land use activities.

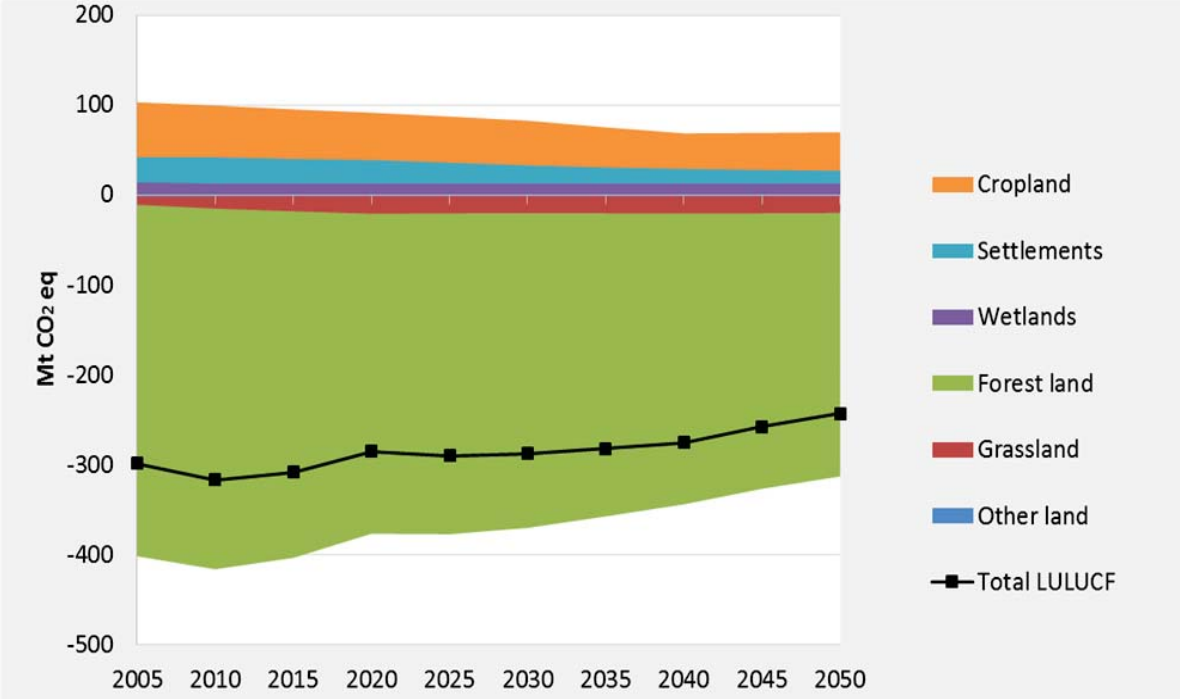
At present, the carbon sink in **managed forests** (-373 Mt $CO_{2\ eq.}$ in 2010 without applying any accounting rules[121]), is the main contributor to the LULUCF sink. The forest management sink is driven by the balance of forest harvest and forest increment rates (accumulation of carbon in forest biomass as a result of growth of the trees with the age). Forest harvest is projected to increase over time from 516 million m^3 in 2005 to 565 million m^3 in 2030 due to growing demand for wood for material uses and energy production. And the forest increment are projected to decrease with the EU forest becoming older from 751 million m3 in 2005 to 725 million m3 in 2030. As a consequence, the carbon sink in managed forests declines by 32% until 2030. This decline in the managed forests carbon sink is partially compensated by a rising carbon sink from afforestation and decreasing emissions from deforestation in line with past trends. Emissions from deforestation continue to decline from 63 Mt CO_2 in 2005 to 20 Mt CO_2 eq. in 2030. Carbon sequestration from afforested areas increases steadily to 99 Mt CO_2 eq. by 2030, as new forests are continuously, though at slower rate, being established. In addition, young forests that were established over the last 20 years get into a phase of high biomass production.

[120] http://unfccc.int

[121] The GHG accounting approach for LULUCF differs from other emission sectors. Notably, forest management is not accounted compared to historic emissions, but against a so called Forest Management Reference Level. This means that the accounted removals from the LULUCF sector are much smaller than the reported removals seen by the atmosphere.

Activities in the **agricultural sector** (cropland and grassland) have a smaller impact on the total LULUCF sink compared to the forest sector. Still, net carbon emissions from cropland are projected to decline by some 18% by 2030 compared to 2005 as soils converge towards soil carbon equilibrium over time. In addition, perennial crops (miscanthus, switchgrass and short rotation coppice) that typically sequester additional carbon in soil and biomass contribute to decreasing cropland emissions. By 2030, 0.9 Mha of perennial crops are expected to be cultivated. The grassland sink increases to around -19 Mt CO_2 eq. in 2030 as land continues to be converted to grassland e.g. through cropland abandonment while at the same time the total grassland area slightly declines over time due to afforestation and the expansion of settlements.

Figure 34: EU28 emissions/removals in the LULUCF sector in Mt CO_2 until 2050[122]



Source: GLOBIOM-G4M

Research, innovation and competitiveness

REF2016 deals explicitly with the penetration of new technologies. The approach is in two steps. First, assumptions are made on techno-economic characteristics based on latest scientific evidence. Second, the model endogenously selects the most economically viable technologies at each point in time, leading to further technology learning as technologies are deployed.

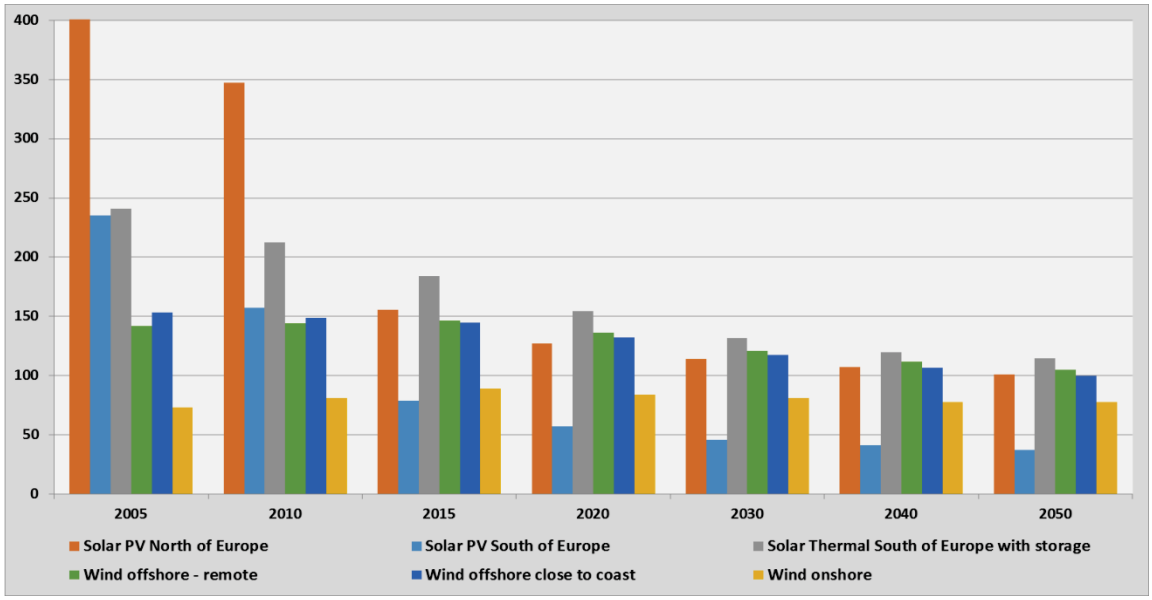
The development of PVs starts from lower costs than in the previous Reference scenario and has a positive learning curve throughout the projection period. This translates into significant deployment of solar PVs in REF2016, especially in Southern Europe.

There remains large uncertainty about the costs for offshore wind and there have been cost increases due to previously unforeseen difficulties and logistics. Surveys have identified significant potential of cost decrease due to economies of scale and possibilities of improvement in logistics, but these cost decreases are likely to occur only

[122] Emissions from deforestation and harvested wood products are included in "Forest land" in contrast to UNFCCC inventories.

towards 2030. As such, offshore wind developments in REF2016 are more conservative than in past exercises.

Figure 35: Illustrative levelized cost of electricity (expressed in €'2013/MWh-net)



Source: NTUA based on PRIMES

The share of advanced biofuels in total consumption of biofuels moderately increases Out of these, about half are projected to be related to innovative technologies and methods, such as forestry residues, or bio-waste.

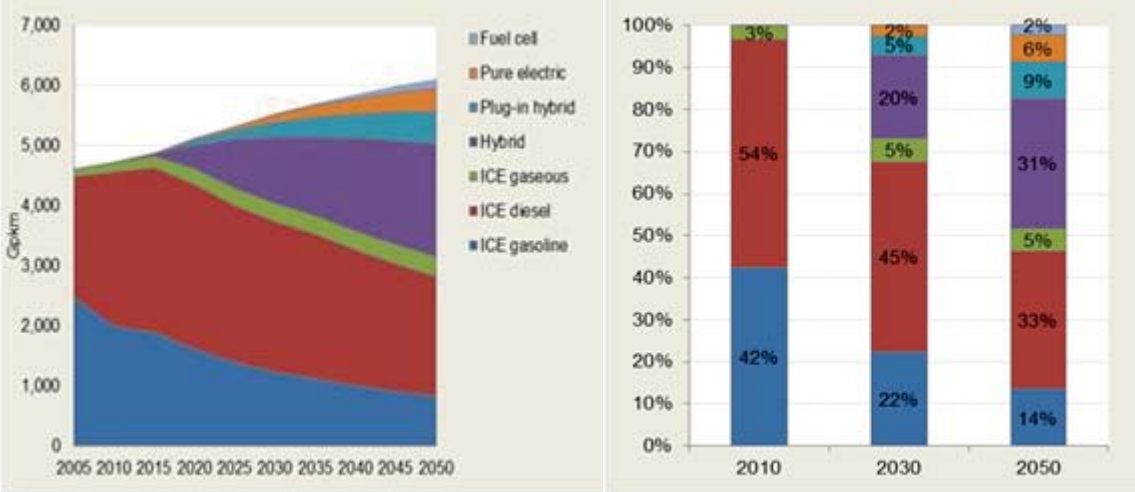
Compared to the previous Reference scenario, the costs of nuclear investment have increased and also the costs for nuclear refurbishments have been revised upwards. Although lifetime extensions of nuclear power plants remain economically viable in most cases, investments in new built plants are lower compared to previous projections.

The construction of power plants equipped with carbon capture technologies has been developing at a very slow pace, and been dependent on public support (e.g. EEPR and NER300). Geological restrictions as well as current political restrictions on storage are also reflected. For these reasons, CCS costs are assumed higher than in previous Reference scenarios.

On the demand side, demand for electric appliances continues to increase. However, there is an uncoupling between appliance stock and energy consumption due to the technological progress facilitated by eco-design regulations.

Car manufacturers are expected to comply with the CO_2 standards by marketing vehicles equipped with hybrid system, which are becoming more appealing to the consumers thanks to lower costs. Electrically chargeable vehicles emerge around 2020 and are kick-started by existing EU and national policies as well as by incentive schemes aiming to boost their penetration. The share of activity of total electric vehicles in the total activity of light duty vehicles reaches 15% in 2050 (Figure 36). Fuel cells would add an additional 2% by 2050. Other energy forms such as LPG and natural gas maintain a rather small share in the final energy demand of the transport sector.

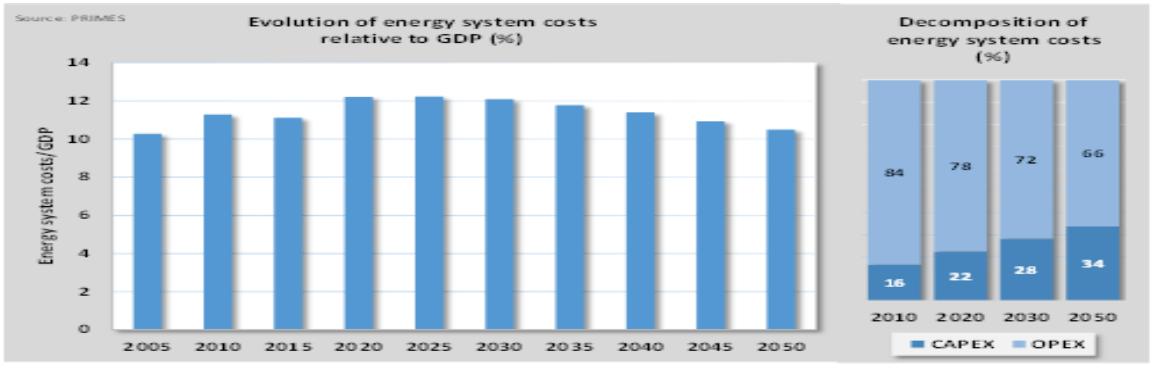
Figure 36: Evolution of activity of passenger cars and vans by type and fuel



Source: PRIMES-TREMOVE

Energy system costs (Figure 37) increase up to 2020. Large investments are undertaken driven by current policies and measures. Overall, in 2020 energy system costs constitute 12.3% of the GDP, rising from 11.4% in 2010[123]. Between 2020 and 2030 the share remains stable and decreases thereafter, as the system reaps benefits from the investments undertaken in the previous decade (notably via fuel savings). In this period, the share of energy system costs in GDP is gradually decreasing, reaching levels close to 2005 in 2050.

Figure 37: Projected evolution of energy system costs



Source: PRIMES, energy system costs exclude ETS auction payments, given that they result in corresponding auction revenues.

8.4.3. Overview of model based policy scenarios used

Two central policy scenarios reflecting the 2030 targets and main elements of the 2030 climate and energy framework agreed by the European Council in 2014[124] have been developed, EUCO27 and EUCO30. This recognises that for the energy efficiency target a review will still be undertaken to set the level of ambition: These scenarios also aim to provide consistency across a number of impact assessments underpinning 2016 Energy

[123] Total system costs include total energy system costs, costs related to process-CO_2 abatement and non-CO_2 GHG abatement.

[124] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145397.pdf.

Union policy proposals. Using two central scenarios increases the robustness of policy conclusions.

Both scenarios start from the EU Reference scenario 2016 and add the targets and policies described in detail below. In addition, coordination policies are assumed which enable long term decarbonisation of the economy. Coordination policies replace the "enabling conditions" which have been modelled in 2030 framework IA and the 2014 IA on 2030 EE targets.

Coordination policies relate to ongoing infrastructure developments that will enable a larger exploitation of cost-effective options after 2020, such as grid developments, and relate to R&D and public acceptance that are expected to be needed to meet long term decarbonisation objectives.

The table below summarises the assumptions on climate, renewable energy and specific energy efficiency policies in the EUCO27 scenario that have been modelled.

EUCO27	This scenarios is designed to meet all 2030 targets set by the European Council: • At least 40% GHG reduction (wrt. 1990) • 43% GHG emissions reduction in ETS sectors (wrt 2005) • 30% GHG emissions reduction in Effort Sharing Decision sectors (wrt 2005) • At least 27% share of RES in final energy consumption • **27% primary energy consumption reduction** (i.e. achieving 1369 Mtoe in 2030) compared to PRIMES 2007 baseline (1887 Mtoe in 2030). This equals a reduction of primary energy consumption of 20% compared to historic 2005 primary energy consumption (1713 Mtoe in 2005). Main policies and incentives additional to Reference: Revised EU ETS • Increase of ETS linear factor to 2.2% for 2021-30 • After 2030 cap trajectory to achieve -90% emission reduction in 2050 in line with Low Carbon Economy Roadmap Renewables policies • Renewables policies necessary to achieve 27% target, reflected by RES values applied in electricity, heating&cooling and transport sectors. Energy efficiency policies: Residential and services sector • Increasing energy efficiency of buildings via increasing the rate of renovation and depth of renovation. In this model, better implementation of EPBD and EED, continuation of Art 7 of EED and dedicated national policies are depicted by the application of energy efficiency values (EEVs). • Financial instruments and other financing measures on the European

	level facilitating access to capital for investment in thermal renovation of buildings. This, together with further labelling policies for heating equipment, is depicted by a reduction of behavioural discount rates for households from 12% to 11.5%. • More stringent (than in Reference) eco-design standards banning the least efficient technologies. Industry • More stringent (than in Reference) eco-design standards for motors. Transport • CO_2 standard for cars: 85g/km in 2025; 75g/km in 2030 and 25 gCO_2/km in 2050[125]. • CO_2 standards for vans: 135g/km in 2025; 120g/km in 2030; 60g/km in 2050[126]. • 1.5% average annual energy efficiency improvements for new conventional and hybrid heavy duty vehicles (HDVs) between 2010-2030 and -0.7% between 2030-2050. • Measures on management of transport demand: - recently adopted/proposed measures for road freight, railways and inland navigation[127]; gradual internalisation of transport local externalities[128] as of 2025 and full internalisation by 2050 on the inter-urban network. Non-CO2 policies • In 2030 carbon values of €0.05 applied to non-CO2 GHG emissions in order to trigger cost-effective emissions reductions in these sectors including in agriculture. • After 2030 carbon values set at EU ETS carbon price level

In the EUCO27 scenario, energy efficiency delivers a large part of GHG emissions reduction in the ESD/ESR sectors. This reduction is complemented by cost-effective reductions in non-CO2 emissions – mostly in agriculture.

The EUCO30 scenario is constructed similarly to the EUCO27 scenario, but raises the ambition level of the specific energy efficiency policies in a cost effective way. It implements the European Council guidance of having in mind 30% for the review of the Energy Efficiency Target. A relevant implication is that more ambitious energy efficiency policies deliver all necessary reductions in ESD/ESR sectors, and no reductions in non-CO2 sectors such as agriculture beyond Reference take place.

EUCO30	This scenarios is designed to meet all 2030 targets set by the European Council: • At least 40% GHG reduction (wrt. 1990)

[125] On NEDC test-cycle.
[126] On NEDC test-cycle.
[127] Directive on Weights & Dimensions, Fourth railway package, NAIADES II package, Ports Package.
[128] Costs of infrastructure wear & tear, congestion, air pollution and noise.

	• 43% GHG emissions reduction in ETS sectors (wrt 2005) • 30% GHG emissions in Effort Sharing Decision sectors (wrt 2005) • 27% share of RES in final energy consumption • **30% primary energy consumption reduction** (i.e. achieving 1322 Mtoe in 2030) compared to PRIMES 2007 baseline (1887 Mtoe in 2030). This equals a reduction of primary energy consumption of 23% compared to historic 2005 primary energy consumption (1713 Mtoe in 2005). Main policies and incentives additional to Reference: Revised EU ETS • Increase of ETS linear factor to 2.2% for 2021-30 • After 2030 cap trajectory to achieve -90% emission reduction in 2050 in line with Low Carbon Economy Roadmap Renewables policies • Renewables policies necessary to achieve 27% target, reflected by RES values applied in electricity, heating&cooling and transport sectors. Energy efficiency policies: Residential and services sector • Further increasing energy efficiency of buildings via increasing the rate of renovation and depth of renovation. In this model, better implementation of EPBD and EED, continuation of Art 7 of EED and dedicated national policies are depicted by the application of energy efficiency values (EEVs). EE values are increased compared to EUCO27. • Financial instruments and other financing measures on the European level facilitating access to capital for investment in thermal renovation of buildings. This, together with further labelling policies for heating equipment, is depicted by a reduction of behavioural discount rates for households from 12% to 11.5%. • More stringent (than in EUCO27) eco-design standards banning the least efficient technologies. • Policies facilitating the uptake of heat pumps Industry • More stringent (compared to EUCO27) eco-design standards for motors. Transport • CO_2 standard for cars: 80g/km in 2025; 70g/km in 2030 and 25 gCO_2/km in 2050. • CO_2 standards for vans: 130g/km in 2025; 110g/km in 2030; 60g/km in 2050. • 1.5% average annual energy efficiency improvement for new conventional and hybrid heavy duty vehicles (HDVs) between 2010-2030 and -0.7% between 2030-2050

	• Measures on management of transport demand: - recently adopted/proposed measures for road freight, railways and inland navigation[129]; - gradual internalisation of transport local externalities[130] as of 2025 and full internalisation by 2050 on the inter-urban network. - modulation of infrastructure charges for HDVs according to CO2 emissions leading to faster fleet renewal. - eco-driving. - deployment of Collaborative Intelligent Transport Systems. Non-CO2 policies • No policy incentive until 2030 • After 2030 carbon values set at EU ETS carbon price level

In addition to these scenarios based on the EU Reference scenario 2016, a stylised WEM-Extra scenario is used in order to compare reductions potentials in higher-income Member States.

This scenario replaces the EU Reference scenario by aggregated national "With Existing Measures" (WEM) projections for the Effort Sharing Decision (ESD) sectors submitted in 2015 under the Monitoring Mechanism Regulation in the form after quality check and where necessary gap filled and recalibrated by the European Environmental Agency as used for the Trends and projections report 2015[131]:

As WEM extrapolation it emphasises existing differences in MS WEM projection methodology and content compared to the EU Reference scenario. By this it provides a sensitivity analysis of projected current trends and achievement of targets. As explained in section 1.3, for 2020 ESD GHG reduction results of the aggregated MS WEM projections are relatively similar, but for 2030 the aggregated MS WEM projection shows significantly less emission reductions.

Additional reduction potentials are then added based on the differences between EU Reference scenario and EUCO27 results. The box below provides more detail. The scenario gives some insight into how the different relative ambition levels of "WEM" projections would extrapolate into a decarbonisation context. It should not be seen as a cost-effective scenario.

WEM-Extra	This is a stylised scenario constructed by first calibrating Member States' "With Existing Measures" (WEM) projections for the Effort Sharing Decision (ESD) sectors to the 2005 figures used in the EU Reference scenario 2016. This is done in multiple steps. Firstly, EEA estimates of scope-corrected ESD emissions for 2005-2014 are used as a starting point for the emissions pathway. Then, the trend taken from Member States WEM is applied from the earliest data from which the WEM provides an emissions estimate, generally between 2010 and 2013. The resulting trend projection from 2005-2030 is calibrated to begin from the EU Reference scenario 2016 ESD emissions for 2005, thus calibrating the WEM projections to EU

[129] Directive on Weights & Dimensions, Fourth railway package, NAIADES II package, Ports Package.
[130] Costs of infrastructure wear & tear, congestion, air pollution and noise.
[131] EEA (2015) Trends and projections in Europe 2015

	Reference scenario 2005 figures. Then, every Member State has been assigned an additional effort, proportional to the additional reduction for that Member State in EUCO27 compared to Reference 2016, in order that the EU reaches a -30% target. In the WEM projections, the EU as a whole does not reduce emissions by 30% compared to 2005, but by 17%. An additional 13% overall reduction is needed to attain a -30% target. We calculate the difference between the 2016 Reference scenario non-ETS emissions in 2030 and the EUCO30 emissions in 2030. This is the "increment". The additional 13% reduction required as above is distributed proportionally to the "increment", i.e. to the additional potential EUCO30 sees above the Reference scenario. The resulting stylised scenario is the "WEM-Extra", or extrapolated WEM scenario.

A number of further policy scenarios based on the PRIMES and GAINS models are already available from published impact assessments, in particular from the 2030 framework impact assessment but also from the 2014 Energy Efficiency Communication with regard to higher energy efficiency ambitions as agreed under the 2030 framework.

These scenarios were based on the 2013 Reference, using the same model suite as EUCO27 and EUCO30.

The 2013 Reference scenario projected less ESD emission reductions in 2030 as the new Reference scenario 2016, i.e. 20% instead of the now achieved 24%, mainly for the following reasons:

- Projected EU28 GDP in 2030 was around 5% higher, assuming a more rapid recovery from the economic crisis as it happened to unfold.

- For ESD CO_2 emissions, this emission increasing trend is however compensated by other changes, e.g. higher projected oil and in particular gas price increases in the 2013 Reference scenario.

- The 2013 Reference scenario did include only policies adopted until 2012 and therefore notably did not include the reviewed F-gas regulation of 2014 which is expected to reduce HFC emissions in 2030 by up to two third to today's levels.

- Also the change to new IPCC inventory guidelines which materialised in 2014 turned out to lead to stronger decreases in non-CO2 emissions

From analyses done for the 2030 framework proposal, the following scenarios remain instructive because they meet the split in ETS-ESD/ESR GHG reduction targets:

- A scenario included in the 2030 framework IA, projecting the ETS/ESR split of -43%/-30% in 2030 compared to 2005 achieving only the -40% GHG target (compared to 1990) (referred to here as GHG40),

- A scenario included in the 2014 Energy Efficiency communication respecting the agreed ETS/ESR split and achieving a 30% energy efficiency objective, resulting in

energy efficiency being the primary tool to reduce emissions beyond the 2013 Reference scenario to achieve the ESR target (referred to here as EE30).

Details are given in the Impact Assessment of the above Communications Details are given in the Impact Assessments of the above Communications (SWD (2014)15 and SWD (2014)255).

GHG40	**General description:** This scenario presents an ambition in terms of GHG emission reduction that meets in 2030 a 40% GHG reduction, and in 2050 a 80% GHG reduction compared to 1990 levels. It uses the 2013 Reference scenario. It is based on the assumption of equalisation of marginal abatement cost of GHG emissions across the economy driven by increasing carbon prices and simulated carbon values. In addition, as of 2035, more stringent CO_2 standards for passenger cars apply to simulate electrification. Carbon pricing incentivise fuel shifts and GHG emission reductions it has also a pull effect on RES penetration and increase of energy efficiency. GHG policies: achievement of 40% and 80% reduction targets in respectively 2030 and 2050 through equalisation of increasing carbon prices and values **EE policies:** There are no additional EE policies compared to the Reference scenario. In the long term, the EEVs are higher than in the Reference scenario to reflect the energy efficiency effect of the carbon value. Stringent CO_2 standards for passenger cars: 95gCO_2/km in 2030 and 25gCO_2/km in 2050. **RES policies:** There is no pre-set RES target and consequently no dedicated policy in support of RES (in addition to the Reference scenario), increased RES share of 26.5% is mostly achieved in the ETS sectors.

EE30	This scenario meets a primary energy savings target of 30%, a GHG reduction target in 2030 (wrt. to 1990) of 40%, a reduction target in the effort sharing sectors of -30%, and achieves a RES share in 2030 of 27.7% EU ETS • Increase of ETS linear factor to 2.2% for 2021-30 in line with Commission proposal for 2030 framework • After 2030 cap trajectory to achieve -90% emission reduction in 2050 in line with Low carbon economy Roadmap Renewables • Renewables values to achieve a RES share of at least 27% Energy efficiency policies: • Increasing energy efficiency of houses and buildings leading to renovation rates of 1.61% in 2015-2020, 2.21% in 2021-2030 and 1.26% in 2031-3050 which will bring average energy savings after renovation of 22.08% in 2015-2020, 45.82% in 2021-2030 and 48.48% in 2031-3050; • Elimination of market failures and imperfections reflected in the reduction of behavioural discount rates from 12% in 2020 progressively to 9% (by 2050) in the residential sector and from 10% to 8.5% (by 2050) in the tertiary sector; • Increased uptake of advanced technologies (Ecodesign);

	• Increased uptake of BAT in industry; • Higher penetration of district heating; assuming that 12% of households will be connected to district heating networks in 2030; • Measures limiting grid losses; • Measures reducing energy consumption in transport and driving the • Electrification of transport in the long-run (e.g. CO2 standard of 72 gCO2/km in 2030 (25 gCO2/km in 2050) for passenger cars and 110 gCO2/km in 2030 (60 gCO2/km in 2050) for LCVs). • Measures leading to improvements in the fuel efficiency of heavy duty vehicles, ambitious vehicle taxation reforms to shift to CO2 based taxation, internalisation of external costs, wide deployment of intelligent transport systems, development of infrastructure for alternative power-trains and other soft measures like fuel labelling and eco-driving.

8.5. Annex 8.5: GDP per capita data used

Table 25 shows the gross domestic product per capita at market prices which is used in this Impact Assessment.

Table 25 Gross Domestic Product at market prices in euro per capita

Member State	2013 GDP per capita
EU28	26700
BE	35400
BG	5800
CZ	14900
DK	45500
DE	35000
EE	14400
IE	39000
EL	16500
ES	22100
FR	32100
HR	10200
IT	26500
CY	21000
LV	11300
LT	11800
LU	85300
HU	10200
MT	18100
NL	38700
AT	38100
PL	10200
PT	16300
RO	7200
SI	17400
SK	13600
FI	37400
SE	45400
UK	31900

Source: Eurostat, code nama_10_pc, update of 19/04/2016

8.6. Annex 8.6: Assessing impacts on Member States using the EUCO27 projection

Table 26: Impact of starting point options on Member State surplus or deficit over the period 2021-2030 using the EUCO27 projection

Scenario	EUCO27					
Option	Sensitivity S2		S1		Sensitivity S3	
Starting point	2020 emissions		2016-2018 emissions		2020 targets	
	Surplus (+) or deficit (-)					
	annual average, 2021-2030, % 2005 emissions	Million tonnes 2021-2030	annual average, 2021-2030, % 2005 emissions	Million tonnes 2021-2030	annual average, 2021-2030, % 2005 emissions	Million tonnes 2021-2030
EU	0.1%	31	1.8%	512	3.3%	928
MS with net surplus	4.6%	589	4.6%	831	8.8%	1448
MS with net deficit	-3.6%	-558	-3.0%	-319	-4.3%	-520
LU	-17%	-17	-17%	-17	-24%	-23
SE	0%	1	2%	8	3%	13
DK	-4%	-15	-3%	-12	-6%	-22
IE	-14%	-65	-13%	-62	-19%	-89
NL	-9%	-102	-7%	-86	-12%	-141
AT	-5%	-29	-4%	-23	-4%	-24
FI	-1%	-3	2%	5	1%	4
BE	-8%	-66	-6%	-50	-10%	-78
DE	-1%	-68	1%	29	-1%	-26
FR	-4%	-145	-2%	-61	-3%	-116
UK	2%	64	3%	144	5%	226
IT	-1%	-47	0%	-8	1%	32
ES	5%	118	7%	157	10%	227
CY	3%	1	5%	2	7%	3
MT	5%	1	7%	1	9%	1
SI	5%	6	6%	7	13%	15
EL	16%	97	18%	110	27%	170
PT	10%	51	12%	60	22%	110
CZ	6%	35	7%	47	15%	96
EE	7%	4	10%	5	16%	8
SK	3%	9	5%	12	13%	33
LT	6%	9	8%	11	16%	21
LV	6%	5	8%	7	17%	14
HR	11%	20	12%	22	24%	42
HU	14%	63	16%	72	28%	129
PL	0%	5	1%	19	3%	61
RO	7%	57	8%	63	20%	153
BG	16%	43	18%	51	33%	90

Source: Commission calculations based on PRIMES and GAINS

Table 27: Access to the one-off flexibility, assessing which MS has a considerable gap over the period after target adjustment in 2030, using the EUCO27 projection

% of 2005 emissions	Average annual gap/deficit (-) or surplus (+)over the period 2021-2030 (emissions as in EUCO27 projections)	
	T2: Limited target adjustment in the group of high income Member States	T3: high target adjustment in the group of high income Member States
LU	-16.8%	-16.8%
SE	1.9%	1.9%
DK	-2.6%	-0.4%
IE	-8.1%	-5.9%
NL	-5.6%	-3.4%
AT	-2.3%	-0.1%
FI	1.5%	1.0%
BE	-4.7%	-2.5%

Table 28: Impact of the one-off flexibility for those Member States that have a considerable gap over the period, using the EUCO27 projection

% of 2005 emissions	EU surplus (+) or deficit (-) over the period 2021-2030 with the EUCO27 projection (million tonnes)					
	T2			T3		
Options	O1	O2	O3	O1	O2	O3
LU	-16.8%	-12.8%	-8.8%	-16.8%	-12.8%	-8.8%
IE	-8.1%	-4.1%	-0.1%	-5.9%	-1.9%	2.1%
NL	-5.6%	-3.6%	-1.6%	-3.4%	-1.4%	0.6%
BE	-4.7%	-2.7%	-0.7%	-2.5%	-0.5%	1.5%
DK	-2.6%	-0.6%	1.4%	-0.4%	1.6%	3.6%
AT	-2.3%	-0.3%	1.7%	-0.1%	1.9%	3.9%
FI	1.5%	3.5%	5.5%	1.0%	3.0%	5.0%
SE	1.9%	3.9%	5.9%	1.9%	3.9%	5.9%

Table 29: Use of LULUCF credits by high income Member States, impact on distribution of use depending on choice of flexibilities using the EUCO27 projection

Million ton	Reference	EUCO27	EUCO27	EUCO27
	T1	T1	T3	T3
	O1	O1	O1	O3
High Income Member States	151	117	127	81
LU	0.2	0.2	0.2	0.2
SE	5	0	0	0
DK	15	12	1	0
IE	27	27	27	0
NL	13	13	13	0
AT	2	2	1	0
FI	5	0	0	0
BE	4	4	4	0
DE	22	0	22	22
FR	58	58	58	58
UK	0	0	0	0

8.7. Annex 8.7: Impacts on Member States of combinations of options for target distribution, access to the one-off ETS/ESR flexibility and LULUCF flexibility

Table 30: Member State impacts of Combination 2 (T2, O2, L2) with EUCO27 projection

	Deficit (-) or Surplus (+) as % 2005 emissions			
Projection used	EUCO27			
2030 Target Adjustment	No	Yes, T2		
One off flexibility	No		Yes O2	
LULUCF credits (if needed)	No			Yes L2
Combination	Comb. 1			Comb. 2
EU Mio surplus (+) or deficit (-)	512	510	607	714
MS with net deficit (potential buyers)	-319	-272	-191	-84
MS with net surplus (potential sellers)	831	782	798	798
EU	1.8%	1.8%	2.1%	2.5%
LU	-16.8%	-16.8%	-12.8%	-12.6%
SE	1.9%	1.9%	3.9%	3.9%
DK	-3.1%	-2.6%	-0.6%	0.0%
IE	-13.1%	-8.1%	-4.1%	0.0%
NL	-7.3%	-5.6%	-3.6%	-2.5%
AT	-3.9%	-2.3%	-0.3%	0.0%
FI	1.5%	1.5%	3.5%	3.5%
BE	-6.4%	-4.7%	-2.7%	-2.3%
DE	0.6%	0.1%	0.1%	0.1%
FR	-1.6%	-2.2%	-2.2%	-0.6%
UK	3.5%	2.9%	2.9%	2.9%
IT	-0.2%	-0.2%	-0.2%	0.0%
ES	6.8%	6.8%	6.8%	6.8%
CY	5.3%	5.3%	5.3%	5.3%
MT	7.2%	7.2%	9.2%	9.2%
SI	6.4%	6.4%	6.4%	6.4%
EL	17.7%	17.7%	17.7%	17.7%
PT	11.9%	11.9%	11.9%	11.9%
CZ	7.3%	7.3%	7.3%	7.3%
EE	9.7%	9.7%	9.7%	9.7%
SK	4.7%	4.7%	4.7%	4.7%
LT	8.4%	8.4%	8.4%	8.4%
LV	8.1%	8.1%	8.1%	8.1%
HR	12.4%	12.4%	12.4%	12.4%
HU	15.5%	15.5%	15.5%	15.5%
PL	1.0%	1.0%	1.0%	1.0%
RO	8.2%	8.2%	8.2%	8.2%
BG	18.4%	18.4%	18.4%	18.4%

Table 31: Member State impacts of Combination 3 (T3, O3, L2), with EUCO27 projection

	Deficit (-) or Surplus (+) as % 2005 emissions			
Projection used	EUCO27			
2030 Target Adjustment	No	Yes, T3		
One off flexibility	No		Yes O3	
LULUCF credits (if needed)	No			Yes L2
Combination	Comb. 1			Comb. 3
EU Mio surplus (+) or deficit (-)	512	513	707	796
MS with net deficit (potential buyers)	-319	-242	-143	-54
MS with net surplus (potential sellers)	831	755	850	850
EU	1.8%	1.8%	2.5%	2.8%
LU	-16.8%	-16.8%	-8.8%	-8.6%
SE	1.9%	1.9%	5.9%	5.9%
DK	-3.1%	-0.4%	3.6%	3.6%
IE	-13.1%	-5.9%	2.1%	2.1%
NL	-7.3%	-3.4%	0.6%	0.6%
AT	-3.9%	-0.1%	3.9%	3.9%
FI	1.5%	1.0%	5.0%	5.0%
BE	-6.4%	-2.5%	1.5%	1.5%
DE	0.6%	-0.5%	-0.5%	0.0%
FR	-1.6%	-2.7%	-2.7%	-1.2%
UK	3.5%	2.4%	2.4%	2.4%
IT	-0.2%	-0.2%	-0.2%	0.0%
ES	6.8%	6.8%	6.8%	6.8%
CY	5.3%	5.3%	5.3%	5.3%
MT	7.2%	7.2%	11.2%	11.2%
SI	6.4%	6.4%	6.4%	6.4%
EL	17.7%	17.7%	17.7%	17.7%
PT	11.9%	11.9%	11.9%	11.9%
CZ	7.3%	7.3%	7.3%	7.3%
EE	9.7%	9.7%	9.7%	9.7%
SK	4.7%	4.7%	4.7%	4.7%
LT	8.4%	8.4%	8.4%	8.4%
LV	8.1%	8.1%	8.1%	8.1%
HR	12.4%	12.4%	12.4%	12.4%
HU	15.5%	15.5%	15.5%	15.5%
PL	1.0%	1.0%	1.0%	1.0%
RO	8.2%	8.2%	8.2%	8.2%
BG	18.4%	18.4%	18.4%	18.4%

Table 32: Member State impacts of Combination 2 (T2, O2, L2) with EUCO30 projection

	Deficit (-) or Surplus (+) as % 2005 emissions			
Projection used	EUCO30			
2030 Target Adjustment	No	Yes, T2		
One off flexibility	No		Yes O2	
LULUCF credits (if needed)	No			Yes L2
Combination	Comb. 1			Comb. 2
EU Mio surplus (+) or deficit (-)	511	509	606	714
MS with net deficit (potential buyers)	-282	-235	-156	-49
MS with net surplus (potential sellers)	793	744	762	762
EU	1.8%	1.8%	2.1%	2.5%
LU	-15.7%	-15.7%	-11.7%	-11.4%
SE	2.1%	2.1%	4.1%	4.1%
DK	-5.5%	-4.9%	-2.9%	0.0%
IE	-13.6%	-8.7%	-4.7%	0.0%
NL	-7.2%	-5.5%	-3.5%	-2.4%
AT	-3.2%	-1.5%	0.5%	0.5%
FI	1.5%	1.5%	3.5%	3.5%
BE	-5.3%	-3.6%	-1.6%	-1.1%
DE	0.8%	0.2%	0.2%	0.2%
FR	-1.0%	-1.5%	-1.5%	0.0%
UK	4.0%	3.5%	3.5%	3.5%
IT	0.1%	0.1%	0.1%	0.1%
ES	5.5%	5.5%	5.5%	5.5%
CY	2.2%	2.2%	2.2%	2.2%
MT	4.4%	4.4%	6.4%	6.4%
SI	6.4%	6.4%	6.4%	6.4%
EL	17.0%	17.0%	17.0%	17.0%
PT	11.2%	11.2%	11.2%	11.2%
CZ	7.6%	7.6%	7.6%	7.6%
EE	7.9%	7.9%	7.9%	7.9%
SK	4.8%	4.8%	4.8%	4.8%
LT	6.3%	6.3%	6.3%	6.3%
LV	7.7%	7.7%	7.7%	7.7%
HR	11.9%	11.9%	11.9%	11.9%
HU	15.7%	15.7%	15.7%	15.7%
PL	0.2%	0.2%	0.2%	0.2%
RO	7.0%	7.0%	7.0%	7.0%
BG	16.5%	16.5%	16.5%	16.5%

Table 33: Member State impacts of Combination 3 (T3, O3, L2), with EUCO30 projection

	Deficit (-) or Surplus (+) as % 2005 emissions			
Projection used	EUCO30			
2030 Target Adjustment	No	Yes, T3		
One off flexibility	No		Yes O3	
LULUCF credits (if needed)	No			Yes L2
Combination	Comb. 1			Comb. 3
EU Mio surplus (+) or deficit (-)	511	512	707	781
MS with net deficit (potential buyers)	-282	-201	-101	-27
MS with net surplus (potential sellers)	793	713	808	808
EU	1.8%	1.8%	2.5%	2.7%
LU	-15.7%	-15.7%	-7.7%	-7.4%
SE	2.1%	2.1%	6.1%	6.1%
DK	-5.5%	-2.7%	1.3%	1.3%
IE	-13.6%	-6.5%	1.5%	1.5%
NL	-7.2%	-3.3%	0.7%	0.7%
AT	-3.2%	0.7%	4.7%	4.7%
FI	1.5%	1.0%	5.0%	5.0%
BE	-5.3%	-1.4%	2.6%	2.6%
DE	0.8%	-0.3%	-0.3%	0.0%
FR	-1.0%	-2.1%	-2.1%	-0.5%
UK	4.0%	2.9%	2.9%	2.9%
IT	0.1%	0.1%	0.1%	0.1%
ES	5.5%	5.5%	5.5%	5.5%
CY	2.2%	2.2%	2.2%	2.2%
MT	4.4%	4.4%	8.4%	8.4%
SI	6.4%	6.4%	6.4%	6.4%
EL	17.0%	17.0%	17.0%	17.0%
PT	11.2%	11.2%	11.2%	11.2%
CZ	7.6%	7.6%	7.6%	7.6%
EE	7.9%	7.9%	7.9%	7.9%
SK	4.8%	4.8%	4.8%	4.8%
LT	6.3%	6.3%	6.3%	6.3%
LV	7.7%	7.7%	7.7%	7.7%
HR	11.9%	11.9%	11.9%	11.9%
HU	15.7%	15.7%	15.7%	15.7%
PL	0.2%	0.2%	0.2%	0.2%
RO	7.0%	7.0%	7.0%	7.0%
BG	16.5%	16.5%	16.5%	16.5%

8.8. Annex 8.8: Analysis of the starting point methodology

The current methodology for defining the target trajectory translated the percentage targets into absolute volumes one year before the start of the trading period, i.e. in 2012. To define the starting point of the emissions budget 2013-2020, the most recent inventory available in 2012 was used (i.e. emissions data up to 2010). To take into account any unexpected annual variability, the starting point was calculated based on average emissions from 2008 to 2010.

Depending on whether the difference between the target level in 2020 and the 2005 emissions was positive or negative, two different methodologies were applied for the calculation of the target trajectory:

- For Member States with a 2020 target below their 2005 emissions: the starting point in 2013 was set at the level of the average emissions from 2008 to 2010 and a linear trajectory was extrapolated to the 2020 target.

  If this methodology were to be applied in the same manner for the period 2021-2030, the starting point in 2021 would have to be set based on the actual average 2016-2018 emissions, resulting in a target trajectory (for the EU as a whole) equal to the light blue trajectory in Figure 38 below.

- For Member States with a 2020 target above 2005 emissions: the starting point was moved from 2013 to 2009 but also set at the average emissions from 2008 to 2010 and extrapolating a linear trajectory towards the 2020 target.

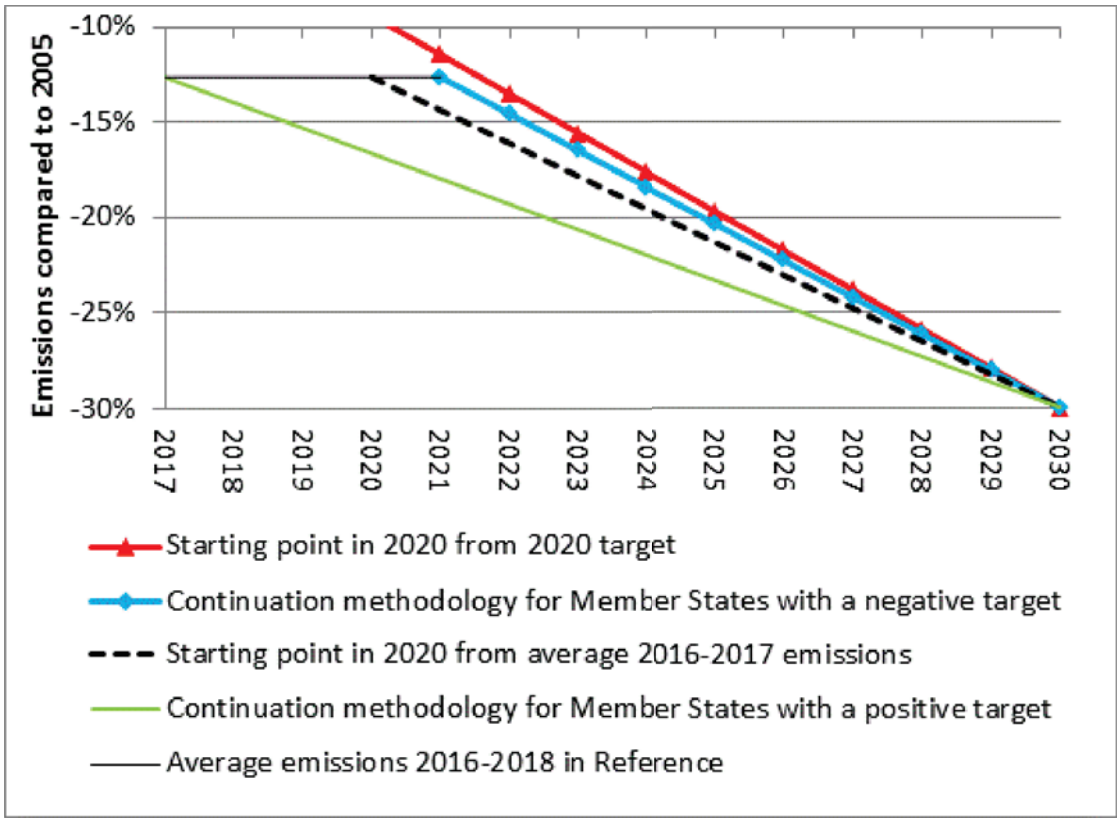
  If this methodology were to be applied for all Member States for the period 2021-2030, this would result in a significantly more stringent target trajectory (for the EU as a whole) equal to the green trajectory in Figure 38 below.

These two existing methodologies result in target trajectories that are not too dissimilar from target trajectories suggested by stakeholders.

- Some stakeholders suggest defining the starting point not in 2021 but earlier in 2020 at the level of the actual 2020 emissions, which would be expected to result in a target trajectory that is very similar to the more stringent green target trajectory in Figure 38 below), assuming an emission profile up to 2020 in-line with the 2016 Reference, reducing emissions to -16% in 2020.
- Some stakeholders suggest rather defining the starting point in 2020 at levels equal to the 2020 target (red target trajectory in Figure 38 below). This would be close to the current target methodology for Member States with negative targets (light blue target trajectory).

The methodology used in this impact assessment is building on the existing methodologies and midway between the stakeholder views and the two methodologies applied currently for Member States with positive and negative target levels in 2020: The starting point is set in 2020 based on the most recent emission inventory of average 2016-2018 emissions. This gives the dotted black line in Figure 38 below that is between the more extreme target trajectories as suggested by different stakeholders. It would also be the starting point for those Member States that would have emissions in 2016-2017 that would already be below the 2030 target, which would de facto result in an emission profile that allows emissions to increase again.

Figure 38: Analysing the existing starting point methodology



Source: Commission calculations based on EU Reference scenario 2016

8.9. Annex 8.9: Analysis of interaction between the one-off transfer between ETS and ESR sectors and the Market Stability Reserve

In the short term the impact on the ETS will notably be in the lowering of the surplus of allowances in the ETS. This in turn will impact the rate at which allowances will be placed in the MSR and impact the surplus on the market through the interaction of the one-off flexibility with the placement of allowances in the MSR .

The below table gives a stylised example of such potential interactions.

It assumes an ETS where from 2019 onwards the emissions are in balance with the annual target, but where there is still a historic surplus of 1.9 billion[132] that needs to be reduced.

In example 1, with no one-off flexibility, this results in 2026 in an ETS that has an surplus of allowances of around 776 million after which no allowances are placed in the MSR. Overall the amount of allowances available for the market or placed into the MSR is equal to 1900 million (776 + 1124).

By contrast in example 2, a one-off flexibility equal to 100 million is applied, reducing the surplus in the market immediately in 2021, resulting in the build-up of the MSR stopping one year earlier in 2025. This actually results in a slight increase of the surplus of allowances to 814 million by the end of the period. Overall the amount of allowances available for the market or placed into the MSR is reduced by 100 million compared to example 1 (surplus of allowances + amount in MSR = 814 + 986 = 1800).

Examples 3 and 4 have a one-off flexibility of the same size as example 1. The difference is the timing when the one-off flexibility reduced allowances in the ETS.

In example 3 it is assumed that the one-off affects the surplus of allowances gradually during a number of years while in example 4 it Is assumed to only affect the supply of allowances after the feeding of allowances into the MSR has stopped.

In examples 3 and 4 the one-off flexibility reduces the supply of allowances, even after the build-up of the MSR has stopped. The consequence is that the supply of allowances by the end of the period is lower than in example 1. In example 4 this is the most extreme, with the one-off flexibility being neutral for the build-up of the MSR and only affecting the surplus of allowances.

It should also be noted that there is a risk in example 2 or 4, with cancellation of allowances in the EU ETS undertaken in only one year (be it early or late in the period), that this could undermine the integrity of the auction calendar, given the proportion of total auction volumes that the one-off flexibility represents in some Member States. This risk does not exist in example 3.

[132] It should be noted that this quantity does not take into account backloaded and unallocated allowances to be placed in the reserve. The starting quantity used for this example is purely illustrative.

Table 34: Stylised examples of interactions of the one-off flexibility and the function of the Market Stability Reserve

Example 1 ton)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Surplus of allowances in year t*	1900	1672	1471	1295	1139	1003	882	776	776	776	776	776
One off flexibility = 0												
MSR feed	-228	-201	-177	-155	-137	-120	-106	0	0	0	0	0
MSR total	228	429	605	761	897	1018	1124	1124	1124	1124	1124	1124
Example 2 (mio ton)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Surplus of allowances in year t*	1900	1672	1471	1195	1051	925	814	814	814	814	814	814
One off flexibility			-100									
MSR feed	-228	-201	-177	-143	-126	-111	0	0	0	0	0	0
MSR total	228	429	605	749	875	986	986	986	986	986	986	986
Example 3 (mio ton)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Surplus of allowances in year t*	1900	1672	1471	1285	1121	976	849	737	727	717	707	687
One off flexibility			-10	-10	-10	-10	-10	-10	-10	-10	-20	
MSR feed	-228	-201	-177	-154	-134	-117	-102	0	0	0	0	0
MSR total	228	429	605	759	894	1011	1113	1113	1113	1113	1113	1113
Example 4 (mio ton)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Surplus of allowances in year t*	1900	1672	1471	1295	1139	1003	882	776	676	676	676	676
One off flexibility								-100				
MSR feed	-228	-201	-177	-155	-137	-120	-106	0	0	0	0	0
MSR total	228	429	605	761	897	1018	1124	1124	1124	1124	1124	1124
* Surplus of allowances in the year (t)= Surplus of allowances in the year (t-1) – one-off year (t-1) - MSR feed year (t-1)												

Taking into account the above different possible impacts on the market, there can be some impact on carbon prices, even though this is expected to be limited. In the short term there will be a reduction of allowances for auctioning, but with 100 to maximally 200 million over 10 year period, this will under options O2 and O3 not have a major impact on a market in relative terms when compared to the volumes that are placed in the MSR. It might even result in a slight increase of remaining surplus in the market (see example 2 above table), even though in the extreme case if the one-off flexibility is

assumed only to reduce surplus of allowances in the last year, it may reduce the available surplus at an equal rate.

In the longer term, if the MSR would potentially feed-back allowances to the market, the available amount will in most be lower which can increase prices, but again given the expected number of allowances entering the MSR, a reduction of this supply by 100 to 200 million seems limited.

8.10. Annex 8.10: Provisions for flexibility instruments in the Effort Sharing Decision

The current rules for *inter-temporal flexibility* allow a Member State to carry over ("bank") any surplus AEAs from a given year to subsequent years within the commitment period (until 2020). It can also carry forward ("borrow") up to 5 % of its annual emission allocation from the following year. Thus, Member States can either cover emissions in excess of their AEAs in a given year by borrowing AEAs from allocations for future years, or, where the emissions of a Member State are below that annual emission allocation, it can bank unused AEAs from one year in order to offset future emissions in excess of the AEAs allocated in future years (Article 3.3 in the ESD).

These instruments provide flexibility to Member States within their own schedule of allocations across the 2013-2020 period and help them managing the use of their AEAs over the whole commitment period to cover any AEA shortage in specific years, for example, due to weather fluctuations. A higher borrowing rate is available to Member States for the years 2013-2014 under the current ESD in the event of "extreme meteorological conditions" (Article 3.3).

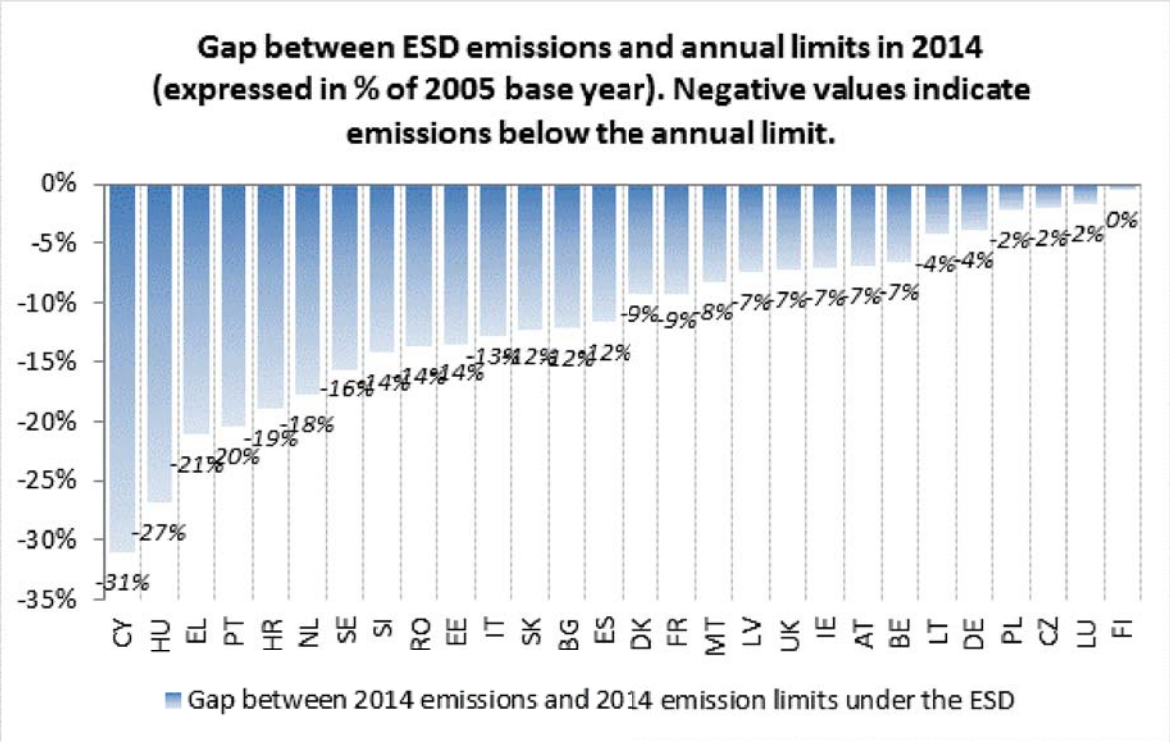
With respect to *inter-Member State flexibility*, a Member State is allowed to transfer up to 5 % of its AEAs for a given year to another Member State at any time (Article 3.4). After the annual compliance check has been concluded it can transfer its entire surplus AEAs for a given year (Article 3.5). A receiving Member State may use these acquired AEAs for complying with its obligation under ESD for the given year or any subsequent years of the compliance period. A Member State cannot transfer any part of its annual emission allocation if, at the time of transfer, that Member State is not in compliance with the requirements of the ESD. Member States are obliged to report any concluded transfers to the European Commission, which then publishes a summary of such transfers as part of its annual progress report.

Finally, under Article 5 of the ESD, Member States can also use *international project credits* under the Kyoto Protocol's Clean Development Mechanism and Joint Implementation to meet their commitments under the ESD. The use of such credits is limited on a yearly basis up to 3% of 2005 non-ETS emissions in Member State. Member States that do not use their 3% limit in any specific year can transfer their unused part for that year to other Member States or bank it for own future use. Member States, which fulfil further criteria (AT, BE, DK, FL, IE, ES, IT, CY, LU, PT, SI, SE) may use CDM project credits up to an additional 1% of their verified emissions in 2005; these credits are not bankable and not transferable.[133]

[133] Such additional CDM project credits must be from less developed countries or small island states.

8.11. Annex 8.11: ESD emissions in Member States in 2014

Figure 39: Gap between ESD emissions and annual limits in 2014



Source: Adapted from Figure 3 of the Climate Action Progress Report 2015, http://ec.europa.eu/clima/policies/strategies/progress/docs/com_2015_576_en.pdf

The figure shows based on preliminary data that in all Member States, ESD emissions were below their annual limit in 2014 as allocated to them under Commission Decisions 2013/162/EU and 2013/634/EU. The emissions are based on approximated inventory data reported in 2015 by Member States or estimated by the EEA on behalf of the Commission, where needed. For details see "Approximated EU GHG inventory: Proxy GHG estimates for 2014", report of the European Environment Agency , http://www.eea.europa.eu/publications/approximated-eu-ghg-inventory-2014.