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Part I

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the documents

Proposal for a regulation of the European Parliament and of the Council amending Regulation (EC) No 443/2009 to define the modalities for reaching the 2020 target to reduce CO2 emissions from new passenger cars

and

Proposal for a regulation of the European Parliament and of the Council amending Regulation (EU) No 510/2011 to define the modalities for reaching the 2020 target to reduce CO2 emissions from new light commercial vehicles

{COM(2012) 393 final}
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Introduction

Regulation (EC) 443/2009 and Regulation (EU) 510/2011 set mandatory fleet-based CO_2 reduction targets for the new car and van fleets respectively. They are the main tools of the 2007 Strategy to reduce Light Duty Vehicle (LDV) CO_2 emissions.

The Regulations include two reduction steps: short-term targets phased-in from 2012 to 2015 for cars and 2014 to 2017 for vans; and long-term targets to be met in 2020. Article 13(5) of Regulation (EC) 443/2009 and Article 13(1) of Regulation (EU) 510/2011 request the Commission to review the "modalities"[1] of achieving the targets set for cars and vans for 2020 and to make proposals to amend the Regulations in a way that is "as neutral as possible from the point of competition, socially equitable and sustainable".[2] The Commission is also asked to assess the feasibility of attaining the 2020 target for vans.

As part of this review, the Commission could consider alternative car and van CO_2 targets for 2020. Several stakeholders, mainly environmental NGOs, component suppliers and many individuals who took part in the public consultation, argued that the 2020 targets should be tightened. In view of the updated cost curves, and in the case of vans lower baseline emissions compared to those assumed in the original proposal, more ambitious 2020 targets could be considered, in particular for vans. However, neither of the Commission's original proposals contained a target for 2020, these were introduced and agreed during the co-decision process. That process was fairly recent: the 2020 car target was established three years ago, the van target one year ago. Establishing these targets involved balancing at a political level many varying interests and the outcome of the political process sent an important signal to industry. It would be extremely destabilising to propose alternative values so soon after the current values have been agreed. Doing so would effectively undermine the value of any new long-term targets that are set, since it would send a signal that these too might be altered after a few years.

1 A glossary of this and other terms is set out in Annex 7.1.**Error! Reference source not found.**
2 Article 13(5) of Regulation (EC) 443/2009 and Article 13(1) of Regulation (EU) 510/2011

While manufacturers can relatively easily adapt vehicle specifications and alter incentives so as to affect their average sales emissions, the less time that is available for this, the more costly would be any change. More substantial adaptations of the target could require longer lead times for product planning. For vans, there is an additional uncertainty relating to the implementation of a procedure to measure emissions from multi-stage vehicles[3] which is currently under development. It is also clear that the stringency of any future targets beyond 2020 and how the manufacturers choose to meet them may have direct implications on the average 2020 emissions from vans.

In view of these considerations, in particular the fact that any change to the targets would undermine manufacturer certainty, the current review and this Impact Assessment do not consider any alteration to the level of the 2020 car and van CO_2 targets. However, in view of the benefits of planning certainty for industry, the need for an understanding of developments beyond 2020 and potential future is discussed.

1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

1.1. Procedural issues

The review of the car and van Regulations is a strategic initiative on the 2012 Commission Work Programme *2012/CLIMA/016*.

The Impact Assessment Steering Group (IASG) established in July 2011 was composed of the following DGs: COMP, ECFIN, ENER, ENTR, ENV, LS, MOVE, RTD, SANCO, SG, TAXUD. Five meetings of the IASG took place between July 2011 and April 2012.

1.2. External expertise and consultation of interested parties

- *External expertise*

Two external studies[4] have provided the main analysis underlying this impact assessment. These are: *'Support for the revision of Regulation (EC) 443/2009 on CO_2 emissions from cars'*[5] referred to as 'the car study' and *'Support for the revision of Regulation (EU) 510/2011 on CO_2 emissions from light commercial vehicles'*[6] referred to as 'the van study'. Both reports present an evaluation of different modalities and assess their costs.

The PRIMES-TREMOVE model has been used to assess the overall impacts of the 2020 targets.

- *Consultation of interested parties*

Stakeholders have been formally consulted through an online questionnaire and through a stakeholder meeting. In addition there has been a continuing dialogue with interested stakeholders in bilateral meetings. Input from stakeholders has been taken into account in assessing the different possible options to regulate CO_2 emissions from light-duty vehicles,

[3] Multi-stage vehicles are vans that are sold as chassis-cabin combinations only and are completed with a dedicated build-up after the vehicles are sold by manufacturers to final users or third companies installing these build-ups. These structures are often constructed to buyers' specifications.
[4] Under framework contract ENV.C.3/FRA/2009/0043 on vehicle emissions
[5] http://ec.europa.eu/clima/policies/transport/vehicles/cars/docs/study_car_2011_en.pdf
[6] http://ec.europa.eu/clima/policies/transport/vehicles/vans/studies_en.htm

particularly with regard to the design of the legislation, possible unwanted effects, and implications for competition on automotive markets, global industrial competitiveness and environmental outcome. External expertise was used to assess the various options available including aspects raised during the consultation process (the external contractor attended the public hearing).

– Public consultation

An on-line public consultation was carried out between 19 September and 9 December 2011 (12 weeks). A total of 3233 replies were received including 137 stakeholder organisations. The majority of responses came from three Member States (UK, DE, FR). Overall the responses give a generally clear message that regulating LDV emissions is important, should be carried out in line with long term greenhouse gas (GHG) goals, be based on new vehicle average emissions and be technologically neutral. Opinion was highly divided on whether the current legislation is working well. The main reason appears to be that many think that the current legislation is not sufficiently robust. There is strong support for setting targets beyond 2020, regardless of other measures that may be implemented, and that these should consider the whole energy lifecycle and include other GHGs, not just CO_2. Finally there was support for considering alternative approaches to vehicle based GHG regulation either now or in the future. The results of the public consultation are summarised in Annex 7.2.

– Stakeholder meeting

A stakeholder meeting was held on 6 December 2011 with 76 participants. The list of participants is given in Annex 7.3. The completed car study and the preliminary conclusions of the van study[7] were presented as well as an outline of the work that will be carried out looking beyond 2020.

Participants did not express any substantial disagreement with the analysis presented. Environmental NGOs argued that since costs are lower than had previously been thought, and in the case of vans emissions are substantially lower than anticipated, the targets should be tightened. Regarding regulation post-2020, there was acknowledgement of the contradiction between industry's need for certainty versus the difficulty of knowing what level of CO_2 reductions may be cost effective. Setting out a pathway forwards in line with the EU's long term GHG reduction goals was largely supported. Participants generally recognised the necessity to consider whether the current regulatory approach is optimal or will need to be changed in future, although no stakeholder took a definitive position on this. The presentations from the meeting are at http://ec.europa.eu/clima/events/0048/index_en.htm along with a summary of the discussion, the latter is attached in Annex 7.4.

1.3. Consultation of the Impact Assessment Board

A draft Impact Assessment was submitted to the Impact Assessment Board (IAB) on 25 April 2012 which issued its opinion on the document on 23 May 2012. The opinion stated that the Impact Assessment should strengthen the problem definition by providing a more detailed policy context, focussing more on the underlying problem drivers and presenting thoroughly the evolution of the situation without new EU action. The IAB recommended establishing a clearer intervention logic by better linking the problems, their drivers, objectives and policy options. The objectives were recommended to be made SMARTer. Futhermore, the IAB

[7] These preliminary conclusions were subsequently confirmed and included in the final report published on DG CLIMA's website (see footnote 6).

concluded that a more substantiated and differentiated impact analysis were needed. Finally, some aspects regarding future monitoring and evaluation arrangements were to be clarified.

These comments were taken into account in the resubmitted Impact Assessment as follows:

- Restructuring of text and further clarifications regarding the nature of the problem, the underlying drivers and the policy context resulting in a more consistent problem definition, SMARTer objectives and clearer intervention logic.

- The description of the baseline scenario was restructured and extended to better explain the evolution of the current situation without the new EU action.

- The presentation of options has been clarified and the impact analysis and presentation have been restructured to assist readability and enhance the link with the objectives.

- The description of monitoring arrangements has also been strengthened.

- Additional information has been presented on the under-valuation of light-weighting with a mass-based utility parameter.

- A glossary of technical terms has been added.

The IAB gave its final opinion on 12 June 2012. The final opinion requested that some aspects be further strengthened. In particular this concerns explaining the intervention logic, quantifying the objectives, explaining the balance between social, enviornmental and economic impacts and further explaining the monitoring arrangements.

These comments have been taken into account in the final Impact Assessment as follows:

- Addition of a graphic illustrating the intervention logic.

- Changes to the objectives to include the 2020 CO_2 targets and footnotes explaining how social equity and inter-manufacturer competition are measured.

- A further explanation of why the main impacts from the options for the modalities will be economic as opposed to social or environmental.

- Additional text explaining how the annual monitoring process enables the required evaluation of progress.

2. POLICY CONTEXT, PROBLEM DEFINITION, EVALUATION OF THE EXISTING LEGISLATION AND SUBSIDIARITY

2.1. Policy context

- **General policy context**

The review of the Regulations takes place in the following policy context:

– The EU has a stated objective of limiting global climate change to a temperature increase of 2ºC above pre-industrial levels.

– While emissions from other sectors are generally falling road transport is one of the few sectors where emissions have risen rapidly. Between 1990 and 2008 emissions from road transport increased by 26%.

– The Commission *'Roadmap for moving to a competitive low carbon economy in 2050'*[8] outlines a plan to meet the long-term target of reducing domestic emissions by 80% by mid-century in the most cost-effective way. According to the Roadmap and the underlying analysis every sector of the economy must contribute and, depending on the scenario compared to 1990, transport emissions need to be between +20 and -9% by 2030 and decrease by 54-67% by 2050 (excluding international maritime emissions).

– The Commission's *'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system'* sets out future transport strategy within a frame of achieving a 60% reduction in transport GHG emissions by 2050.

– The EU is committed to innovation and boosting industrial competitiveness. Research and innovation drive productivity growth and industrial competitiveness. A transition towards a sustainable, resource efficient and low carbon economy is paramount for maintaining the long-term competitiveness of European industries.

– In view of the concerns of increasing scarcity of oil and increasing price volatility, measures that further reduce energy consumption in transport are desirable for increasing the energy security of the EU.

A detailed description of the general policy context for the review is set out in Annex 7.5.

- **Specific policy context**

Implementation of the 2020 targets by defining the "modalities" to reach the targets

The car and van Regulations function in a similar manner (see Annex 7.6 for a detailed summary of the car and van Regulations). The Regulations include two steps of reduction: short-term targets to be phased-in from 2012 to 2015 for passenger cars and 2014 to 2017 for light commercial vehicles; and long-term targets to be met in 2020. For the van Regulation the feasibility of the 2020 target is to be confirmed. For both, cars and vans, the modalities of reaching the 2020 targets must be defined to implement the targets.

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8 COM/2011/0112 final

The Regulations contain a number of "modalities"[9] or parameters which impact on how the targets are achieved and may be considered for amendment in view of implementation of the 2020 targets. The following modalities are currently employed:

- Utility parameter, shape and slope (these together define the limit value curve);
- Excess emissions premium;
- Derogations;
- Manufacturer pooling;
- Eco-innovations;
- Phase-in of targets;
- Super-credits.

The Regulations function by establishing a fleet-average CO_2 emission target for each vehicle manufacturer. This target is calculated by aggregating a nominal CO_2 emission value for each vehicle registered in the EU (in gCO_2/km) which is interpolated from a curve of CO_2 emission versus vehicle mass (the 'limit value curve' where mass is the "utility parameter"). The **limit value curve** is a function specified in Annex I of the Regulations and is based on vehicle mass. The utility parameter, shape and slope of the function do not have an impact on the stringency of the target but influence the distribution of the reduction effort between vehicles of different utility. The current car and van formulae are based on the short-term target. To implement the 2020 targets it is necessary to introduce, in Annex I to the Regulations, new formulae for 95 gCO_2/km for cars and 147 gCO_2/km for vans. The modalities concerning the limit value curve are therefore considered the most important. A description of the other modalities is given below.

The **excess emissions premium** aims at ensuring compliance with the target. An excess emissions premium is payable in a particular calendar year if the actual average vehicle emissions for a manufacturer's entire fleet are above the manufacturer's target. The Regulations set the premia for both cars and vans at €95 per gCO_2/km as of 2019. Without further intervention this premium would remain valid for 2020 and beyond.

Derogations allow certain manufacturers (small volume up to 10,000 annual registrations and niche between 10,000 and 300,000 annual registrations) to have targets which are independent of the limit value curve, and in case of the small volume manufacturers are based on their individual reduction potential. For small-volume manufacturers a second five year compliance period to 2020 could be foreseen. However, for niche manufacturers no new post-2015 target is set by the current Regulation.

The possibility for manufacturers to form a **pool** is a flexibility allowing a less costly way to meet the targets. It is neutral as regards the overall stringency of the legislation and the CO_2 reductions achieved. This flexibility is independent from other modalities but its use may be influenced by the limit value curve shape or slope, the utility parameter and the scope for derogations. It is not phased-out thus with no change it would continue in 2020 and beyond.

Eco-innovations contribute towards reaching the targets since they cover technologies which reduce CO_2 outside the test procedure. A manufacturer will deploy an eco-innovation only if it is cost-effective thus the provision is expected to reduce overall compliance costs and the existence of the modality encourages innovation. The legislation specifies that this provision

[9] See article 13(5) and recital 30 of Regulation (EC) 443/2009, and article 13(1) and recital 30 of Regulation (EU) 510/2011

should phase-out once the new test-procedure is in place. However, it is likely that there will also be technologies not covered by the new procedure in the future.

Phase-in sets a period over which compliance with the target is progressively tightened. This means for example that achieving new car fleet average emissions of 130 gCO_2/km for 100% of the fleet is delayed until 2015. **Super-credits** in principle lower the stringency of the legislation since they effectively allow emissions from vehicles that do not receive them to be higher. These are all phased out before 2020.

In short, of these modalities the limit value curve is the most important because on its basis the individual manufacturers' targets are calculated. Excess emissions premia, derogations and pooling are significant for manufacturers to whom they apply. The other modalities are considered rather less important.

2.2. The nature of the problem

- **The need to reduce CO_2 emissions from light-duty vehicles**

As described in section 2.1, road transport is one of the few sectors with rapidly rising emissions and between 1990 and 2008 emissions from the sector increased by 26%. This trend is not sustainable in view of the EU's climate policy. According to the Commission's 'Roadmap for moving to a competitive low carbon economy in 2050'[10] and Transport White Paper, road transport has to significantly reduce its CO_2 emissions by 2050.

Light-duty vehicles are responsible for a significant part of the overall transport emissions and emit around 13.5% of total EU emissions of CO_2 and about 15% when the emissions from supplying the fuel are included. In view of the expected increase in the light-duty vehicle fleet (see section 2.3), a continuation of the effective application of the EU mandatory CO_2 targets is necessary to ensure further reduction of road transport emissions of CO_2.

- **The modalities of the 2020 target and planning certainty**

The two-step approach of the Regulations requires that the Commission proposes detailed modalities of meeting the 2020 targets by end of 2012. This necessitates updating the formulae in Annex I to the Regulations for the 2020 targets. In addition, the vans target for 2020 requires confirmation of feasibility. The modalities of meeting the 2020 CO_2 emission limits, and indications of how those limits will evolve beyond 2020, are needed to guide the automotive industry. Without this, uncertainty may discourage investments in innovation and delay bringing new technologies to the market. Because the cost of adapting to change for manufacturers is likely to increase as the time available for them to plan decreases, and in view of the time schedules for vehicle platform and powertrain developments[11], it is important to establish as soon as possible the modalities for 2020.

The two Regulations leave uncertainty for the period beyond 2020. However, the automotive industry works to planning cycles that suggest the need to know approximately ten years in advance the broad framework within which vehicles need to be designed, and a shorter period of around five years for more precise decisions on variants that will actually be produced. It is thus important to provide indications as to the future reductions early enough to allow for appropriate planning certainty.

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[10] COM/2011/0112 final

[11] See for example section 5 of the car study

2.3. The underlying causes of the problem

The overall annual CO_2 emissions from usage of light-duty vehicles are a result of the multiplication of the vehicle stock, the annual mileage of LDVs, and their emissions per km. Therefore, each of these factors has a direct impact on the scale of the problem.

- **Stock of the LDV fleet**

The number of LDVs in the EU continues increasing. The stock of passenger cars has increased by 45% since 1990 and by 17.5% since 2000[12]. There is no evidence to indicate that this trend will stop. The stock of vans increased by 24% between 2000 and 2007[13] but this trend has somewhat stabilised during 2008-9 when new registrations of vans in the EU started decreasing. According to ACEA[14] the most recent decrease especially concerned Spain and Italy, followed by the UK whereas sales in other major markets, such as France and Germany, were more stable. However, a reverse trend is expected to occur once the economic outlook improves and businesses currently deferring new vehicle purchases resume their orders.

- **Distance travelled by light-duty vehicles**

There is evidence that the average annual distance travelled by LDVs has stabilised. EU transport in figures shows between 2000 and 2009 passenger km per car dropped slightly from 21,000 to 20,000 per year. There could have been a reduction in average load factors, but this suggests little overall change. The ODYSEE project[15] shows figures suggesting that average car distance driven is just above 12,000km per year and has decreased by 750km since 2000.

The FLEETS study assessed national data for different vehicle categories. Based on this it is possible to produce EU weighted average annual mileages. In the car study these are shown for 2005 as being:

Vehicle type	Petrol small	Petrol medium	Petrol large	Diesel small	Diesel medium	Diesel large
Total annual mileage (km)	14,438	16,772	16,839	23,041	24,574	26,318
Lifetime mileage (km)	250,592	285,222	300,347	379,465	362,316	444,662
Average life	17 years	17 years	18 years	16 years	15 years	17 years

The PRIMES-TREMOVE model assumptions for private car use are broadly consistent with the ODYSEE data, using average annual private car activity of just under 12,000km over the period 2020 to 2030. The average annual mileage assumptions used for the cost benefit calculations throughout the Impact Assessment are at the low end of the FLEETS data.

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12 EU transport in figures; statistical pocketbook 2011

13 See section 2.4.1 of the 2009 Impact Assessment accompanying the proposal for a Regulation setting CO_2 emissions standards for light commercial vehicles; SEC(2009) 1455

14 ACEA figures on new registrations available at http://www.acea.be/collection/statistics

15 Energy Efficiency Trends in the Transport Sector in the EU, Lessons from the ODYSSEE MURE project; January 2012

The driving patterns for vans are slightly different than for cars. The FLEETS study shows that vans are mostly used in urban conditions (shorter distances, lower speeds, many restarts and periods of idling) which results in higher fuel consumption and therefore generates more CO_2 emissions than extra-urban, motorway driving. However, the EU average annual mileage of the whole fleet (old and new vehicles) has been found to be similar between cars and vans. This Impact Assessment assumes the average annual mileage of new vans at 23,500 km.

Overall, this evidence illustrates that while there is some uncertainty over annual driving distances by LDVs, there is little indication that they are changing significantly.

- **Rebound effects**

There is risk of a perverse effect from increasing fuel efficiency of vehicles whereby lower fuel costs lead to the vehicles being driven more. This phenomenon is called a rebound effect. This effect could offset some of the tailpipe emission reduction and could be minimised in case of major increases in fuel costs.

- **Regulatory instrumens**

Taken together, the increasing stock and assumption of constant annual mileage would lead to increasing fuel use and CO_2 emissions without there being a further reduction in LDV emissions per km. The main EU instruments impacting on this problem are the existing Regulations setting CO_2 emission standards for LDVs. At Member State level other policies with an important impact include vehicle circulation and registration tax policies. Fuel taxation is an important factor affecting the problem. Higher levels of taxation would be expected to encourage the purchase of more fuel efficient vehicles.

In view of current developments it is clear that EU CO_2 emissions standards are essential to constrain and reduce LDV CO_2 emissions.

- **The two-step approach of the Regulations**

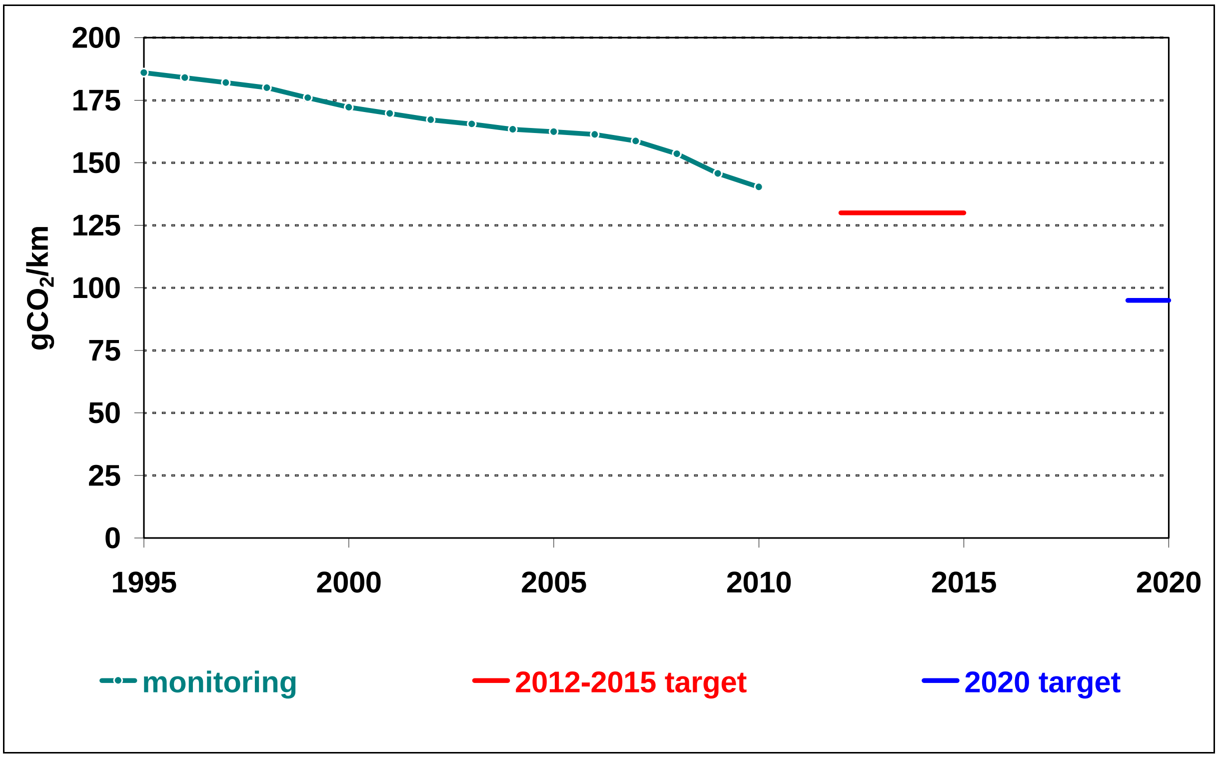
Finally, the other underlying cause of the problem is that the two LDV CO_2 Regulations have a two-step operation. In the first period (up to 2015 for cars and 2017 for vans) the modalities of compliance with the targets have been established. However for the second phase (2020 in both cases) the formulae in Annex I of the Regulations to incorporate the 2020 targets as well as other modalities are left to be determined in the current review.

2.4. Evaluation of the existing legislation

The effectiveness of the legislation

The targets in the existing car and van Regulations are phased-in from 2012 and 2014 and enter fully into force in 2015 and 2017 respectively. This means the effectiveness of the legislation with respect to its main goal of reducing CO_2 emissions from new cars and vans cannot be fully evaluated at present. However, based on EU passenger car registration monitoring data it is clear that average new car CO_2 emissions are falling as shown in figure 1 below.

Figure 1 Long term trend in car CO_2 emissions.



Prior to the current CO_2 standards, the European, Japanese and Korean car manufacturers' associations voluntarily agreed to reduce CO_2 emissions to 140 gCO_2/km by 2008 or 2009. However, average emissions were still 154 gCO_2/km in 2008 and 146 gCO_2/km in 2009 (see Table 1). The greatest reduction progress has been seen after 2007 when the Commission adopted its proposal for a Regulation on CO_2 emissions from cars (the bottom row of Table 1 shows year on year improvement). This illustrates the need for, and effectiveness of, mandatory CO_2 emissions limits. While part of the reductions in 2009 and 2010 might be due to the financial and economic crisis and scrappage schemes implemented in several Member States in that period, the decreasing trend is evident.

Table 1 Average CO_2 emissions from new cars registered in the EU[16]

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
grams CO_2/km	172.2	169.7	167.2	165.5	163.4	162.4	161.3	158.7	153.6	145.7	140.3	135*
% yearly change	na	1.45	1.47	1.02	1.27	0.61	0.68	1.61	3.21	5.14	3.71	3.06

*** Source: 2011 EU monitoring data subject to final confirmation by the Commission**

Procedures to measure CO_2 from light-duty vehicles

Measurement of the CO_2 performance of new cars and vans is carried out as part of the type approval procedure. Tests are carried out by manufacturers on the basis of the New European

[16] The data for years 2000–2009 was monitored and reported under Decision (EC) 1753/2000 establishing a scheme to monitor the average specific emissions of CO_2 from new passenger cars. From 2010 it is replaced by monitoring and reporting under Regulation (EC) No 443/2009 and its implementing Commission Regulation (EU) No 1014/2010.

Driving Cycle (NEDC) and following the procedures set out in the type-approval legislation. There is growing evidence that vehicle performance under real world driving conditions is increasingly diverging from the test procedure results. More detailed investigations have also illustrated the difficulty of repeating road load measurements carried out by manufacturers which provide a key input to the NEDC test. There are likely to be a range of factors contributing to these divergences which are discussed in more detail in Annex 7.7.

In spite of these problems, the Commission does not have evidence that light-duty vehicle test cycle CO_2 results are not correlated with real world CO_2 emissions. Addressing the problems inherent with the test procedures is outside of the scope of the current review and this Impact Assessment. The Commission is working to develop a better understanding of the factors contributing to the divergence, in particular where this results from flexibility inherent in the mandated procedures. In particular it is important to ensure that any updates to the test procedures result in no greater flexibility or margins with regard to measurement of CO_2 emissions. While challenges to ensure that measured CO_2 emissions better reflect real driving emissions remain, the fact that test results are still correlated with real world emissions ensures that the Regulation continues to work appropriately. In view of this it is concluded that the underlying basis for the regulatory approach is robust.

Implementation of the car and vans Regulations

Secondary legislation is needed to implement the two Regulations. Implementation of the cars Regulation is more advanced than the vans Regulation. The latter will however be consistent with the approach of the former. The following implementing measures have been adopted so far:

– Implementing Regulation on CO_2 monitoring from cars[17]

The monitoring scheme is now operational and is working well and, despite the need for some further adjustments, the overall quality of the data is satisfactory. The Commission is currently evaluating the database error margin and developing a methodology to calculate it. The additional administrative burden of the monitoring scheme differs significantly between Member States and is linked to the cost of amendments to the preceding scheme established in Decision 1753/2000 to monitor new car CO_2 emissions. Article 8(9) of Regulation 443/2009 enables the Commission to introduce any necessary amendments to the monitoring scheme in the light of experience through the comitology procedure. In view of this and the limited experience so far, there is no need for action in the current review.

– Implementing Regulation on CO_2 monitoring from vans[18]

Based on the monitoring scheme for cars, the Member States are required to provide data on van registrations from 2012. The implementing regulation is based on the one for cars appropriately adapted. Similarly to the car monitoring scheme the Commission is enabled to introduce any necessary amendments through comitology, therefore it is not further discussed in this review.

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[17] Commission Regulation (EU) No 1014/2010 on monitoring and reporting of data on the registration of new passenger cars pursuant to Regulation (EC) No 443/2009

[18] Commission Implementing Regulation (EU) No 293/2012 of 3 April 2012 on monitoring and reporting of data on the registration of new light commercial vehicles pursuant to Regulation (EU) No 510/2011

– Monitoring of CO_2 emissions from multi-stage vans

One of the most urgent implementation tasks for vans is the monitoring of multi-stage vehicles (MSV). MSVs are vehicles built in stages by different manufacturers, often to a client's specification[19]. According to Article 13(4) and Annex II of the vans Regulation, the Commission is to propose a new procedure to obtain a representative value of the final vehicle CO_2 emissions. This proposal is currently under discussion with the Member States. The proposal foresees that the manufacturer of the base vehicle will be responsible for the final CO_2 emissions of the completed vehicle. These emissions are to be established based on a simplified method to avoid burdensome measurement of emissions of each MSV while ensuring the OEM has access to the information on the vehicles under its responsibility.

– Implementing Regulation setting out a procedure for derogations applications[20] for cars

The derogation scheme for small-volume registrations (up to 10,000 cars per year) and niche manufacturers (10,000 to 300,000 per year) is operational. In 2011 the Commission received 23 applications (3 niche, 20 small volume) for the derogation period starting in 2012. These were assessed and 18 small-volume and 2 niche derogation decisions adopted. The remaining applications were submitted too late for decisions to be taken in 2011. The targets proposed by small-volume manufacturers mostly represent reductions.

Small-volume applications must provide supporting evidence of the manufacturer's economic and technological potential. Most information required, especially regarding the economic situation of the companies, should be readily available to them. Other supporting evidence concerning market characteristics and technological potential is needed to allow an assessment of the proposed targets against competitors.

For the two categories different issues arise:

For small-volume manufacturers, the procedure is relatively cumbersome and creates an administrative burden for the Commission and manufacturers. It could be desirable to reduce these burdens as far as possible. The absence of a minimum threshold means that even where a very small number of cars of a brand may be placed on the EU market the manufacturer is covered by the Regulation.

For niche manufacturers, the procedure is straightforward. A fixed baseline and reduction is set in the legislation, however, if these are not updated, manufacturers falling under this derogation would have no further target beyond 2015. In addition, the suitability of the upper threshold of 300,000 cars per year could be reconsidered as it would potentially enable a new entrant to supply up to 2.5% of the EU market while being in an advantaged competitive position compared to incumbent manufacturers.

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19 The OEMs usually build a basic chassis-cabin structure which receives dedicated bodywork built by another manufacturer.

20 Commission Regulation (EU) No 63/2011 laying down detailed provisions for the application for a derogation from the specific CO_2 emission target pursuant to Article 11 of Regulation (EC) No 443/2009

– Van derogations

The van Regulation contains only one type of small volume derogation which concerns manufacturers of less than 22,000 vans per year. The procedure has not yet been put in place but will be based on the equivalent car procedure.

– Implementing Regulation for cars setting out a procedure for application and approval of eco-innovations[21]

The Implementing Regulation was adopted in 2011 however no complete eco-innovation application has yet been received**.** The regulation includes a review clause committing the Commission to revise the scheme by 2015 at the latest and *inter alia* to consider ways of simplifying the application and approval procedure in the light of experience. Similar rules are to be adopted for vans.

– Practical arrangements on application for pooling for car and van manufacturers

Manufacturers are requested to apply for pooling via a straightforward application form available on the DG CLIMA website[22]. No supporting evidence is required resulting in a small administrative burden.

– Decision on excess emissions premium for cars[23]

The decision states that the procedure to be used for collecting premiums are the rules for recovery of receivable amounts, i.e. of fixed amount, certain and due, set out in the Financial Regulation and its Implementing Rules.

2.5. How will the problem evolve?

2.5.1. How is the problem likely to evolve without new EU action?

Without action the 2020 car and van CO_2 targets could not be implemented and no reduction beyond respectively 2015 and 2017 would be required. This is because neither 2020 target can take effect without legislation defining and implementing the modalities for 2020. This can only be done via the amendment of the relevant Regulations in the ordinary legislative procedure.

Without further EU action in this field it is likely there would be little additional substantial CO_2 reduction from new light-duty vehicles. Some reduction would still be expected beyond 2020 due to the continuing renewal of the existing fleet with newer cars and vans meeting the current CO_2 standards. In addition, the formulae setting the current targets would be regularly adjusted to take account of changes to the average mass of the fleet preventing any increase in average new car and van CO_2 emissions per km.

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21 Commission Implementing Regulation establishing a procedure for the approval and certification of innovative technologies for reducing CO_2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009

22 Standard declaration of pooling members available at: http://ec.europa.eu/clima/policies/transport/vehicles/cars/docs/pooling_declaration_en.doc

23 Commission Decision of 17 February 2012 on a method for the collection of premiums for excess CO_2 emissions from new passenger cars pursuant to Regulation (EC) No 443/2009

However, based upon evidence from the EU and US for periods when there was no administrative requirement for fuel efficiency or CO_2 emissions to improve and no significant changes in oil price, it is concluded that car emissions and fuel efficiency improve on average by the order of 0.1 to 0.2% per year. There may be certain expectations that in view of the current CO_2 requirements and expected regulatory action in this field in third countries to which European vehicles are exported, the fuel efficiency improvement of vehicles may continue somewhat beyond this rate. However, as seen in the EU in the period between 1995 and 2006 for cars, in the absence of the mandatory CO_2 standard this progress is likely to be offset at least to some degree by the increase in power, size or comfort of new cars.[24] When combined with the expected increase in the vehicle fleet and static travel distances (described in section 2.3), overall CO_2 emissions from the LDV fleet would continue increasing.

This 'do nothing' option forms the **baseline scenario** for the modelling used and is implemented in the modelling as Scenario 1 described in Annex 7.8. For the purpose of assessing this option, improvements in CO_2 emissions beyond the mandatory targets in 2015 and 2017 are assumed to continue at historical rates when there was no requirement to reduce emissions. The following paragraphs present the overview of the estimated impacts of implementation of the 2020 targets as compared to the 'do nothing option', effectively presenting the benefits that would be foregone in case of no new EU action.

- **Environmental impacts**

Introduction of the 95 gCO_2/km target represents a 27% reduction in CO_2 tailpipe emissions per vehicle km relative to do nothing by 2020 and beyond. The 2020 target for vans is a 16% reduction per vehicle km relative to do nothing by 2020, and for subsequent years. Total emissions between 2010 and 2030 are estimated to reduce by 24% for cars and 13% for vans.[25] PRIMES-TREMOVE modelling shows aggregate CO_2 emission reductions for cars and vans of around 422 Mt CO_2 in the period up to 2030. In addition, these savings are expected to reduce requirements for EU ETS allowances in the order of 0.5% to 1% in the period up to 2030 due to lower refinery emissions caused by decreased fuel demand.

- **Macro-economic impacts**

EU crude oil consumption was 656 Mt in 2008 of which 598 Mt were imports[26]. Of this some 300 Mtoe is used for road transport, approximately two thirds of which is for light duty road transport. EU oil consumption for LDVs costs approximately €100bn per year.

The main macro-economic impacts of implementing the 2020 targets are linked to reducing fuel consumption and avoided fuel expenditure, financing additional vehicle technology and other economic activity. This is discussed in Annex 7.8. Avoided fuel use increases progressively over the decade 2020 to 2030 from €27bn per year in 2020-2025 to €36bn per year in 2025-2030. Energy use is around 25 mtoe per year lower in 2030, saving in total almost 160 mtoe to 2030.[27]

The impact of this reduced fuel expenditure depends on alternative spending patterns. To achieve the fuel savings, a part of this resource needs to be allocated to innovation and

[24] See the 2007 Commission Impact Assessment accompanying the Proposal for a Regulation to reduce CO_2 emissions from passenger cars, SEC(2007)1724

[25] PRIMES-TREMOVE modelling

[26] http://ec.europa.eu/transport/publications/statistics/doc/2011/pocketbook2011.pdf

[27] Source: PRIMES-TREMOVE modelling

investment and manufacturing of more complex vehicles. These will have a positive economic impact due to an investment multiplier effect[28]. These aspects are explored in detail in Annex 7.10 which indicates that spending on employment could rise by around €9bn and GDP by around €12bn. However, if total imports decrease due to lower oil demand, the exchange rate rises until the balance of trade is restored, making EU goods more difficult to sell abroad in the long run. Some of the initial positive economic impact may be lost due to this rebound effect.

- Energy security

Reducing energy consumption contributes to energy security. The full value of this is uncertain, however two aspects are noted:

– Reduced energy consumption (principally crude oil) means that energy-security related costs (the so-called 'oil premium') decrease. The lower oil premium has two effects. Firstly, a lower demand for oil in the EU has a downward impact on the world oil price and secondly, macro-economic disturbances from oil price shocks are reduced. This has a positive economic effect[29].

– The JRC estimated a value for the economic benefits of improved energy security from increased biofuel use by calculating the cost of achieving a similar improvement in energy security through the establishment of a (additional) strategic stock of oil[30]. The cost was estimated to be about €130 per tonne of oil equivalent, although this estimate is considered to be the upper bound value. Based on this, the estimated aggregate energy security benefit between 2020 and 2030 of introducing the 2020 car and van targets is some €20bn.

- Impact on taxation revenues

Fuel taxes are the most relevant category of taxation in this respect, as fuel consumption will be lower compared to the 'do nothing option' (as described above). The impact on vehicle registration taxes depends on their structure. If dependent on vehicle prices, revenue will go up if the average retail prices increases due to CO_2 standards. If dependent on CO_2 emissions revenues from sales taxes will decrease.

Total fuel expenditure avoided will be approximately €27bn per year in the period 2020-2025 rising to €36bn per year in the period 2025-2030.[31] Tax represents a large proportion of fuel costs. It is estimated that if tax rates are not changed government fuel tax revenues (excise and VAT) would decrease by around €15bn per year in the period 2020-25 and around €22bn per year over the period 2025-30. This decrease could be avoided by altering tax rates or by replacing them with alternative transport pricing mechanisms.

Since the effects on tax revenues are predictable and manageable, they are not considered to be crucial. Any changes that occur are likely to relate primarily to the level of ambition of the 2020 targets rather than any of the modalities under consideration.

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28 The multiplier effect results from the spending of business and employees resulting from the initial investment.

29 Paul N. Leiby (2007), Estimating the Energy Security Benefits of Reduced U.S. Oil Imports

30 JRC (2007) Biofuels in the European Context: Facts and Uncertainties http://ec.europa.eu/dgs/jrc/downloads/jrc_biofuels_report.pdf

31 Source: PRIMES-TREMOVE modelling

The net effect on government revenue is unknown and any loss due to decreased consumption of fuel may or may not be compensated by higher VAT revenue or vehicle taxes. The approach taken by government to replace these revenues may have a strong effect on the eventual outcome in terms of employment. A decrease or reduction in fiscal stimuli for fuel efficient cars could compensate these negative effects in part or in full, depending on the pre-regulation stimulus level.

- **Net costs and benefits for consumers and society**

  - **Savings on fuel spending to end-user**

The largest single economic impact on consumers of no EU action to implement the 2020 car and van targets is foregone benefit of fuel saving for vehicle purchasers. The level of fuel savings per vehicle is purely driven by the existence of the 2020 targets and their overall level of ambition.

The impact of implementation of the 2020 CO_2 targets on fuel savings for private consumers and business owners is evident. Moving to 95 gCO_2/km and 147 gCO_2/km in the new car and van fleets implies reductions in annual fuel consumption of about 27% and 16% respectively (with equal mileage). However, fuel savings may be lower than expected due to rebound effects, as lower running costs may lead to higher distances driven.

In aggregate, these amount to around €27bn per year in 2025 rising to €36bn in 2030. For an average car, and depending on the price of fuel, the end-user will save from €2904 to €3836 over its lifetime[32] as compared to retaining the 130 gCO_2/km target (i.e. a 'do nothing' option). For vans these savings are expected to range from €3363 to €4564[33] as compared to 175 gCO_2/km (see Table 2).

Table 2 User perspective - lifetime fuel cost savings for cars and vans relative to the short-term targets and relative to 2009/10 situation [in €]

Oil price [$/barrel]		90	100	110	120	130	140
Relative to 130 gCO_2/km	Cars	2904	3091	3277	3463	3650	3836
Relative to 2009		4411	4694	4977	5259	5542	5825
Relative to 175 gCO_2/km	Vans	3363	3603	3843	4083	4324	4564
Relative to 2010		4040	4329	4617	4906	5194	5483

  - **Cost-effectiveness to society**

Equally, no implementation of the 2020 targets will result in foregone economic benefits to society linked to no further fuel savings resulting from increasing efficiency. Based on the central cost scenario (i.e. scenario 2)[34] which in view of the results of a thorough analysis

[32] Assuming 14,000km and 16,000km annual distance driven by petrol and diesel and vehicles' lifetime of 13 years with 8% private discount rate

[33] Assuming 23,500km annual distance driven and vehicles' lifetime of 13 years

[34] Cost scenarios are presented in detail in Annex 7.13

undertaken by the US Environmental Protection Agency[35] and factual evidence seems most appropriate, Table 3 shows that both 2020 targets have negative abatement costs which means that society overall saves from implementation of the targets. The higher the oil price the greater the overall savings.

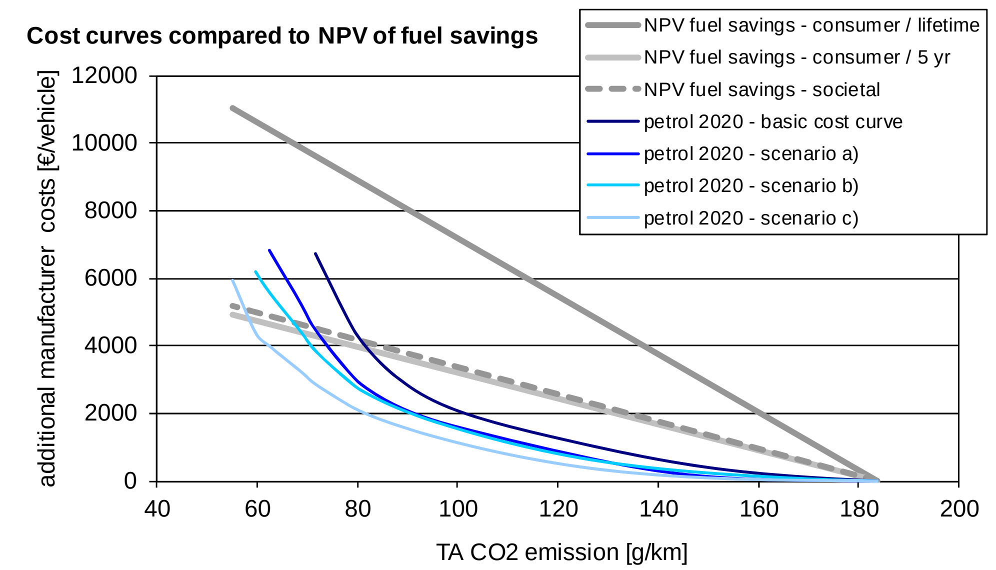
Table 3 Societal perspective[36] - Annual and lifetime fuel savings, NPV of lifetime fuel savings and abatement costs for society

	Oil price [$/barrel]	**90**	**100**	**110**	**120**	**130**	**140**
Cars	Diesel price (ex taxes) [€/l]	0,74	0,82	0,90	0,99	1,07	1,15
	Petrol price (excl. taxes) [€/l]	0,67	0,75	0,83	0,91	0,99	1,07
	Lifetime fuel cost savings[37] (excl tax) [€]	1695	1893	2091	2290	2488	2687
	Abatement costs[38] [€/tonne CO_2]	-82	-112	-142	-173	-203	-234
Vans	Lifetime fuel cost savings (excl tax) [€]	2198	2448	2699	2950	3201	3451
	Abatement costs [€/tonne CO_2]	-172	-196	-221	-246	-270	-295

Figure 2 to **Figure 5** show graphically the net present value (NPV) of fuel cost savings compared with additional vehicle costs for the end-user[39] and society with four different cost scenarios for cars. These figures not only show that during the lifetime of the vehicle, fuel cost savings greatly outweigh additional costs for the level of the limits envisaged but also demonstrate that this will happen within a five year period. These conclusions hold for both passenger cars and vans.

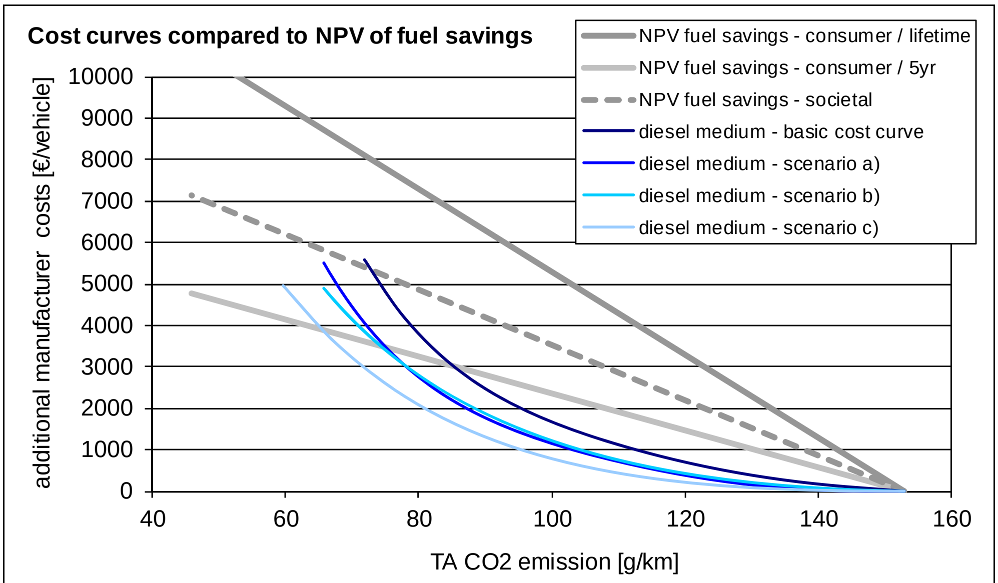
35 Analysis available at http://www.epa.gov/otaq/climate/regulations.htm#1-1
36 4% discount rate used
37 Assuming 14,000km and 16,000km annual distance driven by petrol and diesel and vehicle lifetime of 13 years
38 Based on cost scenario 2, using mass as utility parameter with 60% slope. For detailed explanation of the cost scenarios see Annex 7.13.
39 For end users a private discount rate of 8% is used

Figure 2 NPV of fuel savings for an average medium petrol passenger car compared to cost curves constructed in the car study.



	petrol		
vehicle lifetime (y)	13	discount rate	4%
annual mileage (km/y)	14000	RW/TA	1.195
fuel price (€/l)	1.50	price / manuf. cost factor	1.235

Figure 3 NPV of fuel savings for an average medium diesel passenger car compared to cost curves constructed in the car study.



	diesel		
vehicle lifetime (y)	13	discount rate	4%
annual mileage (km/y)	18000	RW/TA	1.195
fuel price (€/l)	1.50	price / manuf. cost factor	1.235

Figure 4 NPV of fuel savings (**incl. VAT**) for an average Class II diesel LCV compared to cost curve constructed in the van study (assuming annual mileage of 23,500km and 13 years vehicle lifetime).

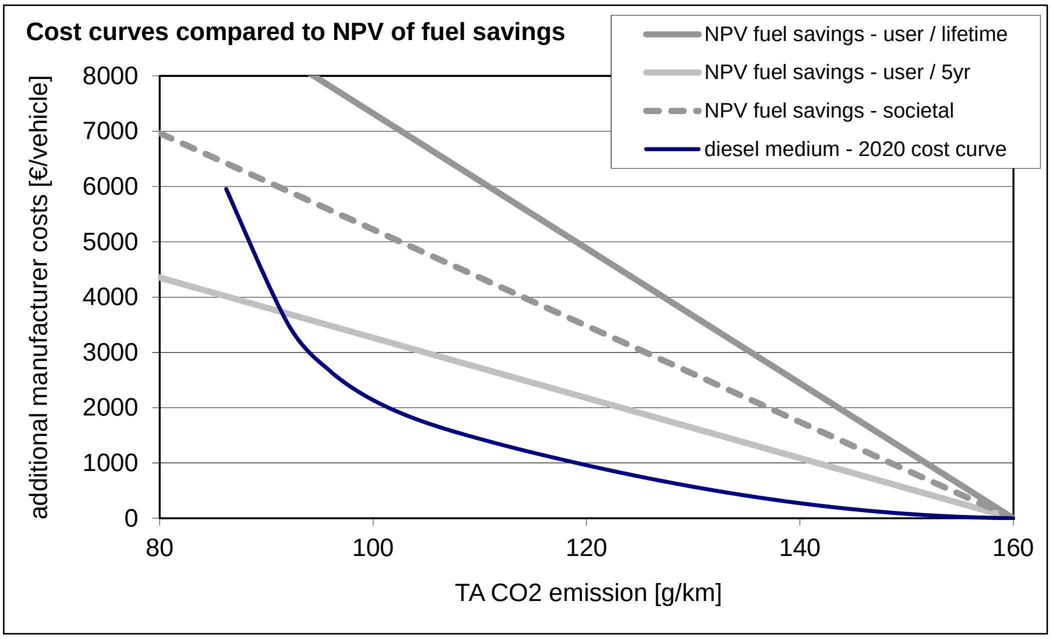
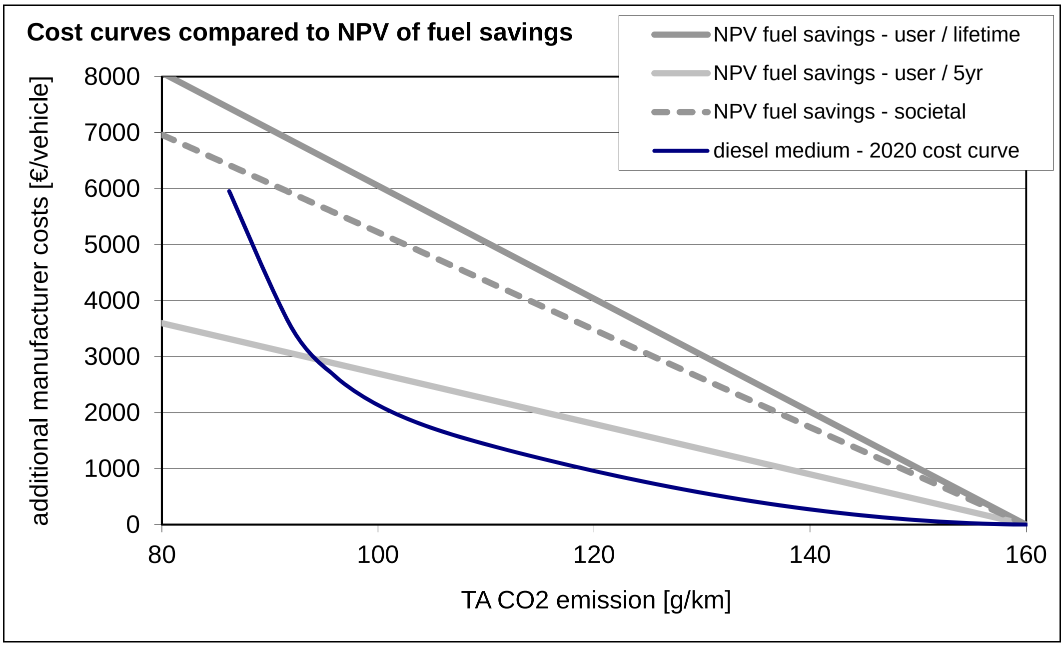


Figure 5 NPV of fuel savings (**excl. VAT**) for an average Class II diesel LCV compared to cost curve constructed in the van study (assuming annual mileage of 23,500km and 13 years vehicle lifetime).



- **Impacts on international trade and competitiveness**

The 'do nothing' option is expected to have a potential negative impact on international trade and competitiveness. This is mainly due to a potential weakening of the competitive position of the EU automotive industry on the third markets. These impacts are presented by outlining the expected benefits of implementation of the 2020 targets.

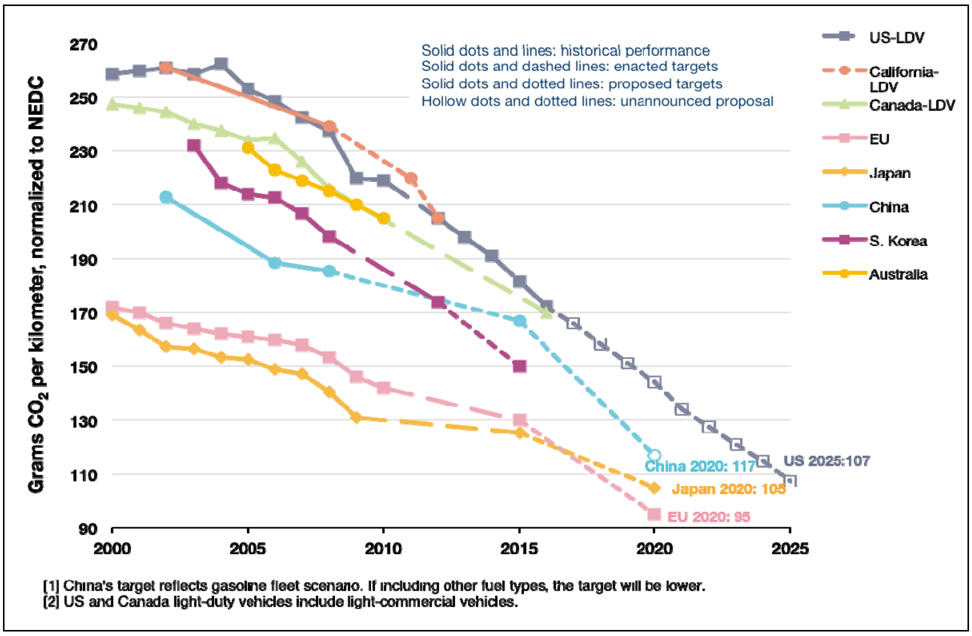
➢ Effect on international market / trade balance

The implementation of the 2020 targets will have two main impacts on international trade: energy consumption and automotive sector sales.

A positive effect on the trade balance is expected in relation to energy as LDVs would consume less oil in the EU.

The new CO_2 targets may affect the competitiveness of vehicle manufacturers and component suppliers on the international export market. If those markets value lower fuel consumption then competitiveness will be improved, if not it could deteriorate. There is a clear tendency towards greater LDV fuel efficiency in countries outside the EU with countries accounting for over 65% of EU automotive exports already having 2020 targets. **Figure 6** shows how CO_2 standards are evolving globally. This suggests that the EU is a frontrunner in producing low CO_2 vehicles giving EU manufacturers a competitive edge (specialisation) in this domain which is valued increasingly highly. The stakeholders are also largely in agreement that retaining this leading position is essential for the competitiveness of the EU automotive industry (see section 4 of Annex 7.2). At the same time it is clear that the international standards are converging, putting increasing competitive pressure on the EU industry.

Figure 6 Evolution of LDV CO_2 standards in different countries (ICCT)



➢ Impacts on competitiveness and innovation

The potential impacts of the Regulations on competitiveness are explored in detail in Annex 7.9. The main effect comes from the implementation of the 2020 targets. Introducing the targets may impact on the automotive sector (vehicle manufacture and component supply) and on all other sectors of the economy which use LDVs. The latter effect is due to lower LDV total costs of ownership (see **Figure 2** to **Figure 5**).

For the automotive sector, the detailed assessment shows that for many of the indicators the impacts are unlikely to be significant (e.g. compliance costs, capital, labour, consumer choice, restructuring). Where impacts are expected to be significant they will lead to reduced energy and vehicle operating costs which will be beneficial to competitiveness for the EU as a whole.

The targets will stimulate innovation. It is clear that the automotive sector has a large capacity for innovation and enjoys a substantial comparative advantage. The industry continues to improve its labour productivity and remains globally competitive, ensuring a trade surplus. This trend has continued following the introduction of CO_2 regulations, as it has in Japan[40], and there is no reason to believe they will be fundamentally altered by the introduction of the 2020 targets or any of the modalities.

The European automotive industry is considered to be a global technology leader - largely due to substantial investments into innovation, but also as a result of a demanding home market. In the responses to the public consultation (see Annex 7.2), 72% of stakeholders and 83% of individuals agreed or partly agreed that EU regulation of road vehicle emissions stimulates innovation in the automotive sector and helps keep Europe's automotive industry competitive.

The main challenges facing the industry appear to derive from other factors. The current situation shows large differences per manufacturer, plant or country, with some, not only premium brands, in good shape and having announced record financial results for 2011[41]. The current Regulations have not had a negative impact on competitiveness and the analysis suggests that, if anything, the implementation of the 2020 targets will further stimulate innovation in the EU automotive sector and enhance its competitiveness in particular making it better placed to benefit from CO_2 and fuel efficiency regulations that will be implemented in other major vehicle markets over the next decades as shown above.

- **Effect on job market / employees**

The European automotive industry is a major employer of a skilled workforce, directly employing over 6 million people (1.2 million employed by car manufacturers and 4.8 million by suppliers) and indirectly responsible for approximately 12.6 million jobs in large companies and SMEs (2.3 million jobs are directly related to manufacturing, 1.2 million jobs in closely related activities, 4.9 million jobs related to road transport and 4.2 million in various services of automobile use).[42]

A number of reports cite that fuel efficiency could have a beneficial effect on employment[43] as fuel efficiency increases the value of cars manufactured and leads to proportionally higher labour demand. Avoided fuel costs are spent on other goods and services.

Table 4 gives an overview of the relative labour intensity (RLI) of some key sectors in the EU. The first column represents the percentage of the total wages each sector pays to employees, the second column represents the percentage of the monetary value of output each sector generates. The relative labour intensity is the fraction of labour compared to the fraction of output generated by each industry. Increasing fuel efficiency leads to a decrease in

40 See the section on 'Overview of the affected sectors' in Annex 7.9

41 See "Economic situation & competitiveness of the car industry"; support document for CARS21 Sherpa meeting; 18 April 2012

42 ACEA 'The automobile industry pocket guide 2011'

43 Fraunhofer-ISI, 2010, Strukturstudie BWE mobil:Baden-Wurttemberg auf dem Weg in die Elektromobilitat
CERES, 2011, More jobs per gallon, How Strong Fuel Economy/GHG Standards Will Fuel American Jobs
TNO, 2011, Support for revision of regulation No 443/2009 on CO_2 emissions of Cars

demand of relatively non-labour intensive sectors (refineries, extraction) and a shift towards the more labour intensive manufacturing of motor vehicles as well as other goods. The manufacturing sector however is still quite capital intensive.

Table 4 Relative labour intensity (RLI) of sectors (% of compensation / % of output in total economy), source: EU input-output table

Sector	% labour	% output	RLI
Coke, refined petroleum products and nuclear fuels	0.002	0.012	0.18
Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying	0.00	0.00	0.31
Manufacture of motor vehicles, trailers and semi-trailers	0.017	0.024	0.70
Other transport equipment	0.007	0.007	0.98
Construction work	0.064	0.062	1.02
Service of land transport; transport via pipeline services	0.025	0.019	1.32
Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel	0.021	0.015	1.40
Research and development services	0.012	0.006	1.81
Health and social work services	0.093	0.039	2.37
Public administration and defence services; compulsory social security services	0.086	0.034	2.52

An indication of how changes to fuel consumption and purchase of vehicles affect other sectors of the European economy can be derived from EU Input-Output tables. A detailed description and results can be found in Annex 7.10. Substitution of fuel by capital and technology increases domestic demand. As illustrated in Annex 7.10 in **Table 13** this can be expected to increase GDP by around €12bn and annual expenditure on labour by around €9bn. A major contribution to this comes from the fact that vehicle manufacturing is more labour and export intensive and purchase of fuels is import intensive.[44] These results are supported by assessments in a number of reports (see footnote 43).

The conclusion of this assessment is that an increase in vehicle consumption has a proportionally large effect on production and labour demand. The need for improvements in fuel efficiency will have positive impacts on the demand for basic metals, wholesale trade, chemicals and rubber. Other sectors will be largely unaffected.

[44] See JRC report, 2007, *Technological studies on contribution to the report on guiding principles for product market and sector monitoring*, Working paper on competitiveness and sustainability;
See Nemry F., Vanherle K., Zimmer Z., Uihlein A., Genty A. et al., 2009, Feebate and scrappage policy instruments. Environmental and economic impacts for the EU 27, JRC scientific and technical reports.

Conclusion

Without new EU action the 2020 car and van CO_2 targets could not come into effect and the problem of increasing CO_2 emissions from light-duty vehicle would not be tackled by EU policy. Further progress in fuel efficiency could not be assumed as evidence from the EU and US indicates that in the absence of regulatory requirements or large fuel price increases, LDV fuel consumption improves at only a modest rate. This is included in the modelling as Scenario 1 described in Annex 7.8. As described in the section above and in the abovementioned annex, no new EU action results in substantially higher EU oil consumption, greater CO_2 emissions and reduced GDP and EU employment. It would also mean abandoning the strategy of reducing LDV emissions and would be counter to current goals.

2.5.2. The Adaptation to Lisbon Treaty

Regulation 443/2009 was adopted prior to the coming into force of the Lisbon Treaty. As a result the comitology provisions need to be updated and brought into line with the Treaty as part of agreement between the Commission, the Council and European Parliament. This is a mandatory requirement and is therefore not further assessed.

2.5.3. Form and stringency of legislation beyond 2020

As indicated in section 5 of the car study, vehicle manufacturers have approximately 7 year timetables for complete changes to vehicle platforms and 10 to 15 year cycles for completely new engines. Much shorter timeframes apply for adaptations to these. The two-step approach that has been taken to date in the Regulations has been to fix a short term mandatory target approximately 6 years in the future[45] and provide a longer term target with a requirement to confirm the associated modalities at a later date. This is compatible with manufacturers' needs.

It is relatively easy to calculate the required level of CO_2 emissions from different types of vehicles to be compatible with a certain level of overall emissions. However, the assessment of the costs of the technology needed to achieve those emission levels become increasingly uncertain the further ahead the projection is made. In view of this it becomes increasingly difficult to know whether the likely required level of emission reductions is best achieved through technology or through alternative policy instruments. This supports setting longer term targets subject to confirmation of feasibility.

To enable the most cost-effective planning of R&D and investments, it is desirable for manufacturers to have a sufficiently long lead time with regard to the future stringency of CO_2 legislation so that they can adequately allocate resources and effort. This will be particularly important as manufacturers need to introduce different types of powertrain further into the future. In respect of the latter, it is also desirable to consider whether in the future the method of regulation would need adjustment to best ensure a technology neutral approach.

Without a continuation of the 2020 targets and without a communication discussing the Regulations beyond 2020, the automotive industry will not be provided with the necessary information for cost effective planning and investment.

[45] Car target set in 2009 for 2015, van target set in 2011 for 2017.

2.6. Who is affected and how?

Major stakeholder groups affected include the general population, vehicle purchasers, vehicle manufactures, automotive component suppliers and fuel suppliers. The main impacts are:

- The EU population is increasingly affected by climate change through increased climate variability, more frequent extreme weather events, and their related impacts.
- Buyers of vehicles, both individuals and businesses, are affected by possible increases in the price of vehicles and reduced running costs, due to stricter CO_2 emission requirements and the related fuel consumption improvement. Fuel saving benefits are expected to outweigh the cost of compliance with the standards.
- Vehicle manufacturers will be affected by the obligation to reduce CO_2 emissions, and will have to introduce technical CO_2 reduction measures. In the short-term, this is likely to result in increased production costs and could affect the structure of their product portfolios. However, demand for low CO_2 vehicles is expected to increase throughout the world as climate change policies develop and other countries introduce similar standards, manufacturers have an opportunity to gain first mover advantage and the potential to sell advanced low CO_2 vehicles in other markets.
- Component suppliers are expected to benefit from higher demand for advanced technologies. Along with vehicle manufacturers they will benefit from the possibility to export these advanced technologies to other markets.
- Fuel suppliers will be affected as they are likely to see lower demand for transport fuels in the future as a result of the legislation.
- Other users of fuel and oil-related products (e.g. chemical industry, heating) are expected to benefit from lower prices if demand from the transport sector decreases.
- Sectors other than transport that emit GHGs will avoid demands to further reduce emissions to compensate for increased transport emissions. In so far as these sectors are exposed to competition, this will be important for their competitiveness.

2.7. The EU's right to act and justification

The EU has already acted in this area when it adopted Regulations 443/2009 and 510/2011 based upon the environment chapter of the Treaty (cars on Article 175 of TEC[46] and vans on Article 192(1) of TFEU[47]). The single market also provides grounds to act at EU level rather than at Member State level so as to ensure common requirements across the EU and thus minimise costs for manufacturers. This is made clear in the recitals of the current Regulations whose objectives include: *"…establishing CO_2 emissions performance requirements..… in order to ensure the proper functioning of the internal market and to achieve the Union's overall objective of reducing emissions of greenhouse gases …"*

EU action is necessary in order to avoid the emergence of barriers to the single market in the automotive sector and because of the transnational nature of climate change. Without EU level action there would be a risk of a range of national schemes to reduce light duty vehicle

46 Treaty of the European Communities amended by TFEU (see footnote 47)

47 Treaty on the Functioning of the European Union

CO_2 emissions. This would particularly disadvantage vehicle manufacturers and component suppliers as differing ambition levels and design parameters would require a range of technology options and vehicle configurations, diminishing the economies of scale. Manufacturers hold differing shares of the vehicle market in different Member States and would therefore be differentially impacted by various national legislations. Costs of compliance would increase and consumers would not benefit from lower costs and economies of scale that an EU wide policy delivers.

3. OBJECTIVES

GENERAL

The general objective which flows from the Treaty and various EU policies outlined in the policy context in section 2.1 is to:

Provide for a high level of environmental protection in the European Union and contribute to reaching the EU's climate change targets while reducing oil consumption, thus improving the security of energy supply in the EU, stimulating innovation and boosting competitiveness of the EU industry.

SPECIFIC

In line with the general objective but focussing on the scope of this review, the specific objective is to:

Ensure the continued and effective application of the car and van CO_2 regulations particularly in respect of the 2020 targets.

OPERATIONAL

In designing the operational objectives the criteria for a review outlined in Article 13(5) of the car Regulation and Article 13(1) of the van Regulation that the Commission's proposal should be "as neutral as possible from the point of view of competition, socially equitable and sustainable" were taken into account. Furthermore, the operational objectives are also designed to be specific, measurable, achievable, realistic and time-dependent (SMART) to the possible extent. As a result, the operational objectives are as follows:

- *Ensure that the 2020 van CO_2 target is feasible.*
- *Ensure that the CO_2 emission targets for 2020 of 95 gCO_2/km for cars and 147 gCO_2/km for vans are achieved cost-effectively.*
- *Ensure the modalities of achieving the 2020 targets do not have unacceptable social impacts*[48]*.*
- *Ensure the modalities of achieving the 2020 targets do not have undesired competitiveness impacts for the EU automotive sector*[49]*.*
- *Create sufficient certainty for the automotive sector with regard to future light duty vehicle CO_2 requirements.*
- *Minimise where possible the administrative burden and costs for SMEs of the Regulations.*

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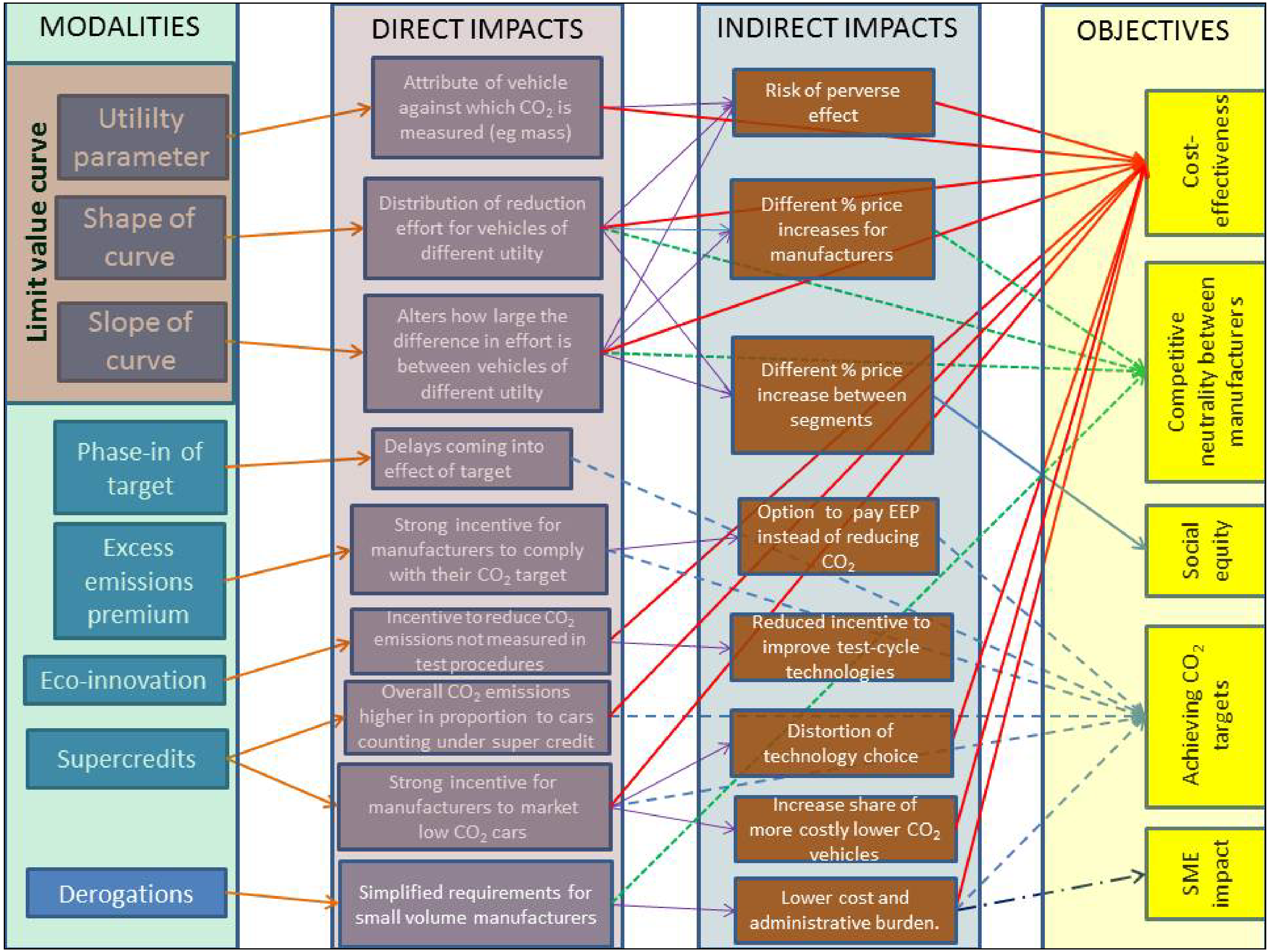
48 The main social impacts are likely to arise from different impacts on car prices. In view of this a particular aim is to minimise the divergence in relative retail price increase between different car segments

49 A range of competitiveness aspects are relevant. However, a key goal is to avoid excessive distortion in competition between manufacturers. This is best assessed through the divergence between the relative retail price increase for a manufacturer compared to the average. Minimising this divergence will lead to the least competitive distortion.

The problem described in section 2 and the objectives outlined in this section fit together to provide an intervention logic. This is shown in the graphic below, illustrating how the various modalities employed in the existing legislation impact on the main objectives sought.


MODALITIES
Limit value curve
Utililty parameter
Shape of curve
Slope of curve
Phase-in of target
Excess emissions premium
Eco-innovation
Supercredits
Derogations
DIRECT IMPACTS
Attribute of vehicle against which CO2 is measured (eg mass)
Distribution of reduction effort for vehicles of different utilty
Alters how large the difference in effort is between vehicles of different utility
Delays coming into effect of target
Strong incentive for manufacturers to comply with their CO2 target
Incentive to reduce CO2 emissions not measured in test procedures
Overall CO2 emissions higher in proportion to cars counting under super credit
Strong incentive for manufacturers to market low CO2 cars
Simplified requirements for small volume manufacturers
INDIRECT IMPACTS
Risk of perverse effect
Different % price increases for manufacturers
Different % price increase between segments
Option to pay EEP instead of reducing CO2
Reduced incentive to improve test-cycle technologies
Distortion of technology choice
Increase share of more costly lower CO2 vehicles
Lower cost and administrative burden.
OBJECTIVES
Cost-effectiveness
Competitive neutrality between manufacturers
Social equity
Achieving CO2 targets
SME impact

4. POLICY OPTIONS

4.1. Methodology

This impact assessment supports the amendment of two Regulations. These Regulations have a structure that has been decided on the basis of the Commission's original proposal and the co-decision process. In view of this, the aspects considered for amendment focus on potential modalities that can be altered within the agreed policy framework.

A broad approach has been taken to identifying policy options. This covers issues raised in the legislation, those arising with implementation and those assessed in the studies analysing possible approaches to improve the legislation's effectiveness. For each aspect an assessment is made of the options available. A preliminary assessment is then made of these options, primarily based upon the analysis carried out in the external studies and on the input from stakeholders. Based on this assessment it is determined which options should be taken forward for detailed analysis.

4.2. Do nothing option

This option implies that the 95 and 147 gCO_2/km targets for 2020 for cars and vans respectively would not be implemented. Further to the extensive assessment of the 'do nothing' option in section 2.5 it is clear that this option would be counter to the general, specific and operational objectives (see section 3). The positive economic, social and environmental effects of reduced CO_2 emissions, savings on fuel spending and resulting macroeconomic impacts, net benefits to consumers and business of increased fuel efficiency of vehicles, as well as positive impacts on international competitiveness of the EU industry would not materialise.

The conclusion to take action, and therefore dismiss this option, is reinforced by the results of the public consultation (see Annex 7.2) whereby 95% of individuals agreed that it was important to set greenhouse gas emission standards as part of overall EU action, and a majority of respondents agreed that these standards should be in line with the GHG targets set out in the Commission's 'Roadmap for moving to a low carbon economy in 2050' and the Transport White Paper .

Finally, in case of a 'do nothing' option the comitology provisions in the car Regulation cannot be brought into line with the Lisbon Treaty.

In view of the arguments outlined above this option is discarded from further analysis.

4.3. Confirmation of feasibility of the 2020 target for LCVs

> The option considered in this section is whether or not the feasibility of the vans 2020 target can be confirmed.

Article 13(1) of the van Regulation requires confirmation of the feasibility of the 2020 van target on the basis of an updated impact assessment. This is assessed from the point of view of the baseline emissions and absolute reduction required to meet the target, the costs of achieving it and the leadtime available to manufacturers to prepare for compliance. These three aspects are discussed below.

(a) Distance to target

The 2010 emissions data indicates that the gap to the 2020 target reduced significantly as compared to the situation in 2007 without a major technological change. Average CO_2 emissions in 2010 are reduced relative to 2007 for all van segments although the level of reduction differed between classes (see **Table 5**).

Table 5 Comparison of 2007 and 2010 data for all van classes

	Petrol			Diesel			Average
	I	II	III	I	II	III	
2010 mass	1117	1455	1846	1173	1497	1966	**1641**
2010 CO_2 emissions (gCO_2/km)	138	168	240	121	161	223	**181.4**
2010 sales	28,837	9,771	1,972	189,195	352,993	477,577	**1,062,090**
Share of sales	1.72%	0.91%	0.19%	17.81%	33.24%	44.97%	**100%**
2007 mass	1110	1455	1958	1191	1556	1975	**1731**
2007 CO_2 emissions (gCO_2/km)	165	198	271	144	179	231	**203**
2007 sales	20,992	6,590	3,761	287,710	429,805	998,287	**1,747,145**
Share of sales	1.20%	0.38%	0.22%	16.47%	24.60%	57.14%	**100%**
Difference in emissions 2010 vs. 2007 (in gCO_2/km)	-27	-30	-31	-23	-18	-8	**-21**

(b) The costs of achieving the target

The updated cost curves in the van study show greater reduction potential and lower costs compared to the previous analysis based on 2007 data (see **Table 6**).

Table 6 The reduction needed and cost of achieving 147 gCO_2/km target for diesel vans

Diesel	Class I	Class II	Class III	Average
Maximum reduction possible (in gCO_2/km)	50.6	73.4	107.1	84.4
Reduction required to meet 147 gCO_2/km (in gCO_2/km)	14.6	18.0	29.6	22.7
Reduction in emissions for 2020 as % of the 2010 baseline vehicle emissions	12.06%	11.30%	13.33%	12.54%
Cost of meeting the 2020 targets from the 2017 target (in €)	330.1	382.8	565.2	456.1

(c) Time needed to comply with the target

The timeframe over which this reduction needs to occur (10 years from the date of adoption of Regulation (EU) 510/2011) is consistent with the time needed for the development of a new van which is considered to be around 7 years[50].

<u>Conclusion</u>

In view of these considerations it is concluded that the vans target of 147 gCO_2/km is feasible. The remaining sections of this Impact Assessment will therefore focus on the assessment of modalities of implementing this level of the 2020 target for vans.

4.4. Policy options for the modalities of meeting the car and van targets

This section undertakes a preliminary assessment of the following policy options for each modality currently included in the Regulations as well as options for inclusion of the alternative modalities:

The limit value curve (section 4.4.1)	**Other modalities in the Regulations** (section 4.4.2)	**Alternative modalities considered- not in the current Regulations** (section 4.4.3)
Utility parameter	Excess emissions premia	Banking and borrowing
Shape of limit value curve	Eco-innovations	Mileage weighting
Slope of limit value curve	Derogations	Combining van and car targets
	Phase-in	Vehicle based limits
	Super credits	

4.4.1. Policy options for the limit value curve

The utility parameter and the function describing the relationship between the utility parameter and CO_2 emissions (setting the shape and slope) are the most important modalities as concluded in section 2.1 and define the limit value curve . This section analyses alternative policy options for each composite of the limit value curve.

50 Source: The van study

Utility parameter

The options considered for this modality are:

(1) Retention of the current utility parameter

(2) Change of the utility parameter

Both Regulations currently use mass as the utility parameter. This parameter was extensively debated prior to adoption of the legislation, in particular for cars, and the Regulations request other parameters to be assessed. A large range of possible parameters have been considered.

Cars

Nine different possible utility parameters were assessed[51] which were: footprint, wheelbase, footprint times height, mass (used currently), payload, composite of seats expressed in volume and volume of boot space, a composite of number of seats and boot space, price, a composite of payload with seat and boot volume, a composite of footprint and mass in running order, a composite of payload with seat and boot volume, footprint and mass in running order. The preliminary assessment[52] of the various options discards all options other than mass and footprint.

Various assessments in the car study are performed using both mass and footprint as the utility parameter to enable a thorough comparison. It can be seen[53] that there is relatively little cost difference between the two parameters based upon size of vehicle, or fuel, with larger vehicles having slightly higher cost for footprint.

Only mass (option 1) and footprint (option 2) are retained for further analysis.

Vans

Three utility parameters are assessed[54]: mass (used currently), payload and footprint. A preliminarily assessment of their fit with fleet CO_2 emissions, their suitability for further analysis and other practical aspects, concludes that all are suitable proxies of vehicle utility.

However, the analysis subsequently discards payload despite its good correlation with fleet CO_2 emissions (although less representative for vehicles above 1900 kg) and its close link to the utility of a commercial vehicle. The main reason underlying this decision is that payload is a parameter derived from the maximum technically permissible vehicle laden mass, i.e. the maximum the loaded vehicle can weigh. This is declared by the manufacturer rather than measured and could therefore be manipulated. In addition, the CO_2 impact of vehicle modifications to increase payload could be relatively small creating a potential perverse incentive.

In view of the arguments above, only mass (option 1) and footprint (option 2) are retained for further analysis.

51 Sections 7 and 8 of the car study
52 Section 9 of the car study
53 Figures 50 and 59 in the car study
54 Section 4 of the van study

Shape of the limit value curve

The options considered for this modality are: **(1)** Retention of the linear limit value curve **(2)** Shift to an alternative limit value curve (flat, non-linear, curved)

The shape of the limit value curve affects the distribution of effort between different vehicles depending on their position on the curve. The existing Regulations are based on a linear function (option 1). The linear function can be truncated at either top or bottom or both (as in the US) to ensure that manufacturers of smaller vehicles need to make less reductions or to ensure that manufacturers of larger vehicles have to make more effort. A curved function achieves a similar objective but avoids the gaming problems associated with a sudden change in slope of the function.

Cars

A range of relevant, conceivable limit value curve shapes are assessed[55]. Four useful functions are identified: flat, linear, truncated linear and curved, and compared[56]. It is shown that the linear function (option 1) has the lowest compliance cost per vehicle and that total compliance costs are lower. The curved shape (variant of option 2) approaches the costs associated with the linear function as the CO_2 target is reduced. Since the analysis shows that most options are more expensive and that there is no clear benefit from a change, option 2 is discarded and option 1 is retained.

Vans

Drawing on the car analysis, only linear (option 1) and non-linear (variant of option 2) limit value curve shapes are assessed for vans [57].

For mass, a linear function (option 1) fits the scatter of CO_2 values of the van fleet well and seems appropriate. Since the current van limit value curve is linear this option would avoid change. For footprint two different trend lines are observed in the scatter of CO_2 emissions suggesting a non-linear correlation[58]. This is the effect of CO_2 emissions levelling off above about $7m^2$ which is largely due to the testing procedure[59]. As a result a linear footprint function is judged inappropriate and a non-linear footprint function (option 2) is assessed (see Annex 7.15 for explanation of non-linear function).

During consultations stakeholders did not express a clear preference for any alternative shape of the limit value curve for cars or vans. The automotive manufacturers favoured the current scheme.

Option 1 for mass and option 2 for footprint are retained for further analysis.

55 Section 9 of the car study
56 Annex K of the car study
57 Section 5 of the van study
58 Section 4 of the van study
59 See Annex E of the van study

Slope of limit value curve

The options considered for this modality are:
(1) Retention of the current slopes of the limit value curves: 60% for cars, 100% for vans
(2) Shift to different slopes from the range 60% to140%

The slope of the limit value curve (see Annex 7.11 for more detailed explanation) affects the distribution of effort between vehicles depending on their position on the curve. Because of this differential effect, changing the slope alters the amount of effort required from different manufacturers and impacts on the overall cost of meeting the target. The slope also affects the possibility for perverse incentives – steeper slopes increase the risk.

The studies[60] provide detailed assessments of the implications of changing the slope of the curve with mass or footprint as the parameter. The analysis in the car study was performed in comparison to the average slope of the 2009 fleet, which is taken as 100%. The range from 60 to 140% slope was analysed. In absolute terms, slopes in the range from 0.0296 to 0.0691 for mass and 17.6 to 41.1 for footprint have been considered. It is important to recognise that the choice of slope is ultimately a decision on an appropriate sharing of burden amongst manufacturers whilst still delivering the overall target for the EU fleet of new cars. This choice of slope can as equally be derived from and related to data from the 2006 fleet, 2009 fleet or an average of the two. [61]

The van study analysis was performed in comparison to the average slope of the 2010 fleet, which is taken as 100%. The range from 60 to 140% for mass[62] and footprint[63] and linear and non-linear function respectively was analysed.

During consultations stakeholders did not express a clear preference for any alternative slope of the limit value curve for cars or vans. The automotive manufacturers favoured the current scheme.

Cars

The percentage new car price increase as a result of the target is higher for small than large cars. A slope below 100% would be more socially equitable since this slightly reduces the small car percentage price increase and the converse for larger cars. However, even at 60% slope this makes only a few percentage points difference compared to a 100% share.

[60] Section 10 of the car study and section 5 of the van study

[61] For example, the most obvious slopes derived from different data sets are as follows:
- the slope from the current Cars Regulation of 0.0457 but adapted to meet the 95g/km target in 2020 would equal to 0.0333;
- the 2009 fleet data and a slope of 60% relative to this baseline would result in a parameter of 0.0296; - the 2009 fleet data with a 100% slope relative to this baseline would equal to 0.0494;
- the average of the fleet data from 2006 and 2009 and a slope of 60% relative to this baseline would result in a parameter of 0.0315.

[62] In absolute terms a range from 0.057 to 0.134 was considered for linear mass-based function.

[63] For a non-linear footprint-based limit value curve two ranges of slopes were considered: in absolute terms from 16.4 to 38.2 to the left from the bending point and an equivalent range of 2.3 to 5.4 to the right from the bending point.

When the Regulation was adopted a slope below a certain level was needed to avoid incentivising mass increases. The 100% line for 2009, depicting the actual distribution of fleet in that year, already has a lower slope than that required in the current Regulation meaning that any slope below this 2009 baseline will avoid this incentive.

Slope has a distributional impact between manufacturers, depending on their sales mix. For slopes below 100%, costs increase for 10 manufacturers and decrease for 10. Manufacturers are conversely affected for slopes above 100%.

In view of these considerations both options are retained for further analysis. However, option 2 will consider only slopes in the 60 to100% range.

Vans

The percentage price increase for meeting the 2020 target is shown to be higher for larger vans in the study. However, this does not mean it is more expensive to reduce emissions from larger vehicles. The effect is due to the cost model optimising the reduction level across manufacturers' fleets. The results suggest larger vans have more reduction potential and therefore OEMs will seek a larger contribution from these to meet their overall targets.

<u>Mass-based function</u>

To avoid perverse incentives, it is desirable for the slope to be no steeper than in the current Regulation. The 100% slope derived from 2010 sales is only slightly steeper than that currently in use. The relative price increase (and additional manufacturer cost) is distributed most evenly over manufacturers around 100% slope. The average costs for meeting the 147 gCO_2/km target are lowest at 80% slope but the cost difference is negligible. In view of these factors the van study recommends a slope in the range 80-100%.

<u>Footprint-based function</u>

Although differences are very small, the lowest overall average additional manufacturer costs for footprint occur at the 110% slope (see **Table 10**). The distribution of additional cost per manufacturer is most even around the 100% slope.

Since changes to vehicle footprint are much easier to implement in vans than cars, perverse incentives to adjust footprint are more important for vans. This is especially important for vans with low footprint, as the non-linear limit function is relatively steep at this part of the footprint range. Extension of footprint may lead to more loading area and extra space, which when used effectively may be beneficial. However, if done to increase the CO_2 target it could lead to increasing average footprint and non-compliance with the overall target. In order to avoid this perverse incentive a lower slope seems more desirable for vans. However, a lower slope increases the difference in cost distribution between manufacturer groups that sell typical vans representing the majority of the market, in contrast to those selling pick-ups or all-terrain vehicles.

Both options are retained for further analysis. However, option 2 will consider only slopes in the 80 to 100% range.

4.4.2. *Policy options for other modalities in the Regulations*

Excess emissions premia

The options considered for this modality are:

(1) No change to the current level of the excess emissions premium

(2) Adjustments to the current level of the excess emissions premium

The excess emissions premia (EEP) are to ensure that manufacturers comply with their CO_2 reduction obligation. The level at which the premia are set needs to be high enough to ensure that manufacturers undertake the necessary technical innovations to ensure compliance rather than just pay EEP. They were originally set at the level of the upper range of marginal cost of compliance with 130 gCO_2/km for mainstream car manufacturers. In reality it is likely that the marginal cost to manufacturers to comply with that target will be substantially lower.

Cars

For cars, the EEP was set to €95 per gCO_2/km, but to allow manufacturers time to adjust to the new regulatory scheme, the first 3 gCO_2/km above the target would receive a lower EEP (increasing from €5 to €25 per gCO_2/km) in the period 2012-2018.

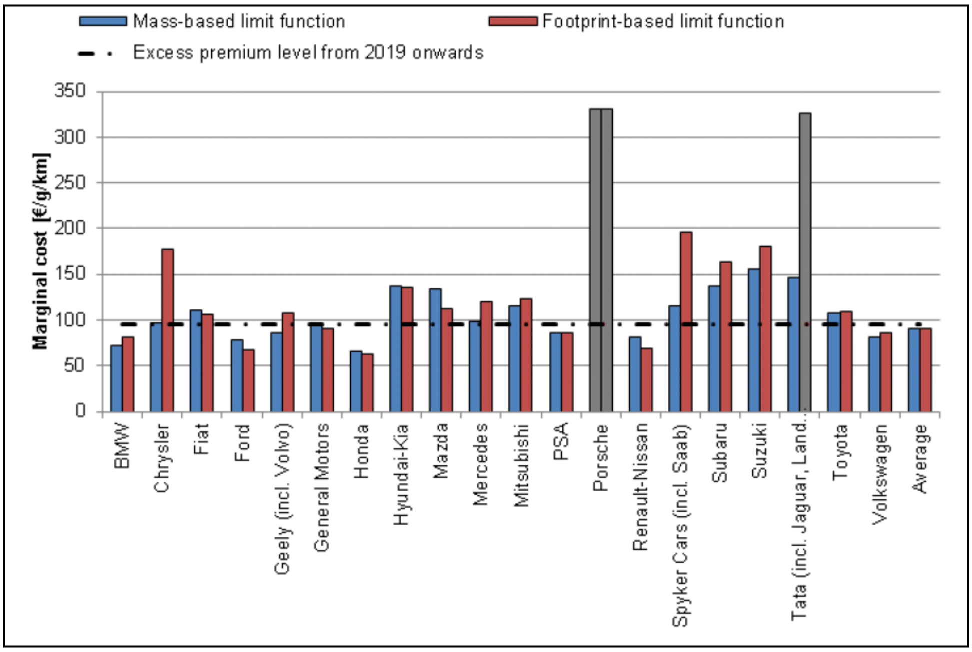
The analysis shows maximum marginal costs for different manufacturers[64], based upon cost scenario 1[65] (see **Figure 7**), with the average marginal cost of reaching 95 gCO_2/km being €91 per gCO_2/km, which is around the level of the current EEP (option 1). Marginal costs will be lower assuming that the middle cost curves (for more explanation see Annex 7.13) are likely to be more realistic.

For most manufacturers, marginal costs are similar to or below the €95 per gCO_2/km level currently in place. For Spyker and Chrysler, costs are only substantially above the level if footprint is used as the utility parameter. Tata, Subaru, Suzuki, Porsche, Hyundai, Mazda and Mitsubishi have marginal costs quite substantially above the current premium level but most of these are currently covered by niche derogations.

[64] Section 13.4.4 of the car study

[65] For detailed description of cost scenarios see Annex 7.13.

Figure 7 Marginal costs per manufacturer for reaching the average of 95 gCO_2/km (based on cost scenario 1)



Option 2 would be to update the EEP to reflect likely upper marginal costs of compliance with the 2020 targets. According to the cars study, if this logic was followed, the EEP might need to be increased to €130-150 for mass as a parameter and possibly higher for footprint. This would increase the probability of meeting the target. Porsche would still have costs above these levels.

EEP needs to be paid by a manufacturer (group) per gCO_2/km of emissions exceeding the target times the number of cars registered. A premium that is too low runs the risk of being an attractive alternative for not reducing emissions, which undermines the environmental objective. A premium that is set too high may also be inappropriate as the objective of the EEP – apart from providing an incentive for manufacturers to comply - is to provide a 'safety valve'. Another consideration is the fact that manufacturers cannot fully control the exact composition of their sales. In case of large unexpected shifts in consumer demand, the penalty is a buy-out option for complying with the Regulation.

In view of the above, and based on the likelihood that for some manufacturers, average marginal costs of compliance will be below €95 per gCO_2/km it is not considered necessary to change the level of the EEP, especially for a mass-based limit value curve. Therefore, option 2 is discarded from further analysis.

Vans

For vans the EEP in the Commission's proposal[66] was set at the level of the upper range of the marginal cost of compliance which was around €120 per gCO_2/km for the target of 175 gCO_2/km. However, in co-decision the level of EEP was lowered to equal that of cars (€95 per gCO_2/km) with a similar introductory regime for the first 3 gCO_2/km above the target in the period 2014-2018.

66 COM(2009)593

The maximum marginal cost for different manufacturers[67] has been analysed based upon a new methodology and a more adequate database. It can be seen (**Figure 8** and **Figure 9**) that the marginal costs of meeting the 2020 van target for both mass and footprint-based functions is slightly below €40 per gCO_2/km if Tata[68] is excluded, quite substantially lower than had originally been estimated.

Figure 8 Marginal costs per manufacturer for reaching the average 147 gCO_2/km (mass as utility parameter)

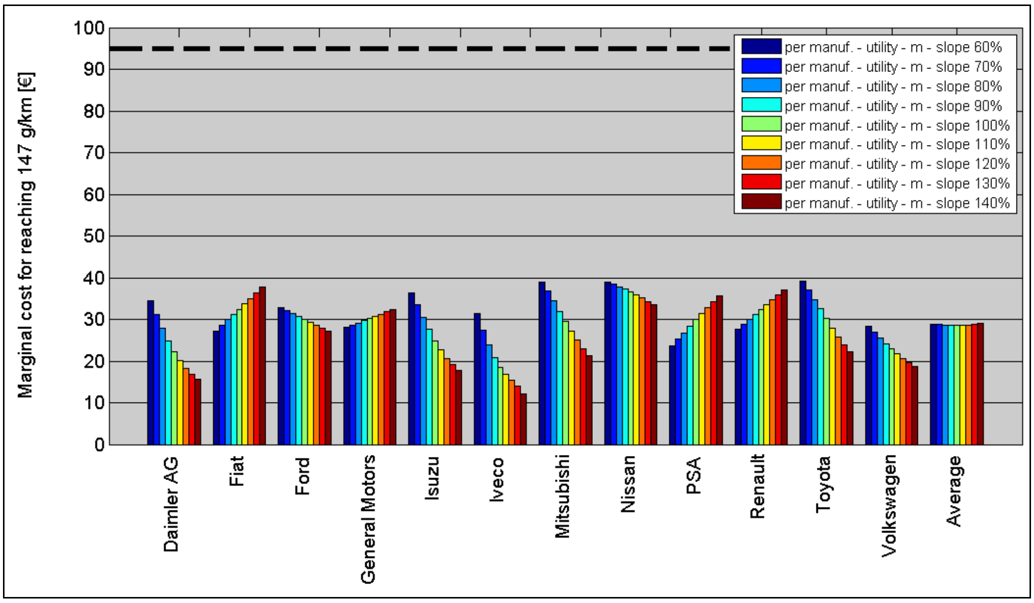
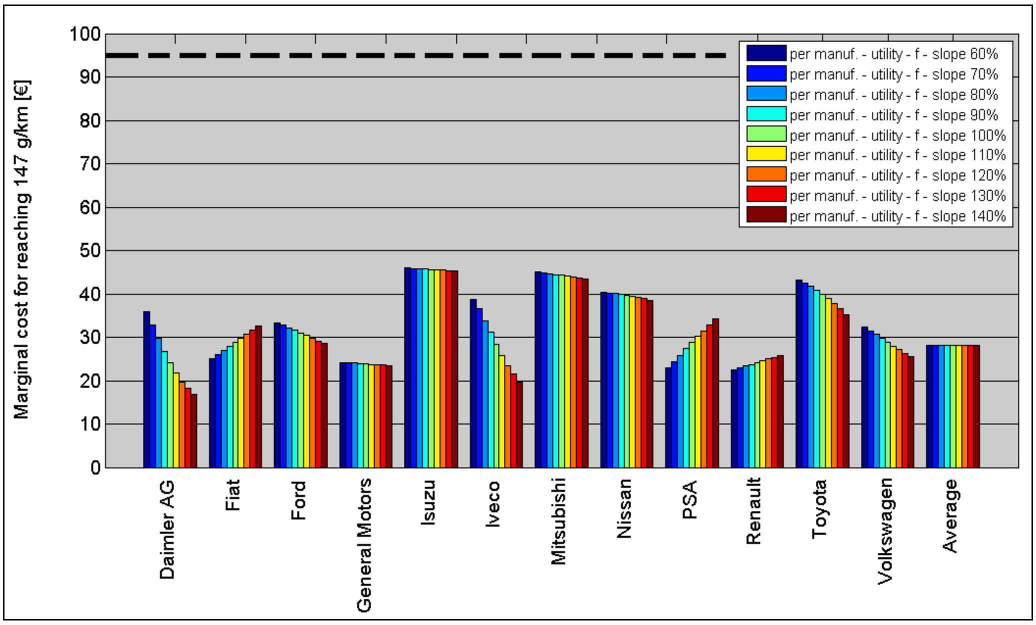


Figure 9 Marginal costs per manufacturer for reaching the average 147 gCO_2/km (footprint as utility parameter)



67 Section 5.8 of the van study

68 TATA (including Land Rover) is likely to be covered by the small-volume derogation and may have a separate reduction target.

For certain van and car classes a regulatory overlap exists where some large cars can potentially be type-approved as light commercial vehicles and benefit from a more lenient target which is expected to be cheaper to meet. If the van EEP is lowered (option 2) this incentive would be further strengthened. In view of this, option 2 is discarded. Retaining the current EEP level (option 1) provides a strong compliance incentive and ensures continued alignment with the EEP for cars.

Derogation scheme

The options considered for this modality are:

(1) Stopping the derogation scheme

(2) Continuation of the scheme

(3) Update of the niche derogation scheme

Option 1 is not seen as a practical solution. As concluded in the previous car impact assessment, manufacturers selling a relatively small number of vehicles with a limited and specialised portfolio may find it very challenging and costly to meet the overall targets set via the limit value curve. In addition, the manufacturers covered by the derogation tend to sell vehicles which are driven shorter distances than cars sold on the mass market. The overall contribution in terms of CO_2 emissions of cars sold by small-volume manufacturers is estimated to be below 0.01%. Therefore option 2 is preferred over option 1.

The niche category has a fixed target of 25% reduction from the 2007 average emissions of each niche manufacturer. Option 3 considers certain updates to the scheme. The baseline in Article 11(4)b of the car Regulation could be updated to ensure a comparable level of effort for niche manufacturers compared to the main fleet. This would imply approximately 27% reduction compared to 2015 or a 45% reduction compared to 2007 for the same level of reduction as larger manufacturers. Analysis shows that manufacturers in this segment are technically able to continue making CO_2 reductions beyond 2015.

It should be reconsidered whether manufacturers of up to 300,000 cars per year should have a differential treatment in terms of CO_2 reduction obligation beyond 2015. This can create unfair competitive distortions in markets where they compete. For example Honda and Suzuki which are both major global manufacturers currently sell around 175,000 cars per year in the EU and therefore fall under this derogation. In addition, there is a possibility that new entrant manufacturers from outside the EU[69] might gain a competitive advantage through use of this derogation. Option 3 could therefore be considered further.

There are several aspects of the derogations procedure that have been identified as meriting further evaluation in view of simplification, these are discussed further in section 4.4.4.

[69] For example manufacturers such as Great Wall Motors (500,000 global sales) or Dongfeng Motor Corporation (2 million vehicle sales)

Eco-innovations

The options considered for this modality are: **(1)** Phase-out of eco-innovations **(2)** Prolongation of eco-innovations

The purpose of including eco-innovations in the legislation was to ensure that manufacturers could also receive credit for innovations that reduce CO_2 emissions during vehicle operation even when these are not measured in the normal vehicle test procedure. Article 13(3) of the car Regulation and Article 13(6) of the van Regulation require that once a new vehicle test procedure has been introduced eco-innovations should no longer be approved (option 1).

Ideally the new test procedure will require operation closer to that experienced in real world conditions including accessories, thus ensuring that reported emissions are more realistic and avoiding the need for eco-innovations. A new test procedure is under development, however its introduction cannot be expected to completely eliminate the possibility that innovations not measured in the test procedure can be implemented. In fact, unless the new test procedure requires a more realistic approach to the operation of various vehicle accessories and equipment, much of the energy using elements will not play any role in determining vehicle CO_2 emissions. In view of this, improvement to these elements would not bring any credit to the manufacturer.

An option to consider is to prolong the possibility for manufacturers to propose eco-innovations under the scheme currently in place (option 2). Implementation of this would be straightforward and the nature of the scheme means that manufacturers would still only be able to claim credit for elements that would not otherwise be counted in the test procedure.

Since manufacturers will not develop such innovations and propose them as eco-innovations if it is not cheaper to do this than to introduce other improvements which are measured in the test procedure it follows that eco-innovation measures should bring CO_2 benefits at lower cost than alternatives available to the manufacturer. It can be concluded therefore that eco-innovations will not be proposed by car and van manufacturers unless they are an efficient route to reduce CO_2 emissions. The design of the measure ensures that eco-innovations are novel and therefore it can be concluded that this modality promotes innovation. It can therefore be concluded that the concept of eco-innovations is both efficient in that approved innovations will reduce CO_2 emissions and effective in that their cost should be lower than alternative options. This view is also supported by the automotive industry, including the producers of automotive components. Therefore, option 2 could be more appropriate than option 1.

Phase-in

The options considered for this modality are:
(1) No phase-in of the 2020 target
(2) Inclusion of phase-in of the 2020 target over the period 2017 - 2020 or 2020 - 2023

The short-term cars and vans targets are currently phased-in over a period of 4 years. It was argued that this was necessary to give manufacturers time to adapt their product portfolio. For vans, an additional argument was the economic crisis which hit the sector in 2009 and 2010.

Option 2 would involve a phasing-in of the 2020 target. This might be carried out over a period of 3 years, comparable to the previous targets. Two variants are considered: a) the phase-in occurs over the period 2017-2020; b) the phase-in occurs over the period 2020-23. Based on the preliminary assessment shown in Annex 7.14 option 2 is discarded for both cars and vans.

Super-credits

The options considered for this modality are:
(1) No prolongation of super-credits
(2) Prolongation of super-credits
(3) Modification of super-credits

The Regulations are based upon CO_2 emissions from the vehicle and ignore those from other parts of the energy supply chain. Therefore certain types of vehicles, essentially using substantial proportion of hydrogen or electricity for their propulsion during the test procedure will be measured as having very low emissions[70]. The Regulations incorporate provisions that count vehicles with emissions below 50 gCO_2/km a multiple number of times for the period up to 2016 for cars and 2018 for vans. It was argued that this multiplier would provide a strong incentive for vehicles meeting this criterion to be marketed. Option 2 and 3 would introduce multipliers for low emission vehicles up to 2020 for cars and vans.

Based on the preliminary assessment shown in Annex 7.14 options 2 and 3 are discarded for both cars and vans because they increase CO_2 emissions, reduce the stringency of the target below that politically agreed, reduce the cost-effectiveness of the Regulations and do not respect the principle of technological neutrality. It is however also clear that the magnitude of these negative impacts can be somewhat limited by the use of low multipliers and a threshold on the number of vehicles which could benefit from super-credits.

[70] For example the Opel Ampera has combined test cycle emissions of 27 gCO_2/km.

4.4.3. Alternative modalities considered

Options for additional modalities considered in this section:

(1) Banking and borrowing

(2) Combining car and van targets

(3) Mileage weighting

(4) Vehicle based limits

In addition to the existing modalities, a further range of modalities has been assessed to consider whether they merit incorporation in the Regulations for 2020.

Based upon the preliminary assessment shown in Annex 7.14 it is concluded that these options should be discarded for both cars and vans.

4.4.4. Simplification and reduction of administrative burden

Options for simplification of the current Regulations considered in this section include:

(1) Reduction of the number of modalities

(2) Simplification of the implementing measures

(3) Simplification of rules for SMEs and micro-SMEs

(4) Simplification of the derogation procedure to reduce the administrative burden

Simplification is assessed from a number of angles. Option 1 is based on the conclusion that the number of modalities should be kept as small as practicable to minimise the complexity of the legislation. This suggests a presumption against proposing modalities for inclusion in the Regulation. This logic is consistent with the analysis which led to the majority of the options considered for modalities, including the alternative approaches, being discarded.

Many aspects of the implementation of the Regulations have been achieved through secondary legislation and these are not affected by the modalities implemented for 2020. These contain their own review provisions and possible simplifications (option 2) can be considered when those take place. Accordingly simplification possibilities for these are not considered in this Impact Assessment.

The potential for simplifying rules for SMEs and micro-SMEs should be considered (option 3). There are many of these companies in the component supply sector that will benefit indirectly through the opportunity to develop new technology and components. However, since they are only indirectly impacted, there is no potential for simplification in relation to them. The only SMEs that could be impacted directly would be SMEs producing a very limited number of vehicles. These by their size would fall under the scope of the small volume derogations in both Regulations. It could be considered to establish a de minimis threshold for the registration of cars and vans below which manufacturers are exempt from the requirements of the Regulation. An alternative to a de minimis registration threshold could be to exempt manufacturers that are SMEs.

It may be preferable to reduce the administrative burden the small volume application and assessment process is likely to cause for the Commission and manufacturers for the period from 2015 onwards (option 4). The possible improvements include clarification that derogations may be renewed or extended for another period; and clarification of the applicability of the derogation (i.e. in relation to which annual targets it applies). Lack of flexibility in the current provisions (e.g. the derogation in order to be applicable for a given calendar year must be granted in the preceding calendar year) may lead to small-volume manufacturers having to pay excess emissions premiums in case their applications cannot be assessed on time due to resubmissions or the need to complete the submitted application, even if they comply with the proposed targets.

Options 3 and 4 are taken forward for further consideration.

4.4.5. Conclusions of the preliminary assessment

Results of the preliminary assessment of the options:

Section	Modalities	Policy options for each modality	
		Cars	**Vans**
4.4.1	**Utility parameter**	Mass and footprint options retained for analysis in section 5; Other options discarded;	Mass and footprint options retained for analysis in section 5; Payload discarded;
4.4.1	**Shape of limit value curve**	Linear function option retained for analysis in section 5; Other options discarded;	Linear function option for mass retained for analysis in section 5; Non-linear function option for footprint retained for analysis in section 5;
4.4.1	**Slope of limit value curve**	Slope options in the range 60%-100% retained for analysis in section 5;	Slope options in the range 80%-100% retained for analysis in section 5;
4.4.2	**Excess emissions premia**	Alternative options discarded;	Alternative options discarded;
4.4.2	**Eco-innovations**	Modality retained in its current format;	Modality retained in its current format;
4.4.2	**Derogation schemes**	Small-volume derogation retained; Option to continue CO_2 reduction for niche manufacturers retained for analysis in section 5;	Small-volume derogation retained;
4.4.2	**Phase-in**	Modality discarded;	Modality discarded;
4.4.2	**Super credits**	Modality discarded;	Modality discarded;
4.4.3	**Banking and borrowing**	Modality discarded;	Modality discarded;
4.4.3	**Mileage weighting**	Modality discarded;	Modality discarded;
4.4.3	**Combining van and car targets**	Modality discarded;	Modality discarded;
4.4.3	**Vehicle based limits**	Modality discarded;	Modality discarded;
4.4.4	**Simplification/ reduction of administrative burden**	Simplification of rules for SMEs and micro-SMEs to reduce the administrative burden retained for analysis in section 5.	Simplification of rules for SMEs and micro-SMEs to reduce the administrative burden retained for analysis in section 5.

4.5. Adaptation to new test cycle

New vehicle CO_2 emissions for the purposes of the Regulations are assessed as part of the type approval procedure using the New European Driving Cycle (NEDC)[71]. Article 13(3) of the car Regulation and Article 13(5) of the van Regulation request the test cycle to be updated to reflect the real CO_2 emissions behaviour of vehicles and to include eco-innovations within the test procedure. Work is proceeding on the World Light Duty Test Procedure (WLTP), but it is uncertain when this will be finalised and implemented.

It is clear that the 95 gCO_2/km and 147 gCO_2/km targets established in the Regulations were intended by the co-legislators to be applied with an equivalent stringency to the 130 gCO_2/km and 175 gCO_2/km targets, i.e. measured under the NEDC. This means that in theory manufacturers could continue testing their vehicles under NEDC conditions till 2020 for the purpose of compliance with the Regulations. However, this would be burdensome and costly once the WLTP has been adopted and would not respond to the desire for emissions to better relate to real world conditions.

Information on the divergence between test and real-world emissions and underlying reasons is provided in Annex 7.7. It is not clear to what extent the WLTP will ensure that test emissions represent real world conditions. It is also clear that exploitation of flexibility in the test procedures has provided some proportion of the measured CO_2 reductions. It is important for the integrity of the legislation that any adaptation to a new testing procedure should not result in an increased amount of flexibility. These factors cause uncertainty for manufacturers.

The Regulations already empower the Commission to adapt the formulas in Annexes I to a new test procedure. However, since the revised test procedure is unlikely to be adopted prior to the coming into force of the amended Regulations this cannot be done at present.

To minimise uncertainty, it could be possible to describe in outline the principles and procedure that will be used for adaptation of the legislation in the legislation. This could potentially increase manufacturer certainty and thereby lower compliance costs.

4.6. Form and stringency of legislation beyond 2020

In view of the two-step nature of the Regulations, greater certainty for manufacturers will be created by setting indicative targets or target ranges for the period beyond 2020 as soon as possible. In consultations, setting these future targets in line with the EU's climate policy goals received a large degree of support. A number of stakeholders such as parts manufacturers and environmental NGOs have called for tighter targets to be set for 2025. Transport and Environment has stated that it believes a car target of 60 gCO_2/km should be set for 2025 and a van target of around or below 100 gCO_2/km for 2025 would be needed to ensure roughly equivalent technical effort in the car and van sectors. Earlier, the European Parliament in its Resolution of 24 October 2007 on the strategy to reduce CO_2 emissions from passenger cars and light-commercial vehicles[72] had indicated the need for further emissions reductions for cars to 70 gCO_2/km or less by 2025.

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[71] See section 2.4.

[72] http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P6-TA-2007-0469&language=EN

The Commission recently indicated in a staff working paper[73], that it would in the period to 2014 "*consider, based on a thorough impact assessment, proposing a target for passenger car emissions to be reached by 2025"*. It noted that this would include assessing the European Parliament's proposed goal. In a consultancy study that has been carried out for the Commission, indications of the range of vehicle CO_2 emission targets for the period beyond 2020 were established that would be compatible with the Transport White Paper[74]. Further work is needed and in particular the Commission is currently studying the impacts of alternative regulatory metrics, particularly on the cost of meeting future targets.

In view of the various aspects that need to be assessed it is considered that the optimal solution would be to publish a consultative Communication setting out the Commission's analysis of the implications of alternative regulatory approaches. The Communication would also provide an illustration of the likely range of stringency that would be required for future CO_2 limits compatible with the longer term climate objectives of the EU. Future changes to the regulatory approach and making the level of emission reductions mandatory would be carried out at a later stage through a legislative proposal. The approach combines the merits of allowing for the necessary further analysis and consultation, while providing a reasonable degree of certainty for manufacturers, albeit not as great as if the mandatory level and regulatory approach were already defined.

[73] "A European strategy for clean and energy efficient vehicles" state of play 2011;SEC(2011) 1617

[74] See figure 4.6: http://www.eutransportghg2050.eu/cms/assets/Uploads/Reports/EU-Transport-GHG-2050-II-Task-6-Draft-Final-Report-16Mar12.pdf

5. ASSESSMENT OF POLICY OPTIONS

5.1. Criteria to compare the options

5.1.1. Main criteria

The retained policy options for the modalities of meeting the targets and options linked to simplification and reduction of administrative burden are analysed further in this section. It should be noted that the Regulations request that the Commission's proposal should be "as neutral as possible from the point of view of competition, socially equitable and sustainable." These criteria are contained in the operational objectives and employed in the three aspects of the assessment.

Neutrality from the point of view of competition is assessed within the economic assessment by comparing manufacturer costs per vehicle. Social equity primarily relates to the relative impacts on different classes of vehicle users and whether these are differentially impacted. Sustainability flows from a combination of the three elements whereby environmental benefits are ensured in a cost effective and socially beneficial manner.

The table below shows how the operational objectives link to the following economic, environmental and social assessments.

Operational objective	Economic	Environmental	Social
Ensure the environmental benefits of the 2020 light duty vehicle CO_2 targets are achieved cost-effectively.	X	X	
Ensure the modalities of achieving the 2020 targets do not have unacceptable social impacts.			X
Ensure the modalities of achieving the 2020 targets do not have undesired competitiveness impacts for the EU automotive sector.	X		
Create sufficient certainty for the automotive sector with regard to future light duty vehicle CO_2 requirements.	X		
Minimise where possible the administrative burden and costs for SMEs of the Regulations.	X	X	X

It is clear from this table that the majority of the objectives have most relevance for assessment under the economic criterion. As already illustrated in section 2.5, the largest part of the expected impacts arise from implementation of the 2020 targets. The modalities that are considered in this impact assessment only alter the manner in which those 2020 targets will be implemented. As a result their effect in the areas other than economic is small or minimal. For example, while there might be social impacts in relation to skills and employment that would arise from implementing the 2020 targets, no discernible change in these is anticipated as a result of altering any of the modalities.

To the degree that social equity and competitiveness impacts will arise from the modalities, these arise principally as a second order effect resulting from the economic impact of the options. For example, social equity may be affected by changes in vehicle prices that impact more or less heavily on different social groups. Similarly changes in the competitive position of manufacturers arise as a second order effect of the cost impact on different classes of vehicle. In view of this, while social and environmental aspects are explored for the different modalities, these impacts are small or insignificant and therefore these sections are short.

5.1.2. Detailed aspects of assessment

The options can have economic, environmental and social impacts through a variety of mechanisms. The main aspects that have been assessed are outlined below:

Expected economic impacts

Aggregate manufacturer <u>compliance costs are primarily driven by the level of ambition</u>. Thus the implementation of the targets will have the following economic effects:

– Additional investments in R&D and production by vehicle manufacturers and component suppliers.

– Possible additional purchase costs to vehicle purchasers which bring them economic benefits from the lower costs of use.

– Fuel savings for users and energy security benefits.

– A possible change in the competitive position of vehicle manufacturers and component suppliers vis-à-vis their global competitors.

These effects are described in detail in section 2.5.1 and Annex 7.8. However, the options for modalities considered in this chapter can also cause economic impacts in a number of ways. These are assessed as follows:

- Cost-effectiveness to society

To decrease the burden of environmental protection, CO_2 emissions reductions should be undertaken at the lowest cost to society. This implies a comparison of costs (e.g. investment in new technologies) and benefits to society (e.g. fuel savings) of different policy options. The assessment in section 2.5.1 has shown that the fuel savings substantially exceed the costs. However, some options may reduce the overall cost effectiveness.

- Manufacturer compliance costs

The Regulations aim to be competitively neutral taking account of the diversity of the EU automotive industry and avoiding unjustified distortion of competition between manufacturers. Options that affect the distribution of effort will change the relative impacts on different vehicle manufacturers although these are unlikely to impact on component suppliers. Options should therefore also be compared based on the average cost of compliance faced by different manufacturers present on the EU market. This will feed through into costs for consumers.

- Other economic impacts: certainty for industry, innovation, competitiveness

In order to minimise compliance costs and create incentives for the automotive industry, including manufacturers and component suppliers, to invest in new technologies, it is important to ensure long-term regulatory certainty. Options that undermine previous expectations or reduce future certainty can cause wasted investment and unnecessarily lock-up capital. Therefore, policy options undermining previous expectations or reducing future certainty are less preferable to alternatives without such effects or with a smaller negative impact. In addition, policy options incentivising innovation and strengthening the competitiveness of EU industry are preferable.

- Impacts on SMEs

No disproportionate regulatory burden should be put on small and medium enterprises and options should therefore be assessed from this aspect.

Expected environmental impacts

The direct environmental impact covers CO_2 emissions, which is the main greenhouse gas emitted by LDVs, as well as emissions of air pollutants. The most important environmental impact of the Regulations stems from the implementation of the 2020 targets and their level of stringency (see sections 2.5.1 and 4.2).

Policy options might lead to changes in the level of reductions in these emissions which is assessed. The effect on air pollutant emissions is indirect but it is assumed that reductions in vehicle fuel consumption should lead to a reduction in pollutant emissions.

Expected social impacts

The Regulations specify that they should be revised in a socially equitable way implying that policy options without disproportionate impacts on certain social groups are preferable. This impact can arise from the differential effect of the policy options on different vehicle classes and this is analysed. The policy options can also have an impact on the level and the quality of employment.

The major social impacts arise from the level of ambition and implementation of the 2020 targets. The deployment of CO_2 reducing technology is likely to lead to increased manufacturing costs and given a certain cost pass-through to an increase in purchase price. As shown in the economic analysis, fuel efficiency improvements flowing from the revised targets more than compensate for any increase in vehicle purchase prices, given the high price of fuel.

5.2. Utility parameter - cars

Two options are assessed – mass or footprint.

A. Economic impacts

- Average costs of compliance and distribution between car segments

Additional car manufacturer costs compared to the 130 gCO_2/km target are shown in **Table 7** for these alternative utility parameters and two selected slopes for the most likely cost scenario.

Table 7 Additional average manufacturer cost per car compared to 130 gCO_2/km

Utility parameter	Slope	Cost (€)
Mass	**60%** **a=0.296**	1219
	100% **a=0.494**	1218
Footprint	**60%** **a=17.6**	1164
	100% **a=29.4**	1168

Note – Costs shown for mass have been adjusted to take account of the average undervaluing of light-weighting in the original study methodology (for details see Annex 7.12).

On aggregate it can be seen that there is little change in average additional manufacturer cost per vehicle for either utility parameter for different slopes of the limit value curve. However there is a larger difference when looking at vehicle size as shown in **Table 8** below.

Table 8 Additional manufacturer cost (€) per car for different car categories relative to 130 gCO_2/km legislation showing cost difference between mass and footprint parameter

		Petrol			Diesel		
Utility function	**Slope**	**Small**	**Medium**	**Large**	**Small**	**Medium**	**Large**
Mass	**100% of 2009 a=0.494**	1222	1283	1452	943	1067	1248
Footprint	**100% of 2009 a=29.4**	1195	1275	1706	907	1094	1678
Cost difference (mass-footprint)	**100% of 2009**	**27**	**8**	**-254**	**36**	**-27**	**-430**
Mass	**60% of 2009 a=0.296**	1150	1308	1577	865	1118	1634
Footprint	**60% of 2009 a=17.6**	1135	1304	1769	845	1133	1870
Cost difference (mass-footprint)	**60% of 2009**	**15**	**4**	**-192**	**20**	**-15**	**-236**

Note – Costs shown for mass have not been adjusted to take account of the undervaluing of light-weighting in the original study methodology (for details see Annex 7.12).

It can be seen that manufacturer costs are lower for footprint than mass except for large cars, in which case mass is substantially cheaper. The cost difference between the options is less pronounced with a lower slope. In the case of mass the cost per car is more evenly distributed over the different vehicle segments (diesel-petrol, small-large) which leads to a higher percentage relative price increase for smaller cars. This is clearly shown in **Figure 10** and **Figure 11** which show the additional manufacturer cost (including mark-up) as a percentage of new car prices for each car segment[75].

[75] Relative retail price increase is calculated by multiplying the additional manufacturer costs by a mark-up factor and dividing by the average retail price for the segment or manufacturer. It excludes sales taxes.

Figure 10 Relative price increase per car segment with mass as utility parameter, compared to maintaining 130 gCO_2/km between 2015 and 2020 (cost scenario 2).

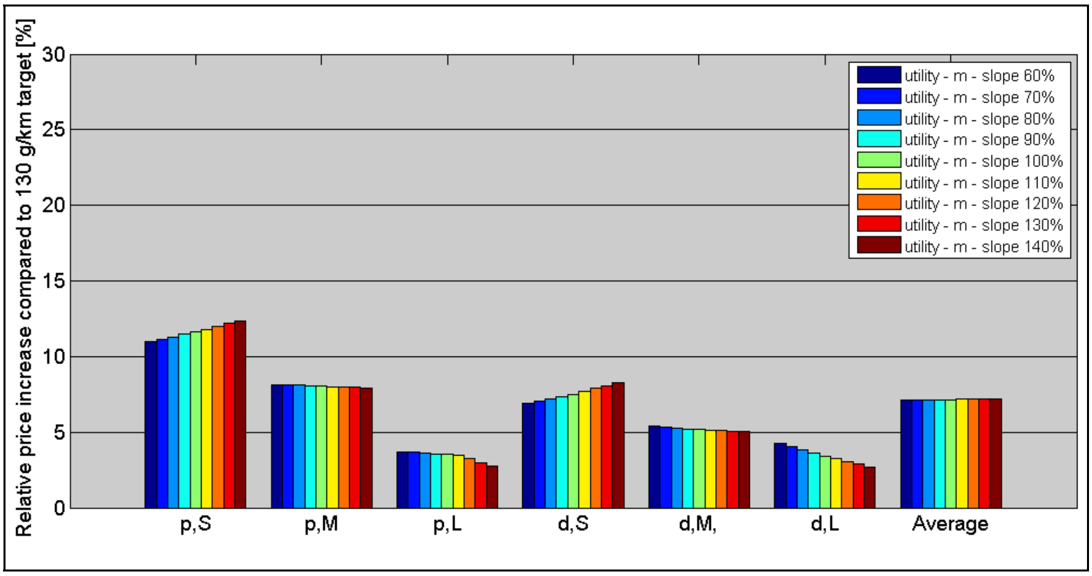
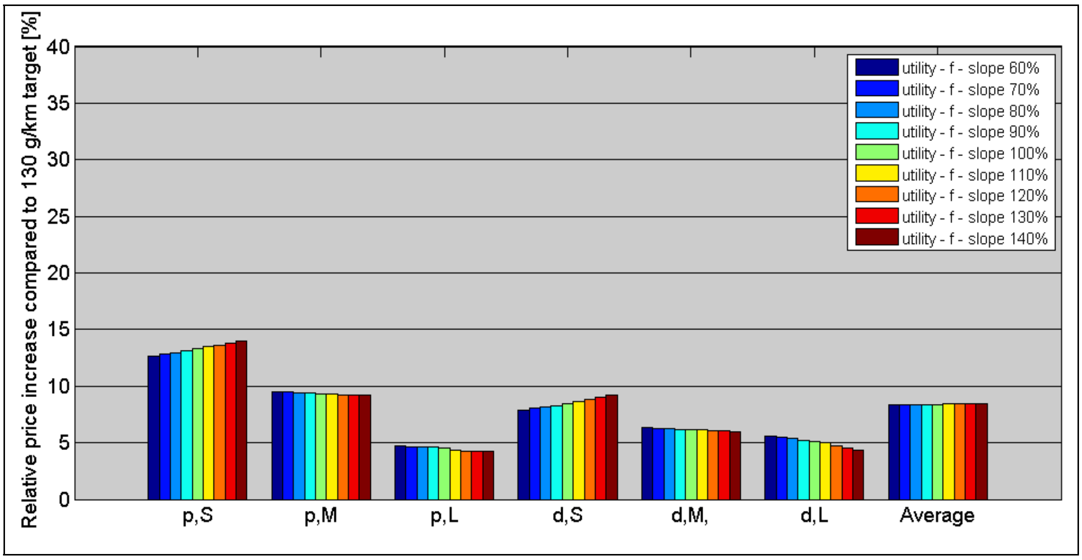


Figure 11 Relative price increase per car segment with footprint as utility parameter, compared to maintaining 130 gCO_2/km between 2015 and 2020 (cost scenario 2).



- Distribution of costs between manufacturers

A change in utility parameter can have an impact on competition between different manufacturers. This is most clearly seen by comparing **Figure 12**

Figure 12and **Figure 13** which show the relative price increase for different manufacturers. For some, such as Chrysler and Spyker the change of parameter could quite significantly alter their costs compared to the average. However, for many manufacturers the difference is relatively small for example Volkswagen and Fiat.

Figure 12 Relative retail price increase per manufacturer per car with <u>mass</u> as utility parameter compared to the average price increase (cost scenario 2).

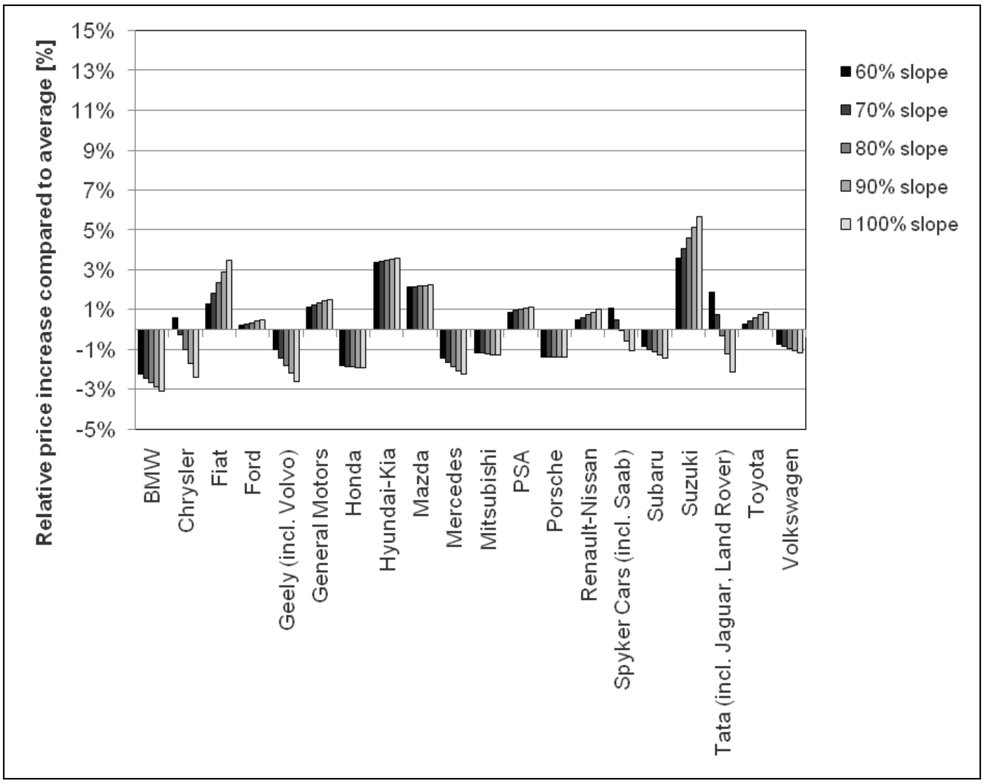
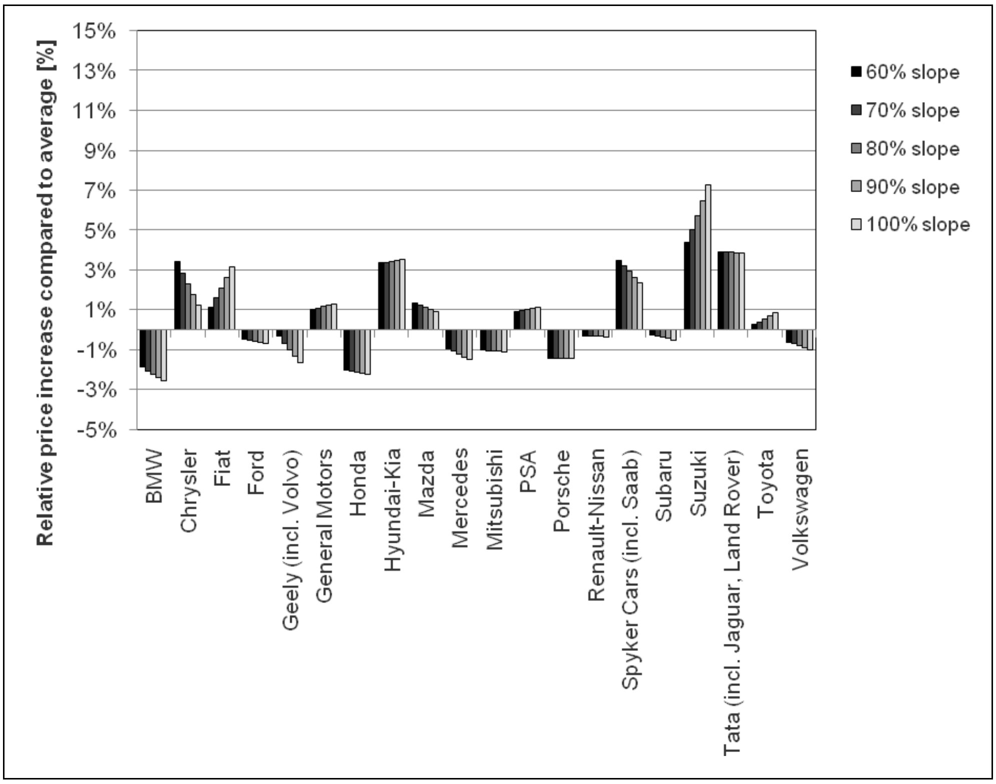


Figure 13 Relative retail price increase per manufacturer per car with <u>footprint</u> as utility parameter compared to the average price increase (cost scenario 2).



- Certainty

With regard to certainty, the current Regulation is based upon mass as the utility parameter. While it is clear in the Regulation that alternatives should be considered, it is understood that manufacturers have planned their compliance pathways to 2020 on the basis of a continuation of the current utility parameter. In view of this, if a decision were taken to change parameter, it would provide greater planning security if this was linked to the discussion of the regime beyond 2020.

- Innovation

With regard to innovation, there is unlikely to be an impact on most routes to meet the 2020 target with the exception of light-weighting. In this respect using mass as the utility parameter does not treat all options equally, as mentioned by various stakeholders during the consultation. This is undesirable since it does not enable manufacturers to optimally balance the costs and benefits of all alternative CO_2 reduction measures. In addition it impacts on the competitiveness of suppliers who can provide lightweight components for vehicles since the CO_2 benefit from using their products will be undervalued.

- Competitiveness

With regard to EU industry competitiveness, it might be argued that alignment of the utility parameter with other global markets might assist EU manufacturers. However, while the USA uses footprint as its utility parameter, other markets use mass (e.g. Japan, China, South Korea). Nevertheless, during consultations manufacturers have not argued for alignment as a reason to retain or change the parameter and so this aspect can be assumed to be of minor importance for them.

- Conclusions

In conclusion, the choice of utility parameter impacts on manufacturers in different ways and therefore cannot be said to be entirely competitively neutral. It can be concluded that footprint is slightly more cost-effective than mass as the utility parameter. Nevertheless, a change from mass runs against the objective of ensuring certainty for industry if the change were to be made for implementation of the 2020 targets. The choice of utility parameter is not expected to have any impact on competitiveness, trade or SMEs and any impact on innovation would be minor. It is therefore concluded that the balance of these impacts favours the option of retaining mass as the utility parameter for 2020, but suggests that a debate on a future change to footprint is desirable.

B. Environmental impacts

Provided that the fleet composition remains constant, the choice of the utility parameter does not affect overall CO_2 emissions. However, as has been shown before, it can affect the cost-effectiveness of these savings. The choice of the utility parameter would not be expected to have any effect on air quality.

Autonomous changes need to be taken into account. With mass as the utility parameter there would be practically no change in target CO_2 emissions caused by autonomous weight increase because the overall average mass is adjusted every third year. In the case where footprint was chosen as a parameter a similar provision could be envisaged. With such a provision in place a change to footprint would lead to no change in CO_2 emissions, relative to using mass, or any impact on air quality.[76]

It can be concluded that the choice between utility parameters does not have a direct significant environmental impact.

C. Social impacts

A shift from mass to footprint as the utility parameter might lead in the longer term to impacts on employment in the automotive suppliers sector, for example in the metal industries and automotive parts suppliers. However, these would represent shifts between sectors rather than employment losses and so on balance this is considered negligible.

Social equity impacts can arise with a shift due to the differential cost impact on different classes of car. As shown in **Table 8** and visible in **Figure 10** and **Figure 11**, there is a significant difference in relative price increase with smaller cars having a larger percentage increase. Mass seems to lead to a more equal distribution of relative price increase between different size classes. However, footprint leads to smaller relative price increase for small vehicles which may be desirable from the social perspective (i.e. buyers of smaller cars tend to be more price sensitive). Set against this is the fact that the total cost of ownership for all car classes is expected to reduce due to the fuel savings outweighing the additional costs. In view of these impacts, footprint seems to be more socially equitable than mass.

5.3. Slope of the limit value curve - cars

The options considered are for a range of limit value curve slopes between 60 and 100% of the 2009 fleet line of best fit. In terms of absolute slope, this spans the range of parameter 'a' from 0.0296 to 0.0494. This range also covers the most obvious slopes derived from the fleet data for other years (including 2006 or the average between 2006 and 2009) applying the same methodology as was used to determine the slope in the current Cars Regulation.

In the case of mass, a 100% slope for 2020 (based on 2009 data), in absolute terms equal to 0.0494, is much flatter than a 100% slope based on 2006 data of 0.0762, and flatter than the current 60% slope based on 2006 data for the 130 gCO_2/km target for 2015 (in absolute terms 0.0457). These changes illustrate the way that manufacturers have already responded to the need to reduce CO_2 emissions.

A. Economic impacts

- Average costs of compliance and distribution between van segments

The additional average manufacturer cost for the new car fleet for different slopes are shown in **Table 7**. On average there is only a minor difference in these average costs between 60 and

[76] Changing utility parameter to footprint would make electric vehicles slightly less attractive for manufacturers compared to the use of mass. This is because generally electric vehicles are heavier than their conventional (ICE) counterpart, because of the batteries (by 62 kg for medium and large vehicles). This increases their specific CO_2 emissions target with a mass based parameter (which would allow the manufacturer to have higher emissions from other vehicles). This increase would be 3.5 gCO_2/km, but it only applies to that fraction of overall sales that are for electric vehicles.

100% slope. **Table 9** below shows the difference in cost by car segment depending on whether a 60% or 100% slope is chosen. It can be seen that the effect is broadly the same for both possible utility parameters and shows that for the lower slope the cost increase is smaller for small cars and larger for larger cars.

Table 9 Additional manufacturer cost (€) per car for different car categories relative to 130 gCO_2/km target showing cost difference for different slopes.

		Petrol			Diesel		
Utility function	**Slope**	**Small**	**Medium**	**Large**	**Small**	**Medium**	**Large**
Mass	**100% of 2009 (a=0.0494)**	1222	1283	1452	943	1067	1248
	60% of 2009 (a=0.0296)	1150	1308	1577	865	1118	1634
Cost difference (100%-60%)		**72**	**-25**	**-125**	**78**	**-51**	**-386**
Footprint	**100% of 2009 (a=29.4)**	1195	1275	1706	907	1094	1678
	60% of 2009 (a=17.6)	1135	1304	1769	845	1133	1870
Cost difference (100%-60%)		**60**	**-29**	**-63**	**62**	**-39**	**-192**

Manufacturer costs on average increase with increasing slope for both mass and footprint, although the effect is small.

However, the percentage cost increases for smaller cars are greater than for larger ones as shown in **Figure 10** and **Figure 11**. For petrol, small cars have between 3 times (slope 60%) and 4 times (slope 140%) the percentage increase of large petrol cars. For diesel, small cars have between 2 and 3 times the percentage increase of large diesel cars. Since the lower slope results in a lower divergence, this illustrates that for least competitive impact between segments a lower slope is desirable.

Increasing slope also leads to decreasing cost-effectiveness since it requires more effort from smaller rather than from larger cars. This is because larger cars tend to be driven further than smaller ones, and therefore investment in their fuel efficiency delivers more CO_2 savings overall.

- Distribution of costs between manufacturers

Different manufacturers have different portfolios and the share in their sales of different segments of cars varies. Because of the effects illustrated on different car segments the choice of slope of the curve will result in distributional impacts between manufacturers. These impacts for manufacturers are illustrated in **Figure 12** (for mass) and **Figure 13** (for footprint) which show the difference in relative price increase compared to the average price increase due to achieving the 130 gCO_2/km target for different manufacturers.

In general it can be seen that the variation between individual manufacturers' relative price increases and the average relative price increase is smallest the lower the slope. This suggests that these would be the ones with the lowest distortionary impact on inter-manufacturer competition.

- Perverse incentives

A slope above 100% is undesirable in the case of both parameters as it provides perverse incentives to manufacturers, i.e. increasing the parameter for the car in order to be able to comply with the specific target more easily, which in fact results in additional emissions. In the case of mass, a slope below 100% based on 2009 data should avoid a serious risk of gaming.

- Impacts on innovation, competitiveness, trade, SMEs

The slope is not expected to have any significant effect on innovation, competitiveness, trade or SMEs. There has been no previous expectation of which slope would apply for 2020 so certainty is also not affected.

- Conclusion

In view of the above, it is concluded that a lower slope is most desirable on economic grounds.

B. Environmental impacts

Changing the slope of the limit value curve does not directly cause any change in overall new car fleet CO_2 emissions per km. However, because larger cars are driven further than smaller cars, a lower slope leads to lower overall CO_2 emissions. A lower slope effectively helps to partly compensate for the lack of mileage weighting.

There is a risk of a secondary effect of growth in emissions in the case where the overall average mass of the fleet increases. This secondary effect can happen in between the periods when this average mass is adjusted and is expected to be rather small (+0.25% over three years). See Annex 7.17 for more details.

There is also a possible indirect impact on CO_2 emissions caused by behavioural change which depends on the slope of the curve. If the slope is made steeper it would require smaller relative CO_2 emissions reductions from heavier vehicles and thus these vehicles could become more interesting to sell.[77]

In view of these factors, a lower slope is desirable on environmental grounds.

[77] This secondary effect would lead to a further small increase in CO_2 emissions (although this would be compensated by the autonomous mass increase adjustment). However, evidence from the actual analysis of passenger car sales profiles for 2006 and 2010 suggests that such a shift should not happen.

C. Social impacts

The slope chosen is not expected to have any significant impact on employment. The lower the slope the more relative effort is required from larger vehicles, which would feed through into greater technology needs for them, but have a correspondingly lower impact on smaller vehicles.

The slope of the limit value curve impacts on the distribution of effort between different segments of vehicles. In the case where the standards result in increased vehicle prices it is expected to have a differentiated effect on different social groups. The relative price increase expected due to compliance with the target is highest for small vehicles because of their relatively low price. The result of such price increases for smaller vehicles would be a relatively high impact on the buyers of cheaper small cars, which is likely to be less socially equitable. This effect is slightly alleviated with lower slopes of the limit value curves for both parameters.

In view of these impacts, a lower slope is desirable to minimise the distributional impact on relative new car prices and be more socially equitable.

5.4. Utility parameter - vans

Two options are assessed, mass or footprint.

A. Economic impacts

- Average costs of compliance and distribution between van segments

As with cars, the distributional effects of the vans Regulation vary with the utility parameter chosen. **Table 10** shows the average additional manufacturer costs for meeting the 147 gCO_2/km target. The costs are very similar for both parameters and the overall average compliance cost for the target at 100% slope is around €15 cheaper with footprint, with the mass-based function resulting in a 3 to 16% increase in average costs as compared to footprint for slopes from 80% to 140% respectively. This is due to the costs increasing relatively more for manufacturers like Renault or GM with higher slopes of the mass-based function.

Table 10 Average additional manufacturer costs per van relative to 175 gCO_2/km target for utility parameter and slope options.

Cost in €	60%	70%	80%	90%	100%	110%	120%	130%	140%
Linear mass-based limit function	457	452	450	451	456	463	473	485	500
Non-linear footprint-based limit function	463	455	448	444	441	440	442	445	449
Cost difference footprint vs. mass	6	3	-2	-7	-15	-23	-31	-40	-51

- Distribution of costs between manufacturers

Overall, the relative retail price increase is more evenly distributed over manufacturers in the case of mass than in the case of footprint where a number of manufacturers face higher costs of meeting their targets (i.e. Isuzu, Mitsubishi, Toyota) due to large sales of pick-up trucks and all-terrain vehicles which have a relatively high average mass relative to their average footprint (see **Table 11** and **Figure 15**). This high mass translates into relatively high energy consumption and therefore high CO_2 emissions. For these producers, it costs less to comply with a mass-based target. Daimler and Iveco are relatively sensitive to slope changes, particularly with footprint as the utility parameter.

Table 11 Additional manufacturer costs relative to 2010 for all van manufacturers for the 100% slope of the mass- and footprint-based functions (in absolute terms 0.096 for linear curve based on mass and 27.3 and 3.9 for non-linear curve based on footprint)

Additional manufacturer cost relative to 2010 [€]	**Daimler AG**	**Fiat**	**Ford**	**General Motors**	**Isuzu**	**Iveco**	**Mitsubishi**	**Nissan**	**PSA**	**Renault**	**Toyota**	**Volkswagen**
Mass	555	583	633	561	636	419	779	1048	456	580	807	426
Footprint	616	469	668	367	1768	773	1576	1272	422	340	1209	601
Cost difference footprint vs. mass	62	-113	34	-193	1132	354	797	225	-34	-240	402	175

Figure 14 Relative retail price increase per manufacturer for mass as utility parameter, compared to the average price increase.

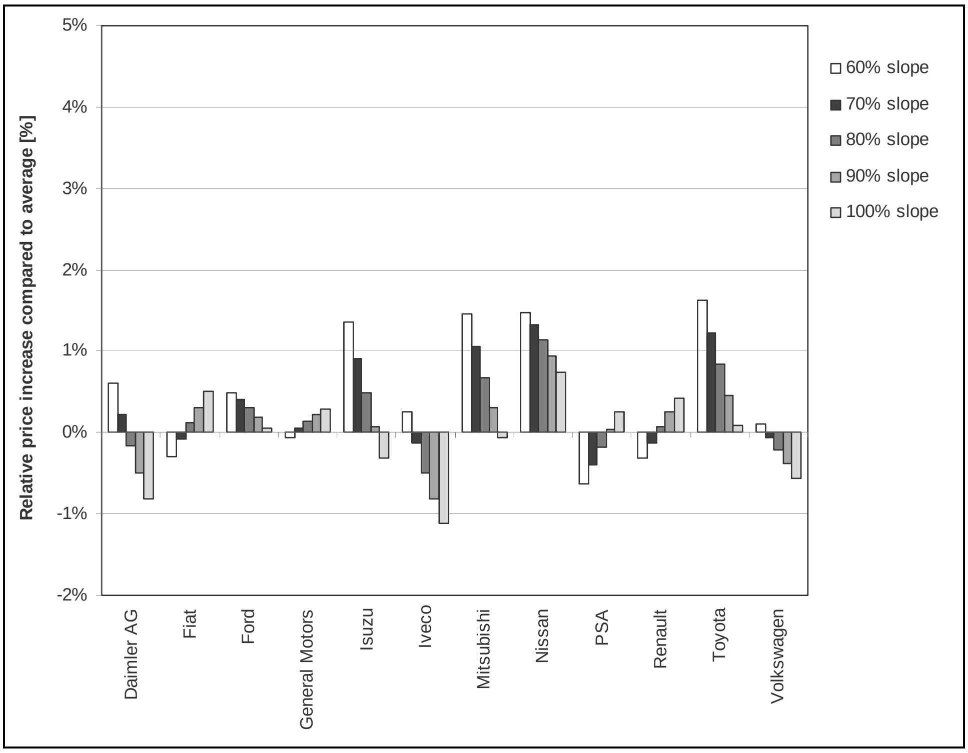
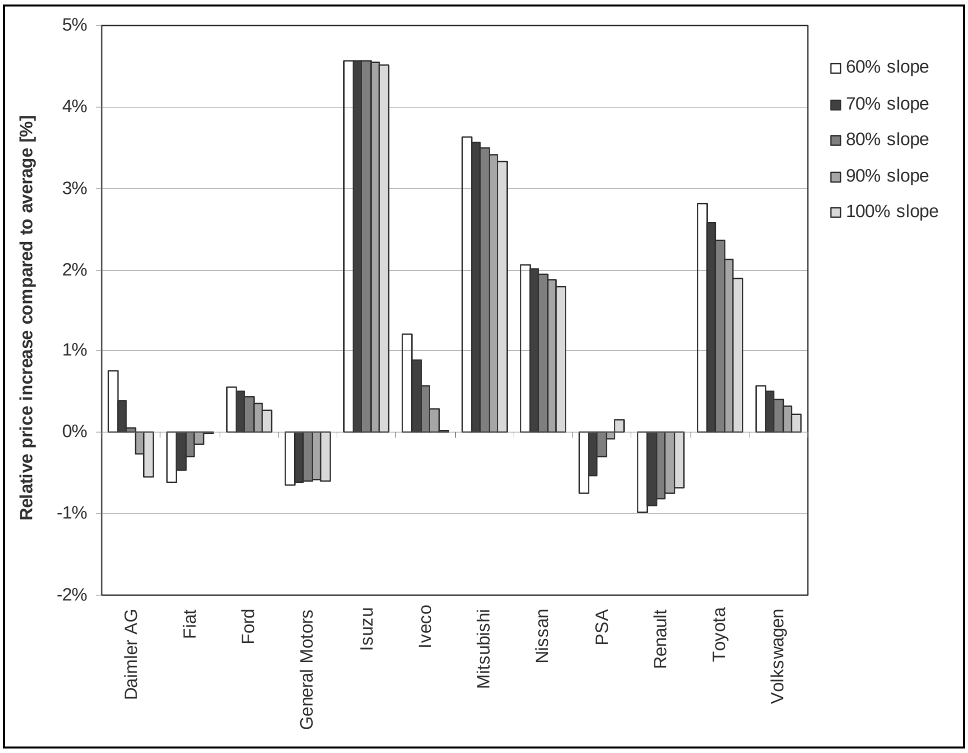


Figure 15 Relative retail price increase per manufacturer for footprint as utility parameter, compared to the average price increase.



- Perverse incentives

The footprint of vans can be easily increased without large negative implications for CO_2 emissions (or performance). The fact that such changes can be easily made makes gaming with footprint relatively easy. The incentive for gaming would be especially strong for vehicles with a relatively low footprint, as the non-linear limit function[78] is relatively steep at this part of the curve.

- Certainty

With regard to certainty, the current Regulation is based upon mass as the utility parameter. The time between compliance with the target of 175 gCO_2/km based on mass (for 2017) and the 147 gCO_2/km target (for 2020) is only three years. If footprint was selected as the utility parameter for the 2020 target, manufacturers with deviant mass-footprint ratios (as explained above) would have to drastically change their CO_2 reduction strategies in a relatively short period. As a result, while a change to footprint has a relatively small aggregate impact on cost, it has a large differential impact on manufacturers undermining competitive neutrality. It is evident that choosing the option of changing the utility parameter to footprint would undermine certainty. This concern was strongly expressed during the stakeholder consultation by automotive manufacturers concerned that changing utility parameter would be counter to the objective of a stable regulatory scheme and make compliance with the 2020 van targets more expensive

- Innovation

With regard to innovation, there is unlikely to be an impact on most routes to meet the 2020 target with the exception of light-weighting. In this respect using mass as the utility parameter does not treat all options equally, as mentioned by various stakeholders during the consultation. This is undesirable since it does not enable cost optimal balancing of alternative reduction options, and in particular reduces the competitiveness of industries that can supply lower mass alternatives.

- Competitiveness, trade, SMEs

With regard to EU industry competitiveness and similarly to the discussion on cars, it might be argued that alignment of utility parameter with other global markets might assist EU manufacturers. However, while the USA uses footprint as its utility parameter, other markets use mass (e.g. Japan, China, South Korea). Nevertheless, during consultations manufacturers have not argued for alignment as a reason to retain or change the parameter.

Overall, the utility parameter for vans is not expected to have any impact on competitiveness, trade or SMEs and any impact on innovation would be minor.

- Conclusion

In view of the arguments outlined above, on economic grounds footprint seems less desirable than mass due to the difficulties for manufacturers implicit in a change of approach within a three year period, the increased risks of perverse incentives, the need to use a non-linear limit

[78] For more information on the non-linear limit function see Annex 7.15.

function and the large distributional impact. The average cost to manufacturer is quite similar for both parameters in case of slopes of 100% and below. It is thus concluded that retention of mass as utility parameter is to be favoured on economic grounds.

B. Environmental impacts

The impact of changing the utility parameter from mass to footprint would be CO_2 neutral over the fleet provided its composition remains constant. As for cars, changing the utility parameter to footprint would make electric vehicles slightly less advantageous because they would no longer have a high target as a result of their higher mass compared to their conventional (ICE) counterpart.

Use of footprint could, in the medium term, lead to an overall increase in CO_2 emissions as it is considered to be easier to manipulate in vans. Footprint can be increased by stretching a van or increasing its wheelbase without large negative implications on CO_2 emissions of that van or its performance. This footprint increase would allow in aggregate more CO_2 emissions and could put at risk meeting the overall CO_2 reduction objective. This risk could be mitigated for larger vans by using a non-linear function levelling off above a certain footprint (see Annex 7.15 and section 5.5). This would remove the perverse incentive to build ever larger vans because they could no longer benefit from a proportionate increase of the CO_2 target.

For vans, whose primary purpose is to move goods rather than people, expectations of autonomous mass increase are limited because this would compromise the load carrying potential of these vehicles. Therefore, the direct benefit of changing the utility parameter from mass to footprint would be even less important.

It can be concluded that the options have no direct significant environmental impact.

C. Social impacts

Similarly to cars, a shift from mass to footprint as the utility parameter might lead in the longer term to impacts on employment in the automotive suppliers sector, for example in the metal industries and automotive parts suppliers. However, these would represent shifts between sectors rather than employment losses and so on balance this is considered negligible.

Contrary to cars, no social equity impacts linked to differential cost impacts per van class are expected as vans are used for business purposes and chosen based on their utility.

It can be concluded that the choice between utility parameters does not have a direct significant social impact.

5.5. Slope of the limit value curve - vans

The options assessed are slopes between 80 and 100%.

A. Economic impacts

- Average costs of compliance

The relative price increase in case of mass is distributed most evenly over the manufacturers and vehicle segments around a slope of 100%. Furthermore, the average costs for meeting the

147 gCO_2/km target are the lowest with a slope of 80-90%. This makes a slope value in the range 80-100% preferable from a distributional perspective.

With footprint as the utility parameter the lowest overall average additional manufacturer cost occurs with a 110% slope, as shown in **Table 10**. Around this slope the additional manufacturer costs are distributed most evenly over the manufacturers and segments. This is influenced by a limited number of manufacturers with relatively high sales selling mostly large vans (e.g. Daimler and Iveco) that benefit from a higher slope as it results in a higher CO_2 target that they can comply with more easily.

- Distribution of costs between van classes

The way the additional manufacturer costs and relative retail price increases[75] are distributed over the segments in case of mass and footprint is heavily influenced by the shape of the cost curves. Although the additional manufacturer costs as a function of the relative CO_2 reduction are quite similar for the three segments, the absolute and marginal costs for a given absolute CO_2 reduction are in most cases higher for larger vehicles than for smaller vehicles. This is due to the assumptions of the model[79] which solves for the optimum distribution of costs between segments, and predicts that manufacturers are likely to apply larger reductions to larger vehicles in their sales portfolio because it is more cost-effective.

In the case of the mass-based limit value curve, differences in relative price increases between classes do not differ much with different slopes but tend to be the largest with lowest (60%) and highest (above 100%) slopes. Class I vans tend to have slightly higher relative price increase as compared to other classes in the case of slopes above 100% and the opposite for lower slopes. The difference is however very small, apart from the extreme cases analysed. The most even distribution is seen for the 100% slope (see **Figure 16**) and amounts to around 2.5% for all classes. In the case of the footprint-based limit function the most even distribution across van classes is seen with the slope of around 100-110% (see **Figure 17**).

79 In the model used in [TNO, 2012] it is assumed that manufacturers strive to minimise the additional manufacturer costs for meeting their average CO_2 emission target. The optimum distribution is characterised by equal marginal costs over the three size segments. Therefore, the model predicts that manufacturers are likely to apply larger reductions to the larger vehicles in their sales portfolio than to the smaller vehicles.

Figure 16 Relative retail price increase compared to 2010 per segment for mass as utility parameter per manufacturer.

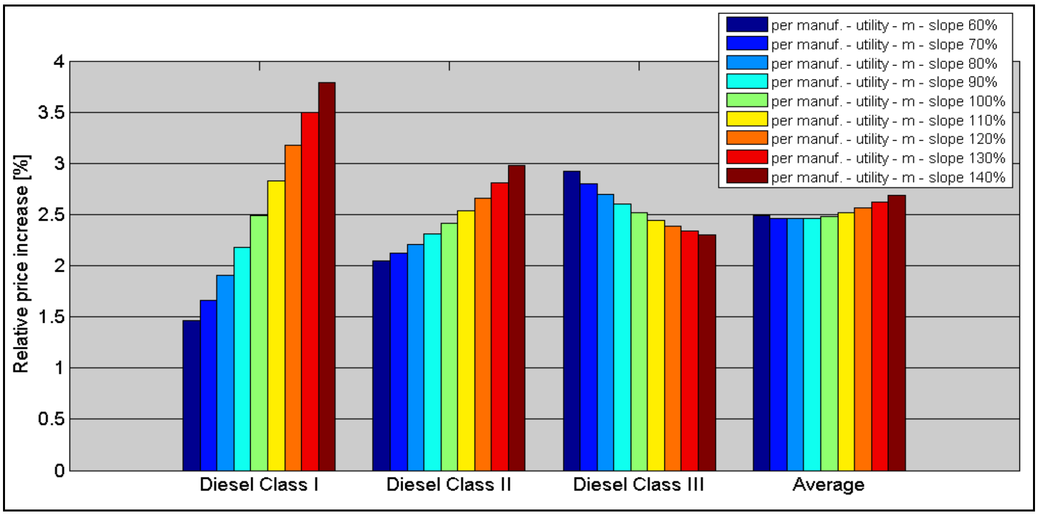
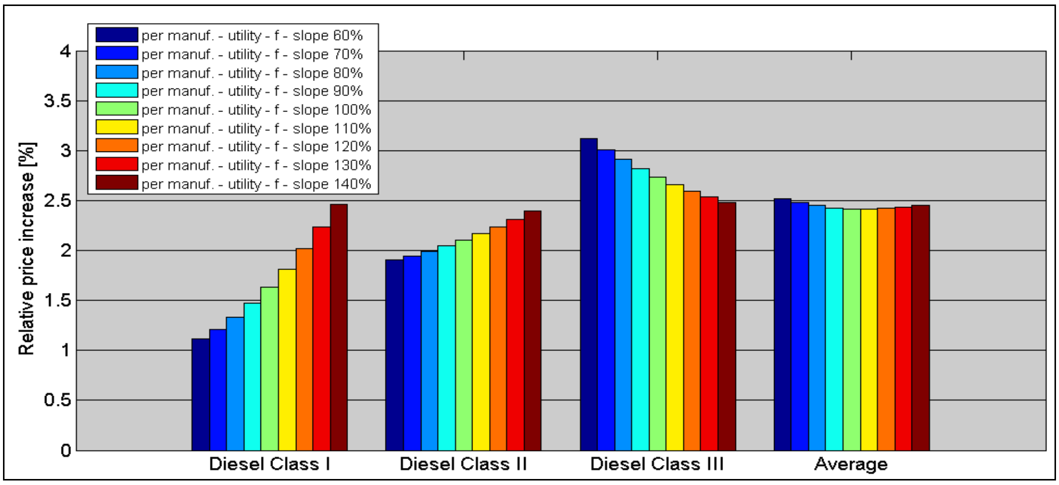


Figure 17 Relative retail price increase compared to 2010 per segment for footprint as utility parameter per manufacturer.



As already mentioned, the most optimal way for manufacturers to meet their specific target implies that manufacturers apply larger absolute reductions to the larger vehicles in their portfolio (see footnote 79). As a consequence in the case of both utility parameters, the absolute and relative cost increase for large vehicles will tend to be larger than for small vehicles. The absolute cost increase (**Figure 18** and **Figure 19**) will be slightly higher for all classes when mass is used as utility parameter.

Figure 18 Manufacturer cost increase compared to 2010 per segment for mass as utility parameter per manufacturer, compared to maintaining 175 gCO_2/km until 2020.

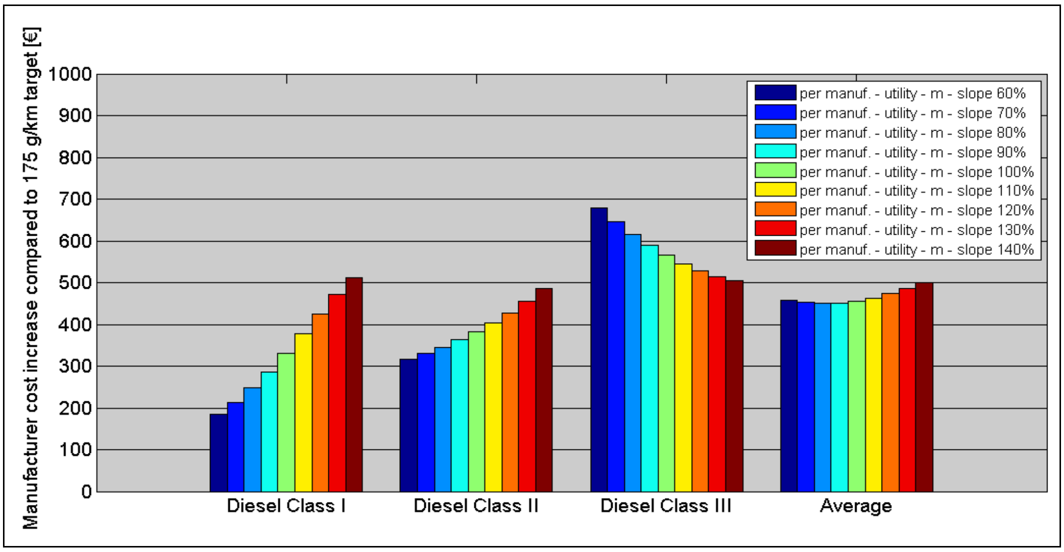
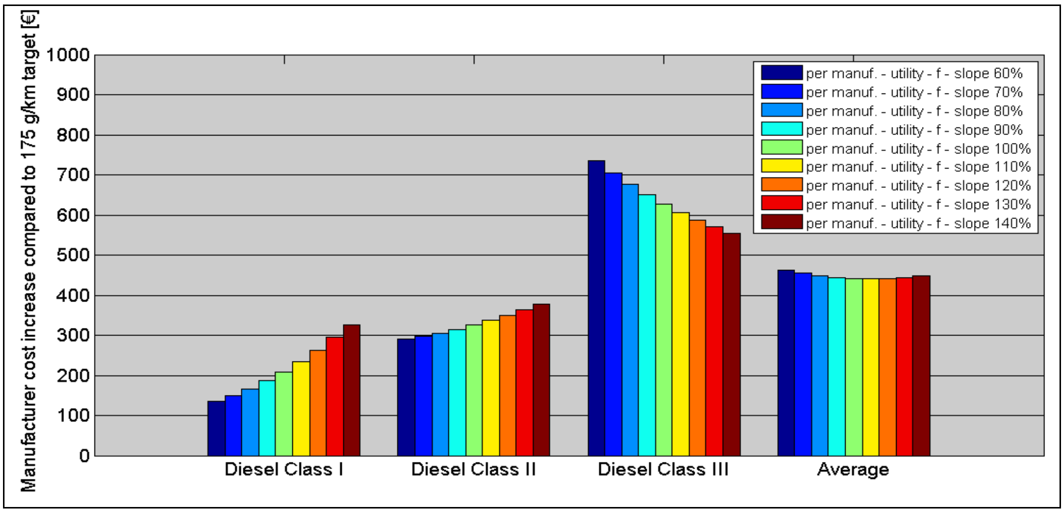


Figure 19 Manufacturer cost increase relative per segment for footprint as utility parameter per manufacturer, compared to maintaining 175 gCO_2/km until 2020.



- Perverse incentives

With mass as the utility parameter, the risk of perverse incentives increases with increasing slope of the limit value curve. Therefore it is desirable to implement a slope not steeper than that currently used for the 175 gCO_2/km target for 2017. The 100% limit function based on the 2010 sales database is only slightly steeper than that for 2017 and therefore a slope of 100% or less relative to the 2010 data is desirable. In section 5 of the van study an 80% slope has been shown to be optimal with this respect.

The risk of gaming with footprint leading to undesirably large vehicles suggests that in this respect a lower slope would be desirable. However, a lower slope (below 100%) increases the differences in cost impacts, especially for the manufacturer groups that sell typical vans - rather than pick-ups or all-terrain vehicles - and these represent the majority of the market.

This trade-off needs to be taken into account in the choice of a slope value for the limit value curve.

- Competitiveness, trade, SMEs, innovation

The slope is not expected to have any impact on competitiveness, trade, SMEs or innovation.

- Conclusion

The slope of the limit value curve preferable for a mass-based function is in the range 80-100% from the cost and distributional perspective. For footprint, the lowest cost occurs with 110% slope however such a steep slope is likely to give a perverse incentive to increase footprint, therefore, a slope around 100% seems preferable.

B. Environmental impacts

Changing the slope of the mass-based limit value curve does not directly cause any change in overall new van fleet CO_2 emissions per km. There is no evidence that larger vans have higher mileage thus it cannot be concluded whether this would result in lower overall emissions.

Similarly to the analysis for cars, autonomous mass increase, could lead to similar effects in the period in between adjustments of the overall average mass (as described in Annex 7.17). In the case of a shift to a footprint-based function the incentive to increase footprint is more pronounced although could be somewhat limited by the choice of a non-linear function and introduction of an autonomous footprint increase adjustment (similar to the autonomous mass increase).

Therefore, the environmental impact of changing the slope is likely to be small or negligible.

C. Social impacts

Because light commercial vehicles are mainly purchased for business use and therefore the vehicles are chosen based on the utility needed and their price, no social impact is expected for users from the cost increase. The choice of slope is also not expected to have any impact on overall employment. As a result the slope will have no impact on the social impacts expected from implementation of the targets.

As a result the slope is not expected to have any social impacts

5.6. Derogations for cars and vans

The options considered are whether or not to introduce a de minimis element to the small-volume derogation and whether to continue CO_2 reduction requirements under the niche derogation beyond 2015.

A. Economic impacts

- Small-volume derogation - cars and vans

Establishing a de-minimis threshold for the registration of cars and vans below which the manufacturers are exempt from the scope of the legislation would be in line with simplification objectives and reduction of burden on SMEs. Based on monitoring information[80], excluding manufacturers of below 1000 cars from the scope of the legislation would eliminate about 50% of small-volume manufacturers, yet account for about 0.05% of new car sales. If the limit were 100 cars it would apply to about 30% of these manufacturers and less than 0.005% of new cars.[81] The introduction of a minimum threshold to small volume derogation is estimated to save each of these manufacturers about €25,000[82] and the Commission about €10,000 in administrative costs.

While the threshold would not be competitively neutral, since it reduces the administrative burden and the obligations on the affected companies, these represent a tiny part of the market and are not considered to be effectively in competition with mainstream manufacturers.

Allowing for more flexibility regarding the date of granting the derogation and the date of its entry into force would reduce compliance costs and the burden of assessments on the Commission. It would allow for a smoother assessment process and would help to avoid unnecessary premiums for manufacturers willing to meet their individual targets.

Other than the benefits for the companies directly affected, the de minimis threshold is not expected to have any impact on competitiveness, trade, SMEs or innovation.

- Niche derogation - cars

Continuing the niche derogation CO_2 reduction requirements beyond 2015 would be in line with the competitive neutrality objective. The upper limit of the niche derogation means that a manufacturer can hold about 2.5% of the EU car market before being subject to the normal CO_2 regulatory regime. This includes potentially well known manufacturers such as Honda and Suzuki. If these manufacturers are not subject to any CO_2 reduction requirement, it represents a significant distortion of competition and could even be damaging to EU manufacturer competitiveness and trade balance in respect of new entrants to the EU car market. By its nature the niche CO_2 requirements would not have any direct SME impact although they may have benefits for SMEs in supplying niche manufacturers with CO_2 reducing technology. As regards certainty, while the Regulation is silent on continued CO_2 requirements for niche manufacturers beyond 2015, the competitive neutrality objective means that it is likely to be have assumed that such a derogation with CO_2 obligation would continue beyond 2015.

- Conclusion

In view of the above, on economic grounds it may be desirable to set a de minimis limit for the small volume derogation and to continue with a CO_2 reduction requirement for manufacturers under the niche derogation.

B. Environmental impacts

The scale of CO_2 emissions from vehicles produced by manufacturers registering less than 100 cars per year, even if these manufacturers were to make no further progress, is estimated

[80] See **Table 16** in Annex 7.6.

[81] In the US rulemaking similar procedures exist for lower volume manufacturers (i.e. less than 400 000 sales per year) who are provided with temporary alternative standards (25% reduction), manufacturers with less than 5,000 sales per year do not have targets in the first period up to 2016 but this will be reconsidered for future targets.

[82] Cost estimated by ESCA

to be around 500 tonnes per year[83] and roughly ten times greater if set at 1000 cars per year, which is a marginal impact. In case of vans, it is expected to be even less important because the number of small-volume producers in this category is much lower. Simplification of administrative procedures is not expected to have any environmental impacts.

Continuing the CO_2 reduction requirement for manufacturers under the niche derogation will lead to additional CO_2 savings. If the requirement is made of a comparable stringency to the mainstream manufacturers, it could be expected to lead to around 50,000 tonnes CO_2 avoided per year by 2020 for a manufacturer registering 100,000 vehicles.

In view of the above, the de minimis threshold will lead to possibly minutely higher CO_2 emissions from affected manufacturers than in its absence. The continuation of the niche reduction requirement will lead to an environmental benefit and is therefore desirable to take forward on environmental grounds.

C. Social impacts

Simplification of the small cars derogation will free some resources in the affected manufacturers for other uses. This might have a very small impact on employment within the companies. However, since these vehicles are not purchased in the mass market, but in principle because of their special appeal, there is no social equity impact.

Any amendment to the cars niche derogation scheme is not expected to have any significant social effects.

Overall, the options for amending the derogations are not expected to have noticeable social impacts.

5.7. Summary of the economic impacts for cars and vans

While there are economic reasons to argue that a shift to footprint is desirable for the passenger car utility parameter, such a change needs to be signalled far enough in advance for adaptation. The need for manufacturer certainty to avoid unnecessary costs argues to retain mass for now as the utility parameter for cars. A range of arguments relating to cost effectiveness and competitive neutrality suggest that the slope selected should be as low as possible. A 60% slope is identical to that which was adopted for 2015 and seems appropriate for 2020.

There is a risk of significant perverse incentives with the option of using footprint as utility parameter for vans. While these can be overcome, a change of utility parameter has strong impacts on inter-manufacturer competition which when coupled with the fact that there is no strong overriding reason for a change suggest that mass should be retained as the utility parameter for vans. The analysis suggests that the best slope would be around 100% in line with that previously adopted for 2017.

Simplification of the small-volume derogation through introduction of a de minimis threshold is economically beneficial for SMEs without other adverse impacts and therefore desirable. Continuation of the niche CO_2 requirement ensures competitive neutrality with affected manufacturers and is therefore also desirable.

[83] Based on an average annual mileage of 5000km suggested by ESCA

5.8. Summary of the environmental impacts for cars and vans

The major impact of all the options for cars and vans as compared to 'do nothing' relates to GHG emissions from the introduction of the 2020 targets. The policy options considered for the various modalities are assessed as either causing no further change, provided certain assumptions are met, or having a very minor impact. There are potential secondary and behavioural impacts caused by vehicle-km being slightly differently distributed across the fleet.

The impact on air quality is similarly largest due to introduction of the 2020 targets but this is less direct since emissions of air quality pollutants need not scale directly with fuel use. The impacts of all the other policy options were assessed as either causing no further change, provided certain assumptions stated were met, or had a very minor impact.

5.9. Summary of the social impacts for cars and vans

It can be concluded that the main expected social impacts arise from implementing the 2020 targets and are increased employment (in both the automotive and other sectors) and the equity impact due to the different relative price increase of different car classes. For the van modalities and the derogation aspects no significant social impacts are expected.

5.10. How do the main options compare in terms of effectiveness, efficiency and coherence?

As has been shown above, there is no significant difference in effectiveness between the various limit value curve options. All can be designed in a manner to achieve the CO_2 targets. For cars, a lower slope is slightly more effective as a result of the higher mileages of larger cars. For vans, the difficulties and complexity of a non-linear footprint based function suggest that this would be likely to be less effective than a linear mass-based function. Continuation of the niche CO_2 requirement contributes to the effectiveness of the Regulations while the de minimis changes to the small volume requirements have negligible effect.

With regard to efficiency, there is a minor difference in cost between footprint and mass, which suggests that for cars footprint is slightly more efficient as the utility parameter once the costs are corrected for undervaluing light-weighting. However the average cost hardly varies at all with slope. For vans, the situation is slightly more complex, since the relative costs vary depending on the slope. At the likely values to be chosen there is little difference in efficiency of the two utility parameter options. Continuation of the niche CO_2 requirement improves the efficiency of the Regulations while the de minimis changes to the small volume requirements have negligible effect.

With regard to coherence with overarching EU objectives, strategies and priorities, all the options implement the goal of reducing CO_2 emissions from cars and vans with more or less identical effects and stimulate innovation, employment and resource efficiency. Therefore, the options that result in the least competitive distortion and greatest certainty should be the most coherent with overall EU objectives. The de minimis changes to the small volume requirement are coherent with simplification objectives and reduction of burden on SMEs.

5.11. Comparison of options

Table 12 Comparison of impacts of different options of modalities - cars

CARS – summary assessment of options			
Modalities	Options	Advantages	Disadvantages
Utility parameter	**Mass**	Regulatory certainty- no change from current Regulation. More even cost distribution between segments.	Greater risk of perverse incentives than for footprint. Not fully technology neutral since light-weighting is disadvantaged. Average additional manufacturer cost is about 2% greater than with use of footprint since light-weighting is not rewarded.
	Footprint	Average additional manufacturer cost is about 2% cheaper than with mass. Provides greater incentive for light-weighting.	No regulatory certainty- change from current Regulation. Less even cost distribution between segments. Adjustment costs linked to shift to another utility parameter.
Slope of the limit value curve	**Slope<100%**	Costs slightly lower overall. Avoides serious risk of perverse incentives. Compensates for lack of mileage weighting. Beneficial impact on overall CO_2 and pollutant emissions. More socially equitable (lower relative price increase for smaller vehicles).	Actual cost increase per vehicle less even between segments.

	Slope>100%	Actual cost increase per vehicle more even between segments.	Costs slightly higher overall. Increased risk of perverse incentives. Less socially equitable (higher relative price increase for smaller vehicles).
Derogations	**De minimis threshold**	Reduced administrative burden for SMEs and for the Commission.	Marginal reduction of emissions savings.
	Update niche derogation	More competitively neutral. Slightly higher CO_2 savings.	Higher cost for manufacturers benefitting from niche derogation.

In conclusion, as set out in **Table 12**, it is considered that retaining mass as the utility parameter for cars should be preferred for 2020. The slope should be lower than 100% and the analysis suggests that a slope around 60% is desirable. Introducing a de minimis threshold for small volume manufacturers may be desirable as is a continuation of the niche manufacturer CO_2 requirements beyond 2015.

Table 13 Comparison of impacts of different options of modalities - vans

VANS – summary assessment of options			
Modalities	Policy options	Advantages	Disadvantages
Utility parameter	**Mass**	Regulatory certainty- no change from current Regulation. More even cost distribution between segments. Limited perverse incentives to increase mass.	Average additional manufacturer cost slightly higher than footprint, especially for slopes above 100%. Not fully technology neutral since light-weighting is disadvantaged.
	Footprint	Average additional manufacturer cost slightly lower for footprint for slopes above 80%. Provides greater incentive for light-weighting.	No regulatory certainty- change from current Regulation. Requires a non-linear limit value function. Less even cost distribution between segments, especially between class I and III. The cost increase of changing to footprint especially high for some manufacturers. Easier to manipulate than mass but it can be limited by a shape and slope of the limit value curve. Adjustment costs to a target based on the new utility parameter can be expected to be higher due to 3-year gap between the targets.

The limit value curve	**Slope<100%**	Minimises risk of perverse incentive for both functions. Slopes 80-100% lowest costs for mass-based function. Costs lowest and most evenly distributed around 100% slope for mass-based function.	Slopes 60-80% highest costs for footprint-based function. Slopes below 80% lead to uneven distribution of costs between segments.
	Slope>100%	Lower costs for footprint-based function above 100%. More even distribution for footprint-based function between segments above 110% slope.	Increased risk of perverse incentives for both parameters. Highest costs and less even distribution between segments for mass-based function above 110% slope.
Derogations	**De minimis threshold**	Reduced administrative burden for SMEs and for the Commission.	Marginal reduction of emissions savings.

As outlined in **Table 13**, retaining mass as the utility parameter for vans is the preferred option. The balance of advantages and disadvantages suggests that a slope of around 100% is optimal. Introducing a de minimis threshold for small volume manufacturers may be desirable.

6. MONITORING AND EVALUATION

6.1. Core indicators of progress

The core indicators of progress are linked to the evolution of the average new car and van fleets. They cover data relating to:

- specific CO_2 emissions as measured under the EU test procedure, to assess the performance of the automotive industry towards the respect of the mandatory targets,

- utility (mass), to provide an analysis of the evolution of the EU car and van market e.g. in case a shift in utility would require an adaptation of the utility curve in the future. Further utility parameters such as footprint or payload are part of a mandatory monitoring regime in order to assess the appropriateness of such parameters, especially footprint for cars.

In addition, the Commission will collect information regarding the number of derogation applications and the reduction targets proposed by the manufacturers. Based on the EU monitoring scheme the Commission will follow the reduction progress of manufacturers granted a derogation.

Furthermore, the Commission will collect information regarding the number of eco-innovation applications and granted eco-innovation credits. The credits will be taken into account for calculation of manufacturers' overall compliance with their individual targets.

6.2. Monitoring arrangements

As explained in section 2.4 the monitoring scheme for passenger cars is now operational and is working well considering the challenges of first years of operation. The scheme for vans is based on the one for passenger cars and 2012 is the first year of monitoring.

In the case of vans the changes resulting from adoption of the new procedure for multi-stage vehicles (see section 2.4) are not expected to have an impact on the design of the current monitoring scheme. These changes will most likely concern the information included in the certificate of conformity which is the basis for CO_2 monitoring rather than the monitoring scheme itself. Therefore, no significant additional administrative burden to that from setting up the monitoring and reporting scheme is expected.

The Commission will continue to produce annual monitoring reports on the basis of the monitoring data gathered. These reports will provide measureable indication of progress towards the van and car CO_2 targets as well as providing information on other relevant parameters such as average mass. In view of the fact that it is not possible to define a baseline against which elements such as new vehicle prices can be measured, monitoring of social equity or competitive distortion is infeasible.

In the light of experience the Commission may propose to revise the scheme however it is not considered at this stage.

7. ANNEXES (see Part II of the Document)

EUROPEAN COMMISSION

Brussels, 11.7.2012
SWD(2012) 213 final

Part II

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the documents

Proposal for a regulation of the European Parliament and of the Council amending Regulation (EC) No 443/2009 to define the modalities for reaching the 2020 target to reduce CO2 emissions from new passenger cars

and

Proposal for a regulation of the European Parliament and of the Council amending Regulation (EU) No 510/2011 to define the modalities for reaching the 2020 target to reduce CO2 emissions from new light commercial vehicles

{COM(2012) 393 final}
{COM(2012) 394 final}
{SWD(2012) 214 final}

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COMMISSION STAFF WORKING DOCUMENT

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7. ANNEXES

7.1. Glossary

Autonomous mass increase (AMI) – is an indicator of an average increase of mass of the fleet resulting from factors which are external to the Regulation, for example additional comfort and safety measures.

Banking and borrowing – is a scheme whereby the manufacturers are allowed to bank over-compliance in some years and borrow by under-complying in others, while still achieving the end goal. This means that a desired outcome should be achieved by a certain time but the optimal route to that point may differ between economic actors. To enable banking and borrowing it is necessary to define an expected trajectory of compliance and then assess borrowing or banking against that baseline.

Car – a motor vehicle which is of category M1 as defined in annex II to Directive 2007/46/EC and therefore is designed and constructed for the carriage of passengers and has no more than eight seats in addition to the driver’s seat.

Eco-innovations – are innovative technologies which reduce real world CO_2 emissions from vehicles but whose effect is not measured in the type approval test. The current Regulations permit manufacturers to be granted a maximum of 7 gCO_2/km emission credits for their fleet on average if they equip vehicles with innovative technologies, based on independently verified data.

Footprint (as utility parameter) – is a measure of a vehicle's size obtained by multiplying its track width by its wheelbase.

Light Commercial Vehicle (LCV) – An alternative term for vehicles referred to in this Impact Assessment as vans.

Light-duty vehicles (LDVs) – are vehicles consisting of passenger cars and light commercial vehicles (vans). Legally they are vehicles in M and N classes with reference mass below 2,610 kg.

Limit value curve – the utility based approach adopted in the legislation results in the CO_2 reduction obligation being defined as a function of a "utility" parameter (e.g. mass or footprint) reflecting the utility of vehicles. The CO_2 targets are set according to this limit value function expressed as a formula (annex I to the Regulations). The function can take different shapes although in the current Regulations it is linear. The limit value curve approach ensures that vehicles with a larger utility parameter (currently mass) are allowed higher emissions than lower utility vehicles while ensuring that the overall fleet average meets the target. To comply with the Regulation, a manufacturer has to ensure that the overall sales-weighted average emissions of all its new cars or vans is not above the point on the limit value curve for its average utility parameter.

Mass (as utility parameter) – means mass of the vehicle in running order which is the reference mass of the vehicle less the uniform mass of the driver of 75 kg and increased by a uniform mass of 100 kg.

Mileage weighting – takes account of differences in distance driven annually and over their lifetime by different classes of vehicles. The ultimate goal of lowering total vehicle CO_2 emissions might be more cost effectively achieved from a larger reduction in vehicles that travel further and a corresponding reduction in effort for vehicles that travel less. Mileage weighting would in practice mean introducing a mileage weighting factor to the CO_2 emission values based on an estimate of the relative distances travelled by different vehicle classes and fuels.

Modalities – are the parameters established in the legislation which impact on how the targets are achieved. The modalities currently employed in the Regulations include a limit value curve, excess emissions premium, derogations, manufacturer pooling, eco-innovations, phase-in of targets and super-credits. According to the Regulations the modalities may be considered for amendment in view of implementation of the 2020 targets.

NEDC – New European Drive Cycle. This is a driving cycle supposed to represent the typical usage of a car in Europe, and is used, among other things, to assess the CO_2 and pollutant emission levels of new LDVs.

Phase-in – means a gradual increase in the percentage of the fleet required to meet the target. The phase-in for passenger cars means that in 2012, 65% of each manufacturer's newly registered cars must comply on average with the limit value curve set by the legislation. This will rise to 75% in 2013, 80% in 2014, and 100% from 2015 onwards. If 100% compliance is set beyond the target date, e.g. 2020, in reality phase-in leads to delay in implementation of the target.

Slope of the limit value curve – when defining the formulae depicting the limit value curve it is necessary to decide on its slope. A 100% slope is based on the observed trend in a base year (2009 for cars and 2010 for vans), scaled down by an equal relative reduction to reach the desired target. Once the curve is scaled down to a desired level one can rotate it around the point of average utility and the targeted CO_2 level, which means that even though the slope changes the average target remains the same. The rotation can make the curve flatter (below 100%) in which case vehicles with higher utility would have to reduce more in order to meet the target, or steeper (above 100%) for which smaller vehicles would be asked to make more effort.

Super credits – are a multiplier used in the Regulations for vehicles with extremely low tailpipe emissions (below 50 gCO_2/km). In the current car Regulation each low-emitting car will be counted as 3.5 vehicles in 2012 and 2013, 2.5 in 2014 and 1.5 in 2016. Similarly, each low-emitting van will benefit from the following multiplier 3.5 in 2014 and 2015, 2.5 in 2016 and 1.5 vehicles in 2017.

Utility parameter – to establish CO_2 emissions targets for different vehicles an objective means is needed to distinguish between them. Without this, all vehicles would have the same target. Distinguishing between vehicles based upon their utility as perceived by buyers or users has been considered to be most appropriate. Different means can be used to assess utility and some examples include the vehicle's mass, area, volume or carrying capacity. Mass is the utility parameter used in the current car and van Regulations.

Van – a motor vehicle designed and constructed for the carriage of goods which is of category N1 as defined in Annex II to Directive 2007/46/EC and to vehicles of category N 1 to which type-approval is extended in accordance with Article 2(2) of Regulation (EC) No 715/2007. These vehicles have a maximum mass not exceeding 3.5 tonnes.

WLTP – World Light-duty Test Procedure. This is being developed by UNECE and aims to establish a globally accepted methodology to measure light duty vehicle emissions and energy consumption.

7.2. Summary of the public consultation

1. EU policy on road-vehicle greenhouse emissions (evaluation of Part B)

Analysis of responses to ***Questions B.1-B.5***

B.1 Setting greenhouse emission standards for road vehicles is an important aspect of EU action to reduce such emissions.

B.2 These standards should be in line with the greenhouse targets in the EU's roadmap to a low carbon economy and Transport White Paper.

B.3 Road vehicle greenhouse gas emissions standards should be set based on the average greenhouse gas emissions of new vehicles entering the vehicle fleet.

B.4 Standards for road vehicles should apply equally to different technologies used for powering road vehicles.

B.5 EU regulation of road-vehicle emissions stimulates innovation in the automotive sector and helps keep Europe's automotive industry competitive.

In general, the responses to section B of the consultation questionnaire were quite similar amongst stakeholders and individuals. For most questions, there was stronger support amongst individuals towards entirely agreeing with the policy statements, while with stakeholders there was more of a split between those who entirely agreed and those who partly agreed with the policy statements set out in section B.

Of individuals, 95% agreed that it was important to set greenhouse gas (GHG) emission standards as part of overall EU action to reduce such emissions while 55% of stakeholders entirely agreed and 31% partly agreed. A majority of respondents (89% of individuals entirely/partly and 77% of stakeholders entirely/partly) agreed that these standards should be in line with the GHG targets set out in the EU's roadmap to a low carbon economy and Transport White Paper. The choice of the appropriate measurement approach for setting GHG emission standards provoked a broader range of responses. While 64% and 59% of individuals and stakeholders respectively were in favour (entirely/partly agreed) of using the (current) fleet average approach, 33% of all respondents were either neutral or disagreed to some extent with setting targets based on the average GHG emissions of new vehicles entering the entire fleet.

Stakeholders (72% entirely/partly agreed) and individuals (69% entirely/partly agreed) were mainly supportive of applying standards equally to different technologies used for powering road vehicles, while 72% of stakeholders and 83% of individuals agreed or partly agreed that EU regulation of road-vehicle emissions stimulates innovation in the automotive sector and helps keep Europe's automotive industry competitive. The number of stakeholders who disagreed or partly disagreed that standards should be applied equally to different technologies or that EU regulation had had a positive impact in terms of innovation and competitiveness (12% and 13% respectively) was proportionately higher than that of individuals.

These results are shown graphically in charts 1 and 2.

Chart 1: Answers from all citizens to questions in Part B

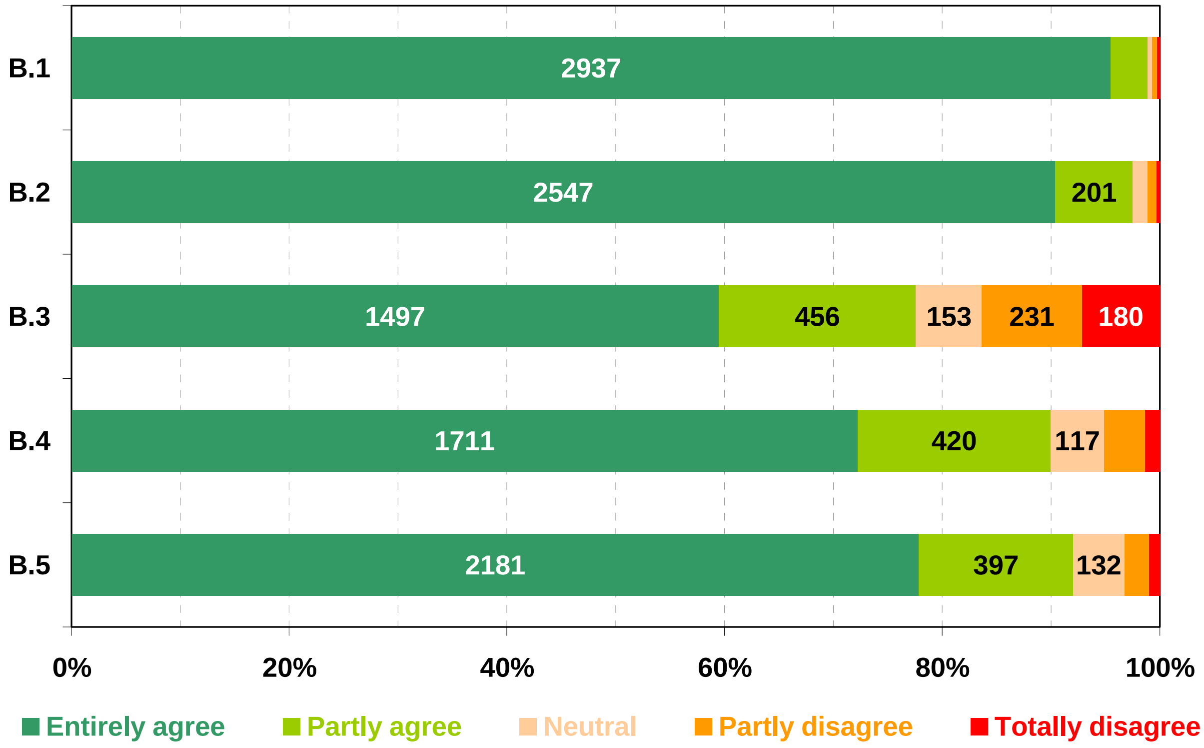
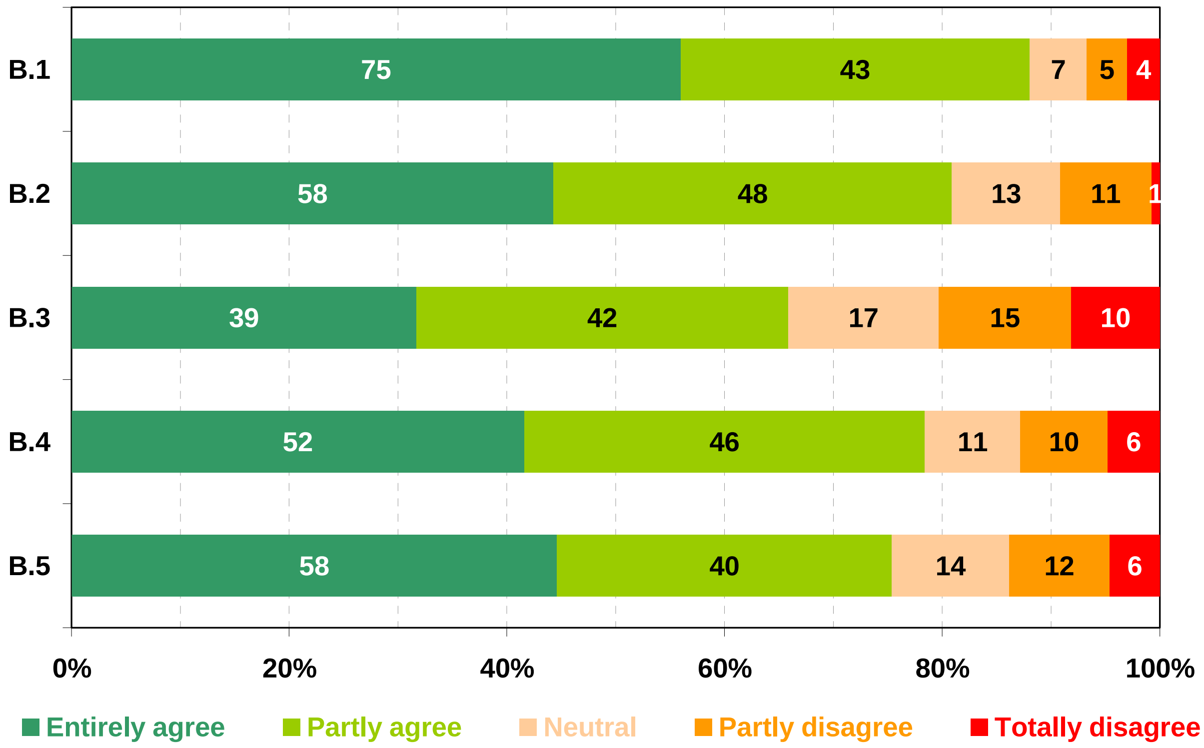


Chart 2: Answers from organized stakeholders to questions in Part B



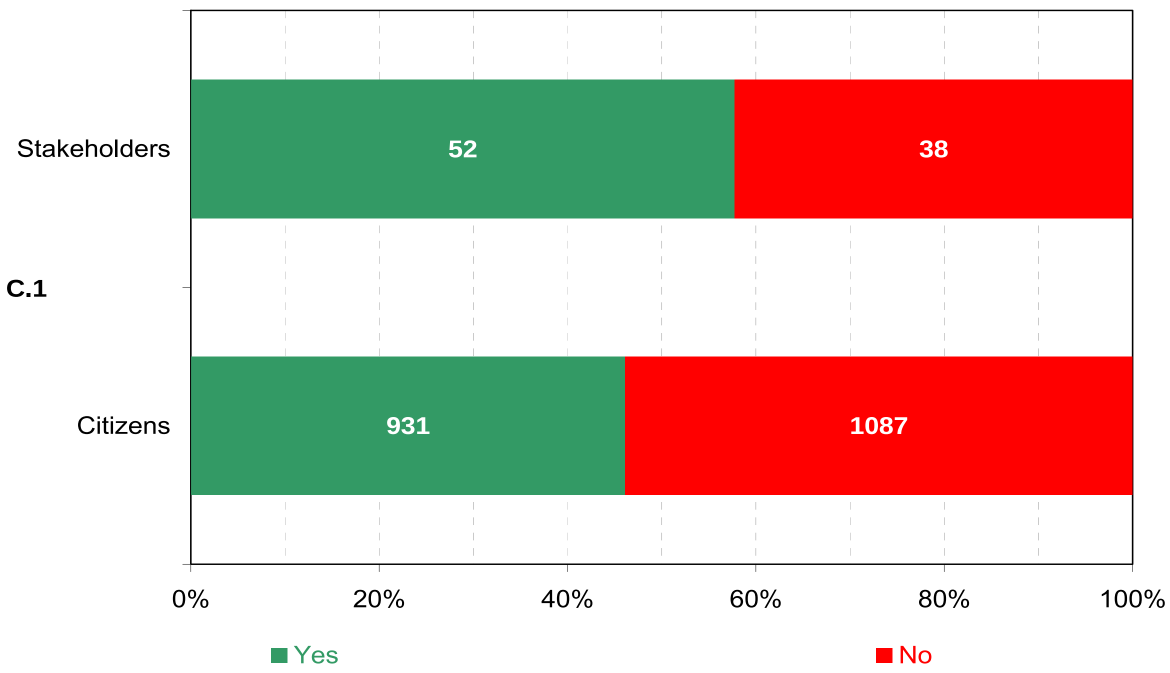
2. Light-duty vehicles (cars and vans) (evaluation of Part C)

Analysis of responses to ***Question C.1***

C.1 Do you think the current legislation is working and delivering tangible benefits?

There was a mixed assessment of the impact of the current legislation on light duty vehicles (cars and vans) by both stakeholders and individuals. While 38% of stakeholders agreed that the legislation was working, 28% felt that the legislation was not working or delivering tangible benefits. With regard to individuals more people felt that the legislation was not working (35 %) as opposed to those who agreed that it was delivering benefits (30%). Quite a significant proportion of stakeholders (34%) and individuals (35%) had no opinion in relation to question C1. This may partly be due to the fact that the legislation has only been in force for a short period of time (particularly the legislation on vans), and thus it is difficult to conclusively assess the impact it has had to date.

Chart 3: Answers to question C.1 in Part C



Summary of responses to ***Question C.2*** *(only answered by respondents answering no to question C1)*

C.2 Please specify why the current legislation is not working and delivering tangible benefits.

The respondents who felt that the legislation was not working or delivering tangible benefits mostly argued that the targets within the current legislation were not ambitious enough (almost 500 responses raised this point, including six from organisations). The majority of these respondents felt that the targets should be more stringent in order to have a greater impact on the reduction of CO_2 emissions and to encourage and stimulate the development of new technologies. Indeed over 80 respondents specifically argued that the legislation does not force technology change, while over 50 respondents felt that non-technical policies, including the promotion of alternative forms of transport, education and taxation, were required to complement technical policies in reducing CO_2 emissions and affecting a culture change in the use of transport. A significant number of these respondents also argued that progress was being made too slowly and that greater enforcement of the current legislation and future legislation was required (over 50 individuals). Around 40 respondents felt that the legislation should do more to promote the use of alternative fuels.

A large number of respondents (almost 200 individuals) felt that the resistance of manufacturers to fully embrace greener technology and produce and promote cleaner and more efficient cars was a major factor in the legislation not being effective. Indeed many of these respondents felt that manufacturers are too powerful, have too much influence over politicians and policymakers and are profit-driven. On the other hand, a small number of manufacturers and individuals felt that the markets were driven by customer needs and consumer demand and thus influencing this would be the driver for change rather than regulation. Over 30 respondents highlighted the need for creating incentives to purchase more efficient, greener vehicles. For some respondents (over 60 individuals), a perceived increase in the number of new cars in general and, in particular, high performance and 4x4 cars being sold, indicated that the legislation was having no effect.

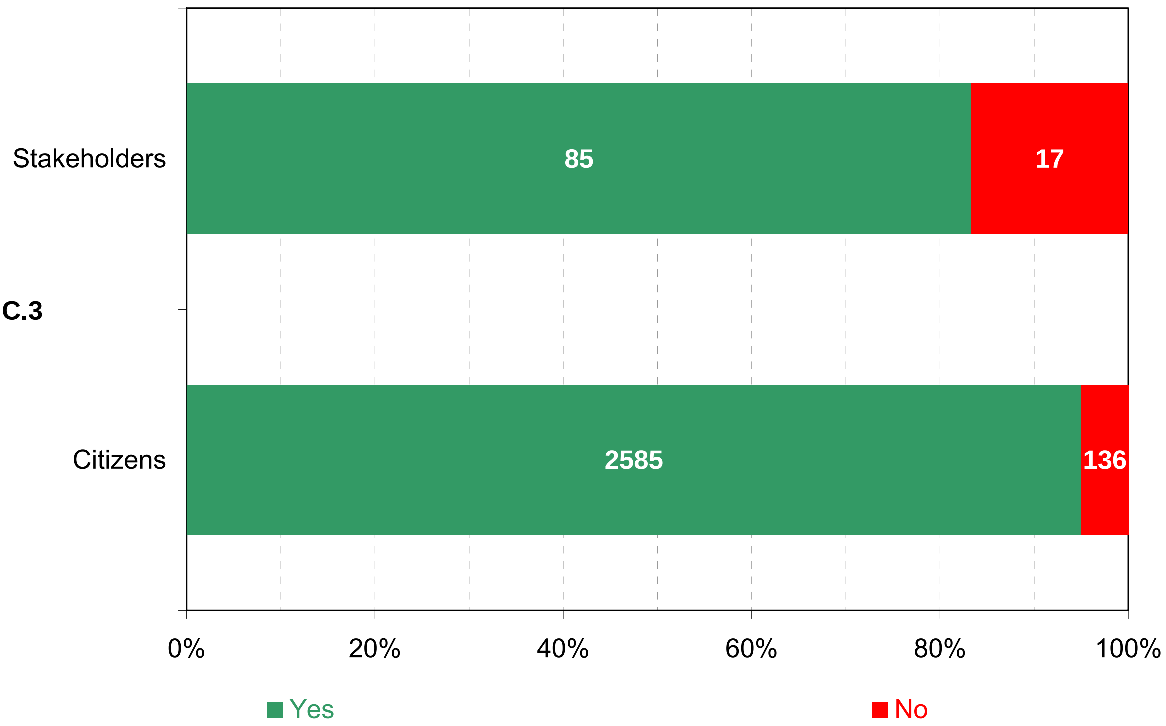
A number of organisations (including World Autosteel) questioned the use of tailpipe measurements, arguing that the legislation should focus on well-to-wheel emissions to enable a better assessment of overall vehicle emissions. Around 60 individuals also argued that more benefits could be obtained through focussing on other initiatives, including imposing more stringent standards on other industries and regulating emissions of other pollutants. Over 20 respondents highlighted that the current legislation was undermined by the fact that it does not regulate older cars, of which there are still a large amount in use. Other comments raised by a small number of respondents (individuals) included the need for alternatives to fleet average measurements, weight of vehicles relative to emissions, distortion between implementation of the legislation in member states, black carbon and the lack of a global market for low CO_2 vehicles.

Analysis of responses to ***Question C.3***

C.3 If the Commission's analysis demonstrates that the 2020 target of 147 gCO_2/km for light-commercial vehicles is technically achievable, at reasonable cost, should the target be confirmed?

In response to this question, 83 % of individuals and 62% of stakeholders felt that the 2020 target of 147 gCO_2/km for light commercial vehicles should be confirmed. A relatively small proportion of stakeholders (26%) and individuals (12%) had no opinion in relation to question C3.

Chart 4 Answers to question C.3 in Part C



Summary of responses to ***Question C.4*** *(only answered by respondents answering no to question C3)*

C.4 Please specify why the 2020 target of 147 gCO_2/km for light-commercial vehicles, if technically achievable, should not be confirmed.

The respondents who did not agree that the 2020 target of 147 gCO_2/km for light commercial vehicles should be confirmed mostly argued for a more ambitious level of reductions. A large number of individuals (over 80) claimed that, if the target can be achieved and it is not set at the limit of feasible reductions, it may not be ambitious enough and thus hinder innovation and delay the necessary CO_2 reductions. Furthermore a small number of individuals (around 10) felt that greater support and investment should be given to developing other technological solutions and cleaner technology. Some individuals (around 20) indicated that the target should be lowered to between 100-130gCO_2/km or suggested (around 10) that the target date should be shifted to an earlier date than 2020 (e.g. 2015). On the other hand, International Road Transport Union (IRU) and some other organisations linked to IRU (e.g. German Bus and Coach Association) questioned the practicality of CO_2 efficiency standards claiming a fuel efficiency standard would be more appropriate and would give greater incentives for transport operators to invest in more efficient vehicles. Some respondents also pointed out the fact that well-to-wheel emissions should be part of the 2020 target (City of Stockholm and 5 individuals) or that the CO_2 standard should rather become an energy efficiency standard accompanied by standards on carbon content of fuels (2 individuals). Other comments raised by a small number of individuals (less than 5) included the need to focus on other areas in reducing CO_2, the benefits of reducing the number of vehicles on the road and the importance of not allowing 'reasonable cost' to be a barrier to setting ambitious targets.

3. Future developments – beyond 2020

Analysis of responses to ***Questions E.1 and E.3***

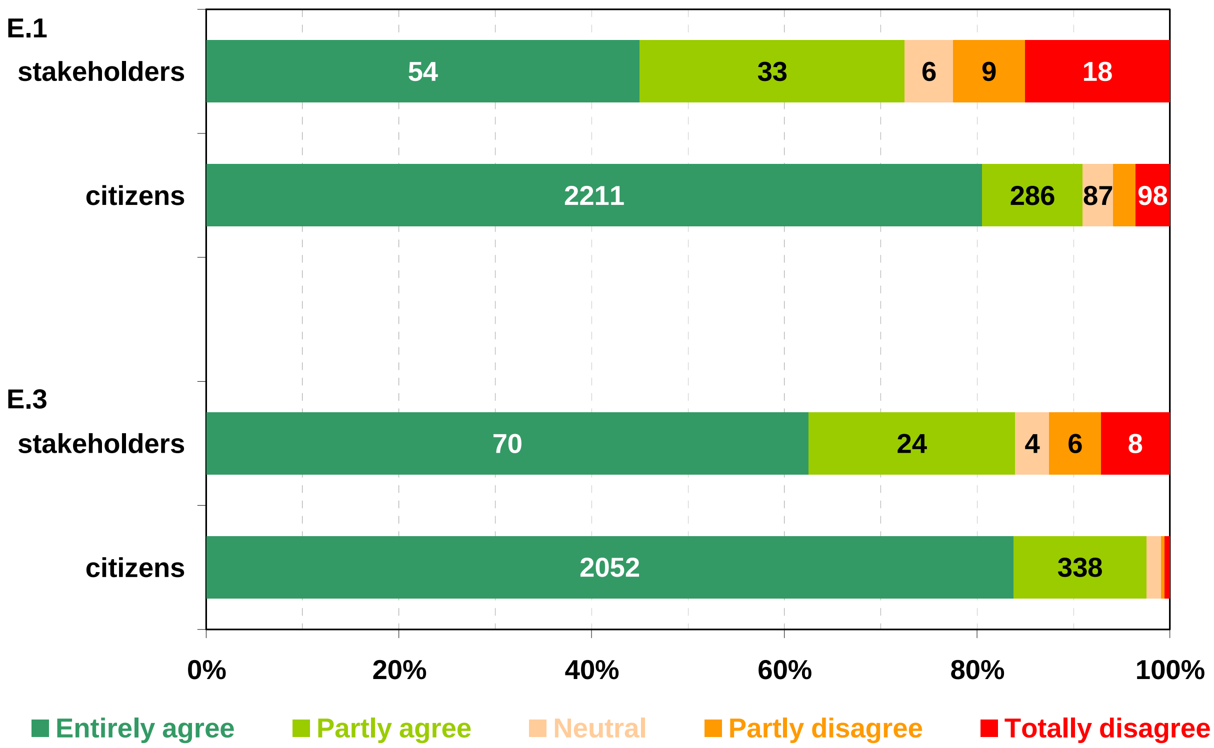
E.1 Road-vehicle emissions may be reduced by changes in other policies, such as taxation. Should targets for road vehicles continue to be set, regardless?

E.3 Should the approach to regulating road-vehicle emissions consider emissions from the whole energy lifecycle?

With regard to developments beyond 2020, there was a slight variation in the views expressed overall between stakeholders and individuals. A majority of individuals (81% entirely/partly agreed) and stakeholders (64% entirely/partly agreed) felt that targets for road vehicles should be set, regardless of the potential impact of other measures on road-vehicle emissions. Quite a significant number of stakeholders (20%) partly or totally disagreed that targets should continue to be set for road vehicles while less than 5% of individuals made similar responses.

There was general support for a life cycle energy approach to regulating road-vehicle emissions from individuals, with 66% entirely agreeing that this approach should be taken and 11% partly agreeing. Proportionally a smaller number of stakeholders were in favour of such an approach (69% entirely/partly in favour), with 13% either being neutral on the issue or disagreeing that a life-cycle energy approach should be adopted.

Chart 5: Answers to questions E.1 & E.3 in Part E



Summary of responses to ***Question E.2***

E.2 In your opinion, which are the policies in which changes might affect the setting of greenhouse gas targets for road vehicles?

Respondents to this question highlighted a range of general policy areas in which changes might affect the setting of GHG targets for road vehicles. A common theme in a large number of responses (over 300 individual responses and over 30 responses from organisations) was a belief that taxation or fiscal policies could have a significant effect on the setting and achievement of targets. Many organisations listed taxation as a key policy area without providing further detail while some individuals highlighted specific tax policies including general taxes on fuel/cars/maufacturers, tax reductions/exemptions for company cars, lower taxes for low emitting vehicles, taxation on alternative fuels and carbon taxes. A large number of respondents (over 200 individuals) argued that policies promoting the use of alternative transport for freight, such as rail and river, and for people, such as walking, cycling, electric and hybrid vehicles, would have a significant effect on the setting of GHG targets. Furthermore over 100 respondents (inc. 5 from stakeholders) felt that policies promoting, developing and improving public transport would be important. In addition over 60 respondents argued that congestion policies, including environmental zoning and road charging, would reduce overall road usage and influence the setting of GHG targets. Further policy areas aimed at reducing road usage and long distance travel, such as general foreign & trade policies and the promotion of local production and consumption (over 75 individuals) were highlighted as being influential on the setting and achievement of targets. Improved industrial and employment policies and practices were also considered to be potential mechanisms through which road usage could be reduced.

A large number of respondents (over 120, including Transport & Logistiek Vlaanderen (Road Haulage Association) and European Road Haulers Association (UETR)) identified policies concerning the design, manufacturing and sale of vehicles as being areas in which further changes and improvements could impact on the setting of GHG targets. Policies in respect of research, development and promotion of alternative fuels (over 90 respondents) and energy/renewable energy (over 70 individuals) were also highlighted by respondents as important. A number of individual respondents (over 40) and organisations (including International Council on Clean Transportation, European Tyre & Rubber Manufacturers Association (ETRMA), Fédération nationale des transports routiers (FNTR), Federeation Internationale de l'Automobile (FIA)) felt that policies concerned with improving public education/awareness of emissions/green technology and behavioural campaigns could have an impact on the setting of GHG targets. A large number of respondents also felt that R&D and innovation (over 75, including 18 organisations) and investment in infrastructure and improved urban planning (over 60) could affect the setting of GHG targets.

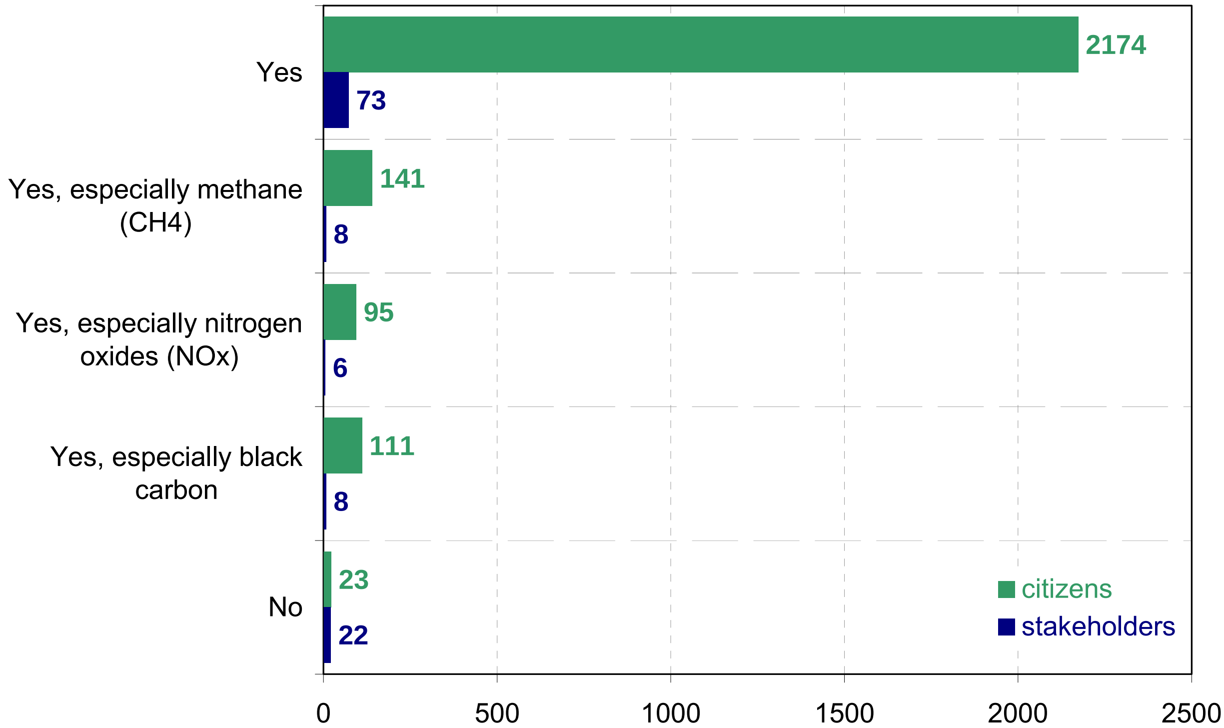
Organisations such as Transport for London, Jumbocruiser Limited, International Association of Public Transport (UITP) and Verband Deutscher Verkehrsunternehmen (VDV) highlighted emission policies such as the EURO classes legislation as an area which could affect the setting of targets while a significant number of individuals (over 90) provided general comments on the actual setting of emission limits and targets. Respondents also highlighted other general policy areas as being significant. These included general transport policy (150+), environment policy (70+), climate change policy (20+), air quality policy (8+), agricultural policy (10+), economic policy (75+), social policy (30+) and health policy (10+).

Analysis of responses to ***Question E.4***

E.4 Should other road-vehicle greenhouse emissions also be measured, alongside carbon dioxide (CO_2)?

Individuals tended to be more demanding with regard to the issue of other road-vehicle greenhouse emissions being measured alongside CO_2. 70% of individuals agreed that other greenhouse emissions should be measured with 5%, 3% and 4% specifically agreeing that methane, nitrogen oxides and black carbon respectively should be measured. Less than 1% of individuals felt that other greenhouse emissions should not be measured. 53% of stakeholders agreed that other greenhouse emissions should be measured with 6%, 4% and 6% specifically agreeing that methane, nitrogen oxides and black carbon respectively should be measured. 16% of stakeholders specified that other road-vehicle greenhouse emissions should not be measured.

Chart 6: Answers to question E.4 in Part E



Analysis of responses to ***Questions E.5 & E.6***

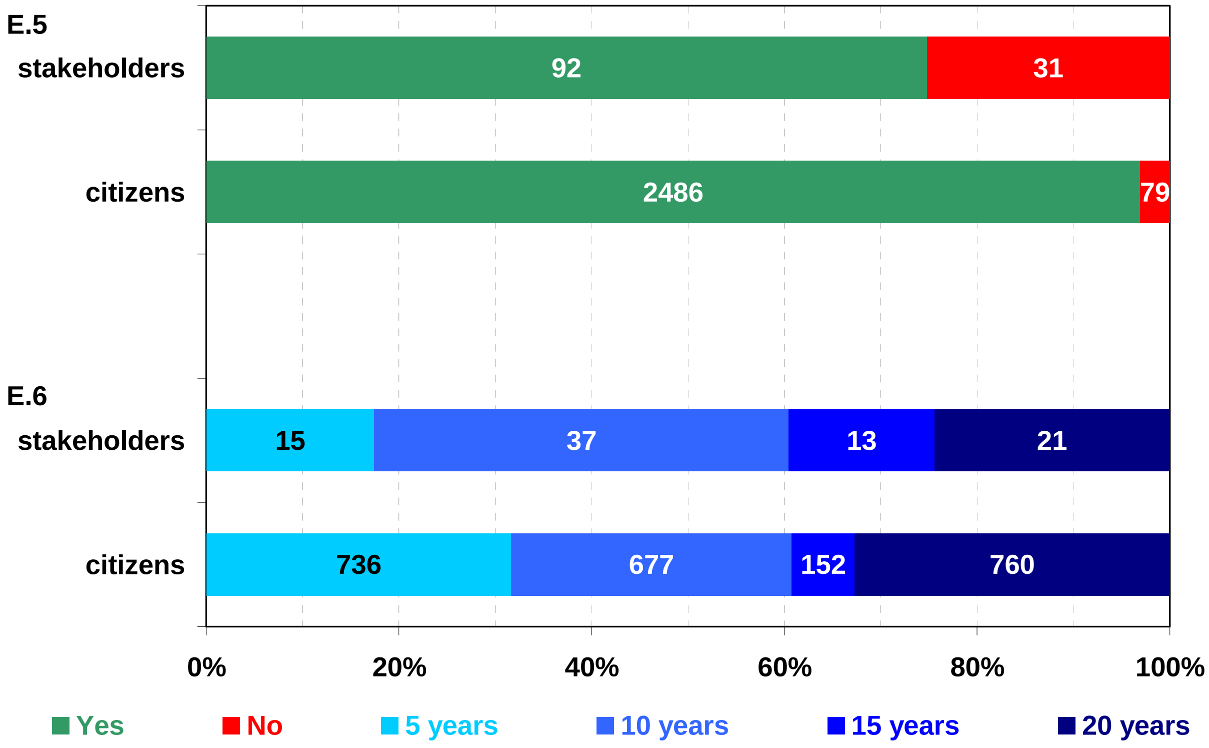
E.5 Should longer-term indicative targets (for after 2020) be set?

E.6 Please specify for what time period (following adoption of the related legislation)?

While the majority of both stakeholders (67%) and individuals (80%) agreed that longer term indicative targets should be set for after 2020, there was more opposition to this amongst stakeholders with 23% disagreeing with the setting of longer term indicative targets as opposed to only 3% of individuals disagreeing with the setting of longer term targets. 17% of individuals and 10% of stakeholders provided no opinion on question E5.

Responses in relation to the time frame for such legislation were quite mixed amongst both stakeholders and individuals. A quarter of all individuals chose not to answer question E6 or expressed no opinion, but of those that did 32% felt that the time frame for targets (following adoption of the related legislation) should be within 5 years, 29% specified 10 years, 15% specified 15 years and 33% specified that 20 year targets should be set. With regard to the stakeholder responses, 63% provided an answer to E6. Of these respondents, 17% felt that the time frame for targets (following adoption of the related legislation) should be within 5 years, 43% specified 10 years, 15% specified 15 years and 24% specified that 20 year targets should be set.

Chart 7: Answers to questions E.5 & E.6 in Part E

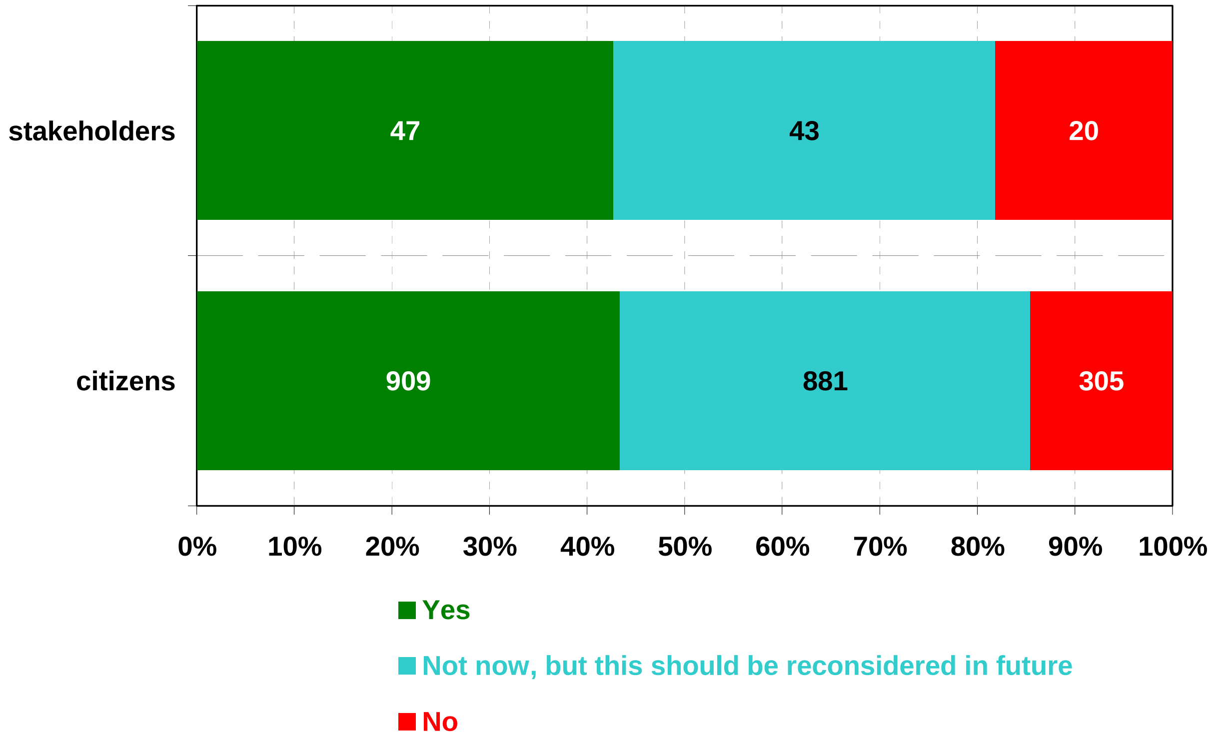


Summary of responses to **Question E.7** *(only answered if respondents answered No to Question E5)*

E.7 Please specify why long term indicative targets for after 2020 should no be set

The respondents who did not agree that long term indicative targets (for after 2020) should be set mostly argued that it was more appropriate to focus on implementing action in the short term to reduce CO_2 and achieve the targets already set for 2020. Around 10 organisations (including representatives of the car industry) and 20 individuals questioned the practicality of setting indicative targets for beyond 2020 without having knowledge of the developments in technology which may or may not materialise between now and then. In addition, 10 respondents claimed that short term targets are more achievable than unrealistic long term targets. The International Road Transport Union further stated that, in the absence of new procedures for the declaration of fuel consumption and CO_2 generation of complete transport units being designed, voluntary targets set by the transport industry should be encouraged. Other comments raised by a small number of respondents (<3) included the setting of conditioned fleet targets, the limited positive impact of legislation on small business, the restriction of private vehicle use and the inconvenience for hauliers of too many policy changes.

Chart 8: Answers to questions E.8 in Part E



Analysis of responses to ***Question E.8***

E.8 The current legislation contains vehicle-based targets until 2020. For post-2020, should we consider alternatives to vehicle-based greenhouse gas regulation?

In relation to question E.8 and the possible consideration of alternatives to vehicle-based targets post 2020, responses were generally quite similar amongst stakeholders and individuals. 34% of stakeholders and 29% of individuals agreed that alternatives to vehicle based regulation post 2020 should be considered. 31% of stakeholders and 28% of individuals felt that alternatives to vehicle based regulation should not be considered now but be reconsidered in the future, while 15% of stakeholders and 10% of individuals felt that alternatives to vehicle based regulation should not be considered. A significant number of stakeholders(20%) and individuals(32%) had no opinion or chose not to answer the question.

Summary of responses to ***Question E.9***

E.9 Please specify which alternatives

The respondents who provided comments on alternatives to vehicle based greenhouse gas regulation (post 2020) highlighted a number of other policy areas and initiatives in which further measures could be implemented to reduce the emission of greenhouse gases. A common theme in a number of responses from individuals (around 65) was a desire for the promotion and development of improved rail and river networks for the transportation of both people and goods. These individuals argued that a reduction of road usage is key to reducing pollution and a proportion of these respondents also recommended that more widespread, targeted congestion measures and road-charging policies should be implemented in towns and cities. In tandem with these comments, a significant number of other respondents (around 40) highlighted the importance of developing, promoting and incentivising the use of public transport, walking and cycling as viable, affordable and safe alternatives to the use of private vehicles. Further promotion and development of electically powered vehicles was supported by organisations including Shecco and Going Electric as well as individuals, as was the research, development and promotion of alternative fuels and more sustainable/renewable energy sources (individuals). The promotion of local production and consumption was also considered to be economically and enviromentally advantageous by individuals.

A large number of respondents (greater than 60) argued that a holistic approach was required with regard to the regulation of all industries/sources of pollution in society, with particular reference being made by some to the airline and energy production industries. A number of transport and motoring organisations, including Transfrigoroute International and IRU, highlighted the importance of implementing a wide range of initiatives in the field of transport, energy and fiscal policy as well as industry led initiatives to reduce fuel consumption. Taxation policy was also viewed as a key tool by individual respondents (around 40), who argued that further initiatives, ranging from the introduction of a carbon tax to having higher taxes on companies/consumers producing/purchasing high emitting vehicles and vice versa, could have a significant effect on the manufacturing, promotion and sale of goods (in particular vehicles) with a subsequent effect on the environment. Some respondents (around 30) also pointed out the fact that well-to-wheel emissions should be part of all future targets (City of Stockholm), while other respondents (around 15) supported the introduction of a personal carbon allowance (or cap and trade) scheme.

Both individual (around 15) and organisational (including ETRMA) respondents supported the undertaking of further research and stakeholder engagement on possible alternative policy options and the development of new technology for reducing pollution. A number of individuals (around 15) supported measures to regulate and improve the design and production of vehicles, with particular focus on the energy costs and emissions from vehicle production, the weight of vehicles and the type and recyclability of materials used in vehicle production.

4. Additional comments (evaluation of part F)

The comments provided as additional input covered a wide range of issues concerning light-duty and heavy-duty vehicles.

Light-Duty Vehicles

A substantial number of individuals (almost 300) felt that it was essential for Europe to continue to lead by example in making efforts to reduce GHG emissions from transport. The majority of these respondents felt that binding legislation, which forces manufacturers to develop, produce and promote more efficient vehicles, is key to reducing overall transport emissions. Furthermore, a large number of individuals (around 100) specifically called for the setting of more ambitious targets and the taking of more urgent action to reduce the impact of transport emissions, raising concerns about the environmental consequences of delayed action on emissions or a lack of action. Some respondents (around 20), including the consumer organisation, highlighted the benefits to consumers of greater fuel efficiency of light-duty vehicles and thus affordable mobility in the context of increasing fuel prices, and called for greater use of vehicle regulation rather than, for example, targets on share of biofuels. A similar number of respondents (individuals) noted other co-benefits of increased fuel efficiency such as greater energy security, better air quality, and savings on fuel spending. Greenpeace and a significant number of individuals (around 50) called for targets for both cars and commercial vehicles to be set for 2025 which should be in line with the effort needed to decarbonise transport by 2050. Public authorities generally stated that the indicative targets for 2025 and 2030 should be set prior to 2015 to give sufficient planning certainty to the industry. A large number of individuals (over 80) felt that the car industry had too much influence and lobbying power and that it was essential that vehicle manufacturers were led by policymakers rather than the reverse.

On the other hand, representatives of vehicle manufacturers raised concerns over setting long-term targets and called for the focus on implementation of the existing legislative framework. Representatives of the automotive industry highlighted that the targets in place are already challenging. According to these contributions, the targets should not be dismissed as unambitious because the good progress the industry has made is due to the substantial investments of car manufacturers in the recent past. They called for taking account of duration of the life cycle of products and the necessity to set the targets which are known to be achievable already today. A delivery company raised concerns of a possible extra burden on the vehicle users in case the legislation is unbalanced and discriminatory across transport users.

Some respondents (around 10) highlighted the need to change the current scheme and base the legislation on the size-based utility parameter rather than mass. The problem of unrepresentative results of the official measurement of fuel consumption and the need to bring it closer to reality was brought up on several occasions (including by 5 individuals). One automotive manufacturer claimed the need to shift to a well-to-tank approach in evaluating the emissions from different sectors and sources, e.g. electricity generation for upstream emissions and automotive producers for tailpipe emissions. A number of individuals (around 20) and organised stakeholders were in favour of regulating life-cycle emissions i.e. taking into account pollution resulting from the vehicle production phase, and involving a range of stakeholders- auto manufacturers, fuel suppliers and users- into action to reduce CO_2. Other individuals (around 35) felt that it was important for manufacturers to continue to invest in research and development and to improve the design and use of technology in vehicles.

A lot of respondents (individuals) referred to the need for a wider integrated legislative approach leading to behavioural change (over 50) and greater transport efficiency e.g. incentives to shift from personal to public transport (around 75), a reduction in road usage and congestion (around 70), appropriate fiscal incentives (around 80), alternative modes of freight transport such as rail and river (around 80), incentives for and promotion of alternative fuels and energy sources (around 80) including those in the early phase of development, a sustainable mobility policy (around 30), and the promotion of local production and consumption (around 40). Respondents representing transport operators claimed the incentives to upgrade their fleets to increase efficiency should be allowed to ease the burden of upfront investments, e.g. financial incentives etc. The same respondents were against speed limiters for light commercial vehicles claiming these could lead to reverse modal shift to other less efficient modes of transport. Transport associations were also concerned by the impact of legislation on SME's and lack of coherent approach of EU transport policies.

Other comments raised by a small number of individuals (less than 10) included the need to review the current scheme by including upstream emissions from production of fuels, extension of the scope of CO_2 standards to other categories of vehicles (e.g. non-road mobile machinery), labelling of vehicles, personal carbon quotas, the need for a worldwide international approach to fighting climate change, the need to reduce emissions of all pollutants and a reduction in speed limits.

7.3. List of participants in the stakeholder meeting 6 December 2011

European Aluminium Association
European Hydrogen Association
Industry Grouping for a Fuel Cells and Hydrogen Joint Undertaking
European Association for Battery, Hybrid and Fuel Cell Electric Vehicles
Association for Emissions Control by Catalyst
European Car Manufacturers Association
Conservation of Clean Air and Water in Europe
Japan Automobile Manufacturers Association
HONDA (JAMA Europe)
SUZUKI (JAMA Europe)
European Renewable Ethanol Association
Association of European Small Volume Manufacturers
McLaren (ESCA)
LOTUS Cars (ESCA)
ASTON MARTIN (ESCA)
Burson-Marsteller (consultant to ESCA)
PEUGEOT CITROEN
TOYOTA
VOLKSWAGEN
FIAT
DENSO
BOSCH
European Association of Automotive Suppliers
Johnson Controls International
HYUNDAI Motor Company
Transport and Environment
European Climate Foundation
Greenpeace EU
Greenpeace UK
DAIMLER
VOLKSWAGEN
Organisme Technique Central
RENAULT
BETTER PLACE
Ministry of Interior, HUNGARY
Ministry for Ministry of Infrastructure and Transport, ITALY
Environment and Nature Policy Section of the Permanent Representation of the NETHERLANDS to the EU
Ministry of Infrastructure and the Environment, Directorate General of the Environment, section Climate and Air Quality, NETHERLANDS
Leaseurope
Ministry of Economy, Trade and Business Environment; ROMANIA
Ministry of Science, Industry And Technology, Automotive Industry Department; TURKEY
Office for Low Emission Vehicles, UK LEV
Department for Business, Innovation and Skills, UK
Department for Transport, UK
The Society of Motor Manufacturers and Traders Limited

Low Carbon Vehicle Partnership
The International Council on Clean Transportation
Verband der Automobilindustrie
Ministry of Transport, BELGIUM
Ministry of Environment, BELGIUM

7.4. Summary of the stakeholder meeting of 6 December 2011

Chairman: Philip Owen, DG Climate Action

The aim of this meeting was to present to stakeholders the work carried out so far by contractors (TNO consortium)[1] which will underpin the reviews of the modalities of achieving the 2020 targets set in Regulation 443/2009/EC (CO_2/cars) and Regulation (EU) 510/2011 (CO_2/vans). In addition, the Commission also presented its intentions for considering these emissions beyond 2020.

1. Introduction

The European Commission, DG Climate Action opened the meeting and outlined the context of the discussion highlighting the EU's objective of 80-95% GHG reduction by 2050 and the ongoing Commission initiatives such as *'Roadmap for the competitive low carbon economy in 2050'* and the *'Transport White Paper'*. The role of transport decarbonisation in meeting the EU 2050 targets, as well as co-benefits of increased energy security and competitiveness of the EU automotive industry were highlighted.

2. Presentation of car analysis

The contractor presented the main findings of the study 'Support for the revision of Regulation 443/2009 on CO_2 from cars'. Data on vehicle fleets, technologies, costs and projections of the likely cost and technological means of achieving the 2020 targets had been gathered. The study analysed the cost impacts and distribution of effort between manufacturers depending on the choice of modalities i.e. the utility parameter (mostly mass and footprint), different shapes and slopes of the limit value curve, and some other flexibilities (e.g. super credits, banking and borrowing).

Stakeholders were invited to ask questions and make comments.

<u>Summary of discussion</u>

- Costs

Stakeholders asked for clarification regarding the differences between the alternative cost curves included in the report, notably the differences between the curves based on input from ACEA and those based on US EPA analysis. The environmental groups (T&E, Greenpeace, ECF) praised an approach of looking at alternative cost curves in particular using data from other parts of the world, and also taking account of additional progress in average CO_2 emissions in 2002-09 not explained by the technological improvements.

The issue of unexplained progress was discussed. The contractor explained that the progress not due to technologies on the cost curve was believed to have arisen using other technologies, powertrain optimisation and utilisation of flexibilities in the test procedure. A significant part of the reductions were not from the technology cost curve and it was likely that each scenario had elements of truth. While US data was key, EU industry data could not be ignored. ECF argued that the scenarios including this unexplained progress had to be the central assumptions for the Commission's further analysis.

[1] Consortium composed of TNO, Ricardo, IHS Global Insight, CE Delft, Okopol, AEA Technology, Transport and Mobility Leuven; analysis carried out under Framework Contract on Vehicle Emissions - No ENV.C.3./FRA/2009/0043

ESCA stated that in the period before the CO_2/cars legislation, manufacturers did not have so much incentive to reduce CO_2 emissions and this sudden improvement of average emissions is probably linked to careful engine tuning, cheap technological improvements and exploiting test-cycle flexibilities, and these would have been essentially cost free.

An extensive discussion took place regarding the extent to which the costs of meeting emissions targets are passed through to consumers via vehicle prices. The contractor explained that the relationship between these factors is not straightforward, especially since the prices of vehicles have not increased despite substantial improvement in car fuel efficiency seen in the last decade. Even though these reductions required investment by manufacturers, the efficiency gains in other aspects of vehicle production could have outweighed these costs. A further Commission study[2] on this subject was mentioned.

- Utility parameter

Several participants (SMMT, LowCVP, ESCA) enquired about the impacts of changing the utility parameter from reference mass to footprint and the additional cost of this shift. The consultant explained the methodology underlying the analysis and highlighted the conclusion that the additional average cost of changing the parameter to footprint would be only €10 higher than maintaining mass, and that this effect is due to the usage of the same cost curve for both parameters. If a separate cost curve was constructed for footprint it would result in lower cost of light weighting which is more effective for footprint. The result would therefore be a somewhat lower average cost for footprint (estimated at around €60 less than for mass).

LowCVP expressed regret that a similar analysis based on alternative cost curves from the US EPA analysis was not carried out in view of their much lower weight reduction costs. The consultant explained that further work was needed to ensure the appropriateness of the US analysis for the characteristics of the EU fleet. A discussion regarding differences in expected costs of light weight technologies in the EU and US followed, with an indication of a wide range of different approaches underlying the EU and US cost assumptions.

- Limit value curve

The representative from ESCA questioned whether the linear curve was a proper function, especially for vehicles at the extremes which are usually produced in low volumes and have a negligible impact on total CO_2. The contractor explained that overall for the purpose of defining limit functions there is no convincing alternative, for example non-linear curve or other function, and that for this reason small-volume manufacturers have a separate provision under the current scheme.

- Co-benefits

T&E and Greenpeace asked the Commission to take a proper account in the impact assessment of the benefits resulting from greater fuel efficiency of vehicles such as fuel savings to consumers, impact of lower demand for oil imports on prices of oil, shift of oil expenditure to other sectors of the EU economy and increases in employment in R&D and manufacturing.

- Other interventions

The ICCT explained that the US legislation sets a target of 50% reduction by 2025 which is supported by 13 manufacturers. This target when translated to the EU fleet characteristics

[2] "*Effect of regulations and standards on vehicle prices*" available for download at: http://ec.europa.eu/clima/policies/transport/vehicles/cars/docs/report_effect_2011_en.pdf

means an equivalent of 70-80 gCO_2/km. ICCT also explained that in January it will have new information on technology cost, which seems likely to show lower costs than the TNO analysis.

Better Place stated that in their view battery cost assumptions used were too high making electrified powertrains appear less attractive than they already are.

ACEA noted that the study covers the issues well. It highlighted that this microeconomic analysis should be put in the macroeconomic context of the EU economic situation and uncertainties as to how the market will look in 2020. ACEA expressed preference for a stable regulatory scheme and expressed concerns if a shift from mass to footprint was favoured arguing that the correlation between CO_2 and mass is better than with footprint. Footprint may be similar for vehicles with different design thus it does not necessarily reflect the utility of the vehicle as claimed. ACEA stated that the majority of countries in the world (including China, Japan, South Korea) base their CO_2 or fuel economy standards on mass. It also outlined its main concerns regarding CO_2 monitoring. Finally, ACEA argued that manufacturers should have flexibility as to how they reach the long-term target and therefore intermediate targets are not desirable.

3. Presentation of van analysis

The contractor presented the interim results of the equivalent analysis carried out for light commercial vehicles (vans). The feasibility of the 2020 target for vans needs to be confirmed and according to the updated analysis the target can be met at an additional average cost of €550. This is lower than assumed in the 2008 report, partly due to a shorter distance to the target (the fleet average emissions of 203g CO_2/km in 2007 dropped to 181g CO_2/km in 2010). In addition, the consultants have analysed the possibility of using the alternative utility parameters of footprint and payload.

Stakeholders were invited to ask questions and make comments.

<u>Summary of discussion</u>

- The 2020 target

In view of the 22 gCO_2/km drop in average emissions from 2007 to 2010, T&E expressed concern as to the discrepancy between the reduction effort expected from cars and vans and lack of sufficient incentives to use reduction technologies that will be used in cars. The contractor explained that the answer lies partly in the lower quality of 2007 data and partly in a possible overestimation of the baseline.

The environmental groups claimed that a more stringent 2020 target may be necessary.

- Utility parameter

The European Aluminium Association highlighted that the utility parameter should primarily be correlated with utility rather than CO_2 and called for technological neutrality in regulatory design. They argued that using mass as the parameter disadvantages lightweighting. T&E argued that it was important to move away from mass since this could reduce compliance costs and it was difficult to see why manufacturers oppose it.

The ICCT confirmed that the 2010 average in LCV market was 180 gCO_2/km according to their database, and suggested that in order to overcome the difficulties of using footprint as a utility parameter for vans the fleet could be split into 3 sub-segments. The consultant highlighted possible perverse incentives for gaming due to separate limits per category within the same legislation.

Daimler highlighted that payload is one of the most important purchasing criteria thus there is still a benefit of making the vehicles lighter in case of a mass-based parameter. In addition, it stated that manufacturers have been improving fuel efficiency for years leading to the drop in average emissions. VDA also stated that the argument against mass giving a lower incentive for lightweighting is theoretical. The contractor disagreed with this statement claiming that some manufacturers have stopped development in this area while in the longer term lightweighting will be an increasingly important reduction technology. If mass is retained as a utility parameter some of this potential will be lost.

- Other issues

The representative from the Department for Transport (UK) asked to what extent the cross-over between cars and vans was taken into account in the cost curves. The consultant explained the cross-over cars/vans exists and the resulting cost reductions of wide-scale application of certain technologies in both categories. The cost curves include these learning effects where possible but whenever reduction technologies have a different potential in vans it is taken into account.

ACEA stated that they do not see any major change in cost estimates from the previous analysis. They also mentioned the problems with CO_2 data for vans, especially for multi-stage vehicles.

4. Post-2020 issues

The Commission presented its intentions for work on the post-2020 perspective for light duty vehicles. The presentation listed the concerns associated with this timeframe, i.e. the uncertainty as to the costs of technologies and the optimal reduction potential, as well as the conflict between these and industry's need for planning certainty. The presentation outlined the main points for upcoming analysis that will look at possible alternative regulatory metrics to the current approach of tailpipe emissions, and their impact on the attractiveness of different technologies. Finally, the Commission explained that a certain indication of a possible post-2020 reduction level is necessary in order to provide the industry with planning certainty as had been the case with the 2020 target. Such indication of a potential future level of ambition could be included in a Commission communication accompanying the proposals.

Summary of discussion

LowCVP highlighted that a technology neutral approach would mean that the entire life cycle analysis would be needed and mentioned a study on this topic available on their website. Metrics alternative to the tailpipe approach would give a lot more opportunities for manufacturers to decide how to reduce their emissions.

T&E supported discussion on this topic and added that in addition to a change of metric two other issues needed to be taken into account: change of test-cycle and revision of the Labelling Directive. The appropriate order for these actions should be established. It also questioned why trading schemes were included as no stakeholder was requesting these. Greenpeace support setting intermediate targets in line with a 95% decarbonisation objective. They stated that the car sector is able to achieve zero emissions and that it may be necessary to accelerate reductions beyond 2020.

ACEA said that agreement was needed on where to go, but there was no industry position on this topic yet. ACEA called for a new integrated approach post-2020 whereby all actors involved would contribute towards the emission reductions. Finally, ACEA expressed preference for setting a long-term perspective first and allowing for the flexibility as to the ways of achieving these targets.

ECF highlighted the role the transport sector has to play in decarbonisation, and highlighted that road transport can deliver a big share of these reductions. ECF urged the Commission to set an ambitious pathway, especially in view of expected wider penetration of electric vehicles.

VDA raised the issue of uncertainty in the long-term perspective and questioned the possibility of defining an optimal reduction target without knowing what is possible. The Commission explained that the thought had been for a Communication accompanying the proposals to contain indicative targets or ranges with a further step of detailed analysis a few years later. It was highlighted that US legislation defines a target for 2025 already now.

UK argued that a vision for emission reductions is needed and pointed out that some of the embedded and lifecycle emissions are regulated even if not within the vehicle Regulations.

ESCA supported the view that further work on well-to-wheel reductions is needed and would also like to see a technology-neutral scheme, also from the point of view of emissions covering other GHGs not just CO_2. ESCA stated that trading would introduce uncertainty.

5. Other issues

Mileage weighting – in view of the potential improvement in cost effectiveness, is it worth considering taking account of vehicle lifetime mileage in the regulatory scheme?

The participants were unenthusiastic about this option and referred to difficulties of obtaining mileage profiles for different categories of vehicles and EU Member States, and the need for a robust monitoring of mileage. T&E highlighted a trade-off between complexity and effectiveness, the danger of loopholes and the need to ensure the environmental integrity of such a scheme. LowCVP raised concern over potential market distortion and a lower reduction pressure on larger vehicles. VDA mentioned the complexity, lack of data and potential disadvantages to certain manufacturers based on their portfolio. Better Place had concerns over data, future changes in mileage and its belief that a shift from oil was the key objective.

Eco-innovations – is there a need to continue this flexibility?

VDA and CLEPA stated that there will always be off-cycle technologies and that it is important to provide incentives for such innovative technologies. T&E argued that a new test-cycle that requires all devices to be operated would remove the need for such flexibility. Greenpeace were critical and stated that the best incentive for innovative technologies are tough targets. UK supports the principle of eco-innovations but thought the process could be improved and costs reduced. SMMT said that eco-innovations help to keep the cost of compliance with the legislation down.

Super-credits – in view of the fact that they lead to an increase in overall CO_2 emissions, are these a desirable feature?

Better Place was in favour of keeping the super-credit scheme to advance market penetration of alternative powertrains and phase-out oil use in transport. T&E argued the main objective of the legislation is to save CO_2 emissions with oil reduction as a co-benefit. Greenpeace opposed super-credits and stated that EVs would already be cost effective according to the study and so tough targets would be enough to see more low emitting cars on the road.

Other comments

VDA asked the Commission to reopen the discussion on how to incentivise consumers to make use of the technologies appropriately (e.g. ecodriving).

T&E asked for the issue of speed limits to be considered in view of the evidence from Spain showing a 9% reduction in fuel use following slightly lower speed limits.

ICCT asked for consideration to be given to how consumers can be encouraged to buy efficient cars and the use of intelligent feebates and labelling.

6. Closing comments

The Chairman summarised the discussion, outlined the next steps and closed the meeting.

7.5. General policy context

- **EU commitment to reduce GHG emissions**

To avoid the most dangerous impacts, the EU has a stated objective of limiting global climate change to a temperature increase of 2ºC above pre-industrial levels. The Copenhagen Accord[3] included reference to this objective. In order to have a likely chance to limit long term global average temperature increase to 2°C or less compared to pre-industrial levels, global emissions need to peak by 2020 and be reduced by at least 50% globally by 2050 compared to 1990. The EU has endorsed this GHG emission reduction objective.

The European Council reconfirmed the EU target of 80-95% by 2050 compared to 1990 in the context of necessary reductions according to IPCC by developed countries as a group, with the aim of keeping average global temperature rise below 2 degree Celsius as compared to pre-industrial levels. However, current EU policies would only lead to ca. 40% reduction in GHG emissions by 2050. Therefore, the European Commission proposed the *'Roadmap for moving to a competitive low carbon economy in 2050'*[4] (hereinafter 'the Roadmap') looking beyond the 2020 objectives and setting out a plan to meet the long-term target of reducing domestic emissions by 80% by mid-century. The Roadmap provides guidance on how this transition can be achieved in the most cost-effective way. According to the Roadmap and the underlying analysis every sector of the economy must contribute and, depending on the scenario compared to 1990, transport emissions need to be between +20 and -9% by 2030 and decrease by 54-67% by 2050[5].

In March 2011 the Commission also adopted the *'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system'* (hereinafter the White Paper on Transport) which outlines the main challenges facing transport, including scarcity of oil in future decades, extreme volatility of oil prices and the need to drastically reduce world GHG emissions. It sets out future transport strategy within a frame of achieving a 60% reduction in transport GHG emissions by 2050. Improving energy efficiency of transport is one of the major contributors to the decarbonisation goal. The White Paper on Transport complements and is fully consistent with the Roadmap.

CO_2 emissions from transport have been growing over the last 20 years with an exception of 2008 and 2009 where a drop in CO_2 was combined with lower transport activity due to the economic slowdown. In 2008 around 70% of transport CO_2 emissions came from road transport[6]. As a result, it is the second biggest source of greenhouse gas emissions in the EU, after power generation and contributes about one-fifth of the EU's total emissions of CO2. Producing the fuel consumed by road transport adds about a further 15% to these emissions.

While emissions from other sectors are generally falling road transport is one of the few sectors where emissions have risen rapidly. Between 1990 and 2008 emissions from road transport increased by 26%. This increase acted as a brake on the EU's progress in cutting overall emissions of greenhouse gases, which fell by 16%. The share of LDV emissions as a proportion of road transport emissions is not known exactly, but is believed to lie between 66% and 75% of the total. Because the share is not known exactly it is not possible to be certain whether overall car emissions are increasing or decreasing.

In order to tackle road transport emissions, the European Commission implemented a comprehensive strategy designed to reach an objective of limiting average CO_2 emissions

[3] UNFCCC, 2010, Decision 2/CP.15, Copenhagen Accord
[4] COM/2011/0112 final
[5] Excluding international maritime emissions
[6] *EU transport in figures 2011*, European Commission

from new cars to 120 grams per km by 2012. In a progress report[7], adopted in November 2010, the European Commission concluded that most of the measures contained in the 2007 strategy have already been implemented or are in the process of being implemented. The goal of reducing new car emissions to 120 gCO_2/km by 2012, as defined in the strategy, is however not likely to be achieved because of changes to the timeline of some measures. In addition to the measures mentioned above, a number of complementary policies exist at EU and Member State level that assist in achieving the Regulations' goals. These include at EU level Directive 2009/33 on public procurement of vehicles, and at Member State level sales taxation, circulation taxes, other incentives (e.g. separate lanes or free parking spaces) and subsidies to procure low CO_2 emitting vehicles.

- **Innovation and competitiveness**

The EU is committed to innovation and boosting industrial competitiveness. Research and innovation drive productivity growth and industrial competitiveness. A transition towards a sustainable, resource efficient and low carbon economy is paramount for maintaining the long-term competitiveness of European industries. Competitiveness would be strengthened by favouring energy and raw material efficiency and promoting innovation and deployment of cleaner technologies along value chains with the use of long term incentives that encourage market creation and facilitate the participation of SMEs in these processes.

The automotive industry is faced with a number of challenges. Constraints on energy supply may exacerbate price volatility and lead over time to higher prices which can impact on demand for vehicles. Globally the market for LDVs is growing, however the geographical location of demand is changing with traditional markets such as the EU and USA stabilising but other parts of the world, Asia in particular, experiencing significant growth in demand for LDVs. This growth is accompanied by expanding LDV production in those areas of the world. New local manufacturers compete primarily for market share in those new markets at present but can be expected to compete more in the future in more traditional markets such as the EU.

The benefits of ensuring alignment between fighting climate change and encouraging innovation thus boosting competitiveness is summed up in the Roadmap for a competitive low carbon economy which states that *"...action, sometimes more ambitious than what countries would be ready to commit to internationally, is driven to a significant extent also by other domestic agendas: to accelerate innovation, increase energy security and competitiveness in key growth sectors and reduce air pollution. A number of Europe's key partners from around the world, such as China, Brazil and Korea, are addressing these issues, first through stimulus programmes, and now more and more through concrete action plans to promote the "low carbon economy". Standstill would mean losing ground in major manufacturing sectors for Europe."*

Increasing production and sales of LDVs in parts of the world other than the EU, North America and Japan are likely to result in increased competition in the automotive market. Evidence from US suggests that failure to innovate weakens manufacturers' competitiveness. Increased global competition for energy resources is likely to lead to higher and more volatile prices. Parts suppliers compete globally. EU suppliers who have developed technology for application in the EU market will be better placed to sell this technology to manufacturers in other regions, especially if there is a short time lag between the requirement from EU regulations and those brought in other areas.

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[7] Progress report on implementation of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles COM/2010/0656 final

- **Energy use**

Oil, the main source of energy for road transport, is a limited resource and so will become increasingly scarce in future decades. Despite becoming more energy efficient, transport still depends on oil for 96% of its energy needs. Gasoline and diesel supply 95% of energy use in road transport. Road transport uses about 26% of all energy in the EU. For every unit of energy used in road transport, the process of extracting and refining the oil consumes a further 15%. While measures to improve performance in that sector are outside the scope of the current policy, that energy use and associated emissions will decrease as the energy used in vehicles reduces. This means that cars and vans combined (hereinafter light-duty vehicles) consume about 35% of EU oil consumption (including the energy used in refining the fuel) and about 18% of total EU final energy consumption. Their use results in the emission of approximately 13.5% of total EU CO_2 emissions including refinery emissions.

The sourcing of oil and the market structure may lead to increasing price volatility. While there are substantial sources of alternative fossil fuels, these mostly result in higher greenhouse gas emissions than oil making their use unviable in a climate constrained world. In 2005 oil prices were around $59/barrel, since then they have been consistently higher and are projected to more than double from 2005 levels by 2050. Globally, the number of cars is projected to increase from around 750 million today to more than 2.2 billion by 2050[8]. Over that time transport is projected to account for almost 90% of increased oil use.

Energy security is an ongoing concern. The share of oil expenditure as a proportion of EU GDP has reduced dramatically since the 1970s. This has helped to improve the EU's resilience to oil price shocks. Measures that further reduce energy consumption in transport and thus reduce the energy needed per unit of activity in the economy, such as increased energy efficiency of vehicles, will further strengthen the EU's energy security.

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[8] IEA, Transport White Paper

7.6. Summary of car and van CO_2 Regulations

As part of the EU's overall strategy to reduce GHG emissions from cars and vans, two Regulations were adopted specifically aimed at setting CO_2 emission targets for new vehicles. Regulation (EC) No 443/2009, setting emission performance standards for new passenger cars was adopted by the European Parliament and the Council in 2009. The overall aim of the legislation is to ensure that average emissions from new passenger cars in the EU do not exceed 130 gCO_2/km by 2015 and should decrease to 95 gCO_2/km by 2020.

Similarly, in May 2011, the EU adopted legislation (Regulation (EU) No 510/2011) to reduce emissions from vans ('light commercial vehicles'). The vans Regulation will cut emissions from vans to an average of 175 gCO_2/km by 2017 – with the reduction phased in from 2014 - and to 147 gCO_2/km by 2020 although the latter target is subject to confirmation of feasibility.

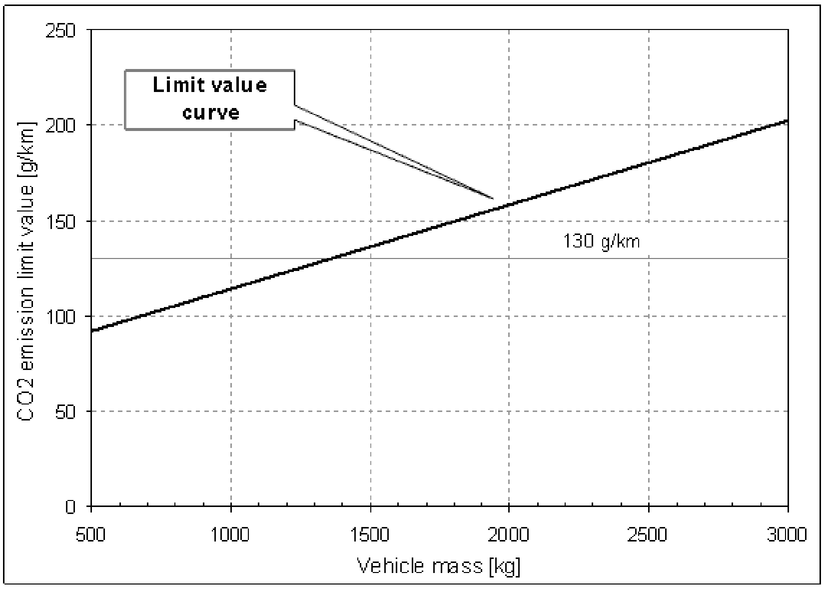
Key elements of the adopted legislation are as follows:

Limit value curve

The targets in the Regulations are set according to the limit value curves expressed as formulae (in annexes I to the Regulations). The limit value curves differ for cars and vans and are designed in such a way that that heavier cars/vans are allowed higher emissions than lighter cars/vans while preserving the overall fleet average. This means that only the fleet average is regulated, so manufacturers are still able to make vehicles with emissions above their indicative targets if these are offset by other vehicles which are below their indicative targets. In order to comply with the regulation, a manufacturer will have to ensure that the overall sales-weighted average of all its new cars or vans does not exceed the relevant limit value curve.

The limit value curve has a certain slope (parameter 'a' in the formulae). The slope of the curve does not change the overall outcome in terms of average gCO_2/km, it only defines the distribution of reduction effort between vehicles with different values of utility parameter, in this case mass. The curve is rotated around the point set by the average vehicle parameter (1372 kg in case of cars and 1706kg for vans) and the average CO_2 target to be achieved by the overall fleet (130 gCO_2/km for cars and 175 gCO_2/km for vans). This ensures that the same overall target is achieved. If the curve has a lower slope, the degree of effort required is proportionately greater from vehicles with a larger parameter (mass or footprint). If the curve is steeper then the effort required is proportionately greater from vehicles that have a smaller parameter.

The curve for passenger cars is set in such a way that, compared to today, emissions from heavier cars will have to be reduced by more than those from lighter cars (lower slope). The limit value curve for cars is illustrated in the graph below.



The limit value curve for vans is different in its value and its slope because cars are lighter and emit less CO_2 than vans. As compared to the cars limit value curve, the one for vans is steeper. As a result a similar level of reductions is required of vans of different sizes.

The precise formula for the limit value curve for cars is:

Permitted specific emissions of CO_2 = 130 + a × (M – M0)

Where:

- M = mass in kg
- M0 = 1372.0
- a = 0.0457

The precise formula for the limit value curve for vans is:

Permitted specific emissions of CO_2= 175 + a × (M – M0)

Where:

- M = mass in kg
- M0 = 1706.0
- a = 0.093

Phasing-in of requirements

In terms of passenger cars, in 2012, 65% of each manufacturer's newly registered cars must comply on average with the limit value curve set by the legislation. This will rise to 75% in 2013, 80% in 2014, and 100% from 2015 onwards.

With regard to vans, as of 2014, manufacturers must ensure that 70% of the new vans registered in the EU each year have average emissions that are below their respective targets. In 2015, the percentage rises to 75% and in 2016 to 80%, reaching 100% in 2017.

Lower penalty payments for excess emissions until 2018

In case of cars and vans, if the average CO_2 emissions of a manufacturer's fleet exceed its limit value in any year from 2012 or 2014 respectively, the manufacturer has to pay an excess emissions premium for each car or van registered. For both cars and vans, this premium amounts to €5 for the first gCO_2/km of exceedance, €15 for the second gCO_2/km, €25 for the third gCO_2/km, and €95 for each subsequent gCO_2/km. From 2019, already the first gCO_2/km of exceedance will cost €95.

Long-term target

Targets of 95 gCO_2/km for new passenger cars and 147 gCO_2/km for vans are specified for 2020. Details of how these targets are to be reached, including the excess emissions premium, are presented in a proposal accompanied by this Impact Assessment. In addition, the 2020 target for vans is subject to confirmation of feasibility.

Eco-innovations

Because the test procedure used for vehicle type approval is outdated, certain innovative technologies cannot demonstrate their CO_2-reducing effects under the type approval test. The manufacturers can be granted a maximum of 7 gCO_2/km of emission credits on average for their fleet if they equip vehicles with innovative technologies, based on independently verified data.

Super credits

Both Regulations give manufacturers additional incentives to produce vehicles with extremely low emissions (below 50 gCO_2/km). Each low-emitting car van will be counted as 3.5 vehicles in 2012 and 2013, 2.5 in 2014 and 1.5 in 2016. Similarly, each low-emitting van will benefit from the following multiplier 3.5 in 2014 and 2015, 2.5 in 2016 and 1.5 vehicles in 2017. This approach will help manufacturers further reduce the average emissions of their new car and van fleets. In case of vans, the manufacturers will be able to claim this 'super credit' for a maximum of 25 000 vans over the 2014-17 period.

Pools acting jointly to meet emission targets

Manufacturers can group together to form a pool which can act jointly in meeting the specific emissions targets. In forming a pool, manufacturers must respect the rules of competition law and the information that they exchange should be limited to average specific emissions of CO_2, their specific emissions targets, and their total number of vehicles registered.

Derogations

Independent manufacturers of passenger cars who sell fewer than 10,000 vehicles per year, and who cannot or do not wish to join a pool, can instead apply to the Commission for an individual target consistent with their reduction potential. Manufacturers selling between 10,000 and 300,000 cars per year can apply for a fixed target of a 25% reduction from their 2007 average emissions.

Independent manufacturers of vans which sell fewer than 22,000 vehicles per year can also apply to the Commission for an individual target consistent with their reduction potential instead of joining a pool.

The tables below show derogations granted in 2011 for 2012 onwards.

Table 1 List of manufacturers granted a niche derogation in 2011; *Pooling 2012-2016

No	Niche OEM derogations granted in 2011	Registrations in 2010
1	Fuji Heavy Industries Ltd	30 655
2	Tata Motors* Jaguar Cars* Land Rover*	3582 23740 65534

Table 2 List of manufacturers granted a small-volume derogation in 2011

No	Small volume OEM derogations granted in 2011	Registrations in 2010
1	Aston Martin Lagonda Ltd	1415
2	Caterham Cars Ltd	135
3	Ferrari S.p.A.	2361
4	Great Wall Motor Company Ltd	344
5	Koenigsegg Automotive AB	-
6	Lotus Cars Ltd	825
7	MG Motor UK Ltd	264
8	Morgan Motor Company Ltd	415
9	Proton	792
10	Ssangyong Motor Company	4785
11	Wiesmann GmbH	8
12	KTM-Sportmotorcycle AG	57
13	Litex Motors AD	-
14	Marussia Motors LLC	-
15	McLaren Automotive Ltd	-
16	Noble Automotive Ltd	-
17	Spyker Automobielen B.V	-
18	Mahindra Europe SRL	48

Monitoring CO_2 emissions from new passenger cars and vans

Under the cars legislation, the Commission sets down rules on the data required to monitor the CO_2 emissions of new cars. The relevant national authorities in each Member State report annual registration figures for new cars to the European Commission, which collates the data. Manufacturers are invited to check that the data is correct. On that basis the Commission publishes, by 31 October each year, a list showing the performance of each manufacturer in terms of its average emissions and compliance with the annual emissions target. This allows for the manufacturers' progress to be tracked. With regard to vans, the Commission laid down similar rules on the data required to monitor the CO_2 emissions of new vans. The Member States are required to monitor and deliver this data as of 2012.

For information the table below based on monitoring data provides reported registrations by manufacturing entity for 2010 where the number of vehicles registered is below the 300,000 registrations upper threshold for the niche derogation. The average vehicle mass and CO_2 emissions are also provided.

Table 3 List of manufacturers below 300 000 annual registrations (data for 2010) excluding manufacturers pooling with OEMs larger than 300 000 registrations

Manufacturer Name	Pools (P) and Derogations (D-small volume; ND-niche)	Number of registrations	Average mass	Average CO_2 (100%)
SEAT		288629	1278.38	131.162
Kia Motors Europe GmbH		253706	1399.30	143.272
Automobile Dacia SA		251938	1237.01	144.989
Volvo Car Corporation		204926	1662.43	156.948
Mazda Motor Corporation		170007	1339.67	149.458
GM Daewoo Auto u. Tech. Comp.		146117	1253.96	143.544
Honda Motor CO	P1	102890	1343.77	143.823
Honda Pool		174637	1345,28	146,902
Magyar Suzuki Corporation Ltd.		87204	1177.91	136.665
Suzuki Motor Corporation		85177	1176.15	144.109
BMW M GmbH		77120	1652.88	156.242
Mitsubishi Motors Corporation (MMC)	P2	72594	1560.20	165.144
Mitsubishi Pool		89124	1463,58	158,122
Land Rover	D	65534	2351.43	231.494
Honda of the UK Manufacturing	P1	47840	1446.21	162.280
GM Italia S.r.l.		37670	1272.82	124.405
Dr.Ing.h.c.F. Porsche AG		34512	1855.34	238.859
Chrysler Group LLC		31121	1973.32	215.200
Fuji Heavy Industries Ltd.	ND	30655	1608.03	179.332
Chevrolet Italia		25442	1073.45	117.607
Jaguar Cars Ltd	D	23740	1900.33	199.016
Honda Automobile China CO	P1	20876	1133.46	126.094
Saab Automobile AB		19979	1676.64	175.341
Maruti Suzuki India Ltd.		19577	932.36	104.287
Daihatsu Motor Co. Ltd.		18972	1108.86	145.374
Mitsubishi Motor R&D Europe GmbH	P2	16530	1039.25	127.284
Dr Motor Company S. r. l.		4943	1167.22	138.566
Ssangyong Motor Company	D	4785	2023.10	215.728
Autovaz		3911	1293.44	219.516
Tata Motors Limited	D	3582	1293.00	151.987
Quattro GmbH		2596	1899.39	299.034
Ferrari	D	2361	1751.12	322.468
The London Taxi Company		1662	1902.13	227.739
Maserati S.p.A.		1626	2009.18	362.557
Honda Turkiye AS	P1	1587	1274.84	156.624

General Motors Company		1490	1847.93	296.400
Honda Automobile Thailand CO	P1	1444	1171.03	142.615
Aston Martin Lagonda Ltd	D	1415	1860.72	348.372
Bentley Motors Ltd		1187	2495.92	395.925
Geely Europe Ltd		918	1592.50	131.466
Lotus Cars Limited	D	825	1159.21	196.596
Proton Cars United Kingdom Ltd.	D	792	1394.89	153.557
Perodua Manufacturing Sdn Bhd		690	1013.88	140.230
Morgan Motor Co. Ltd.	D	415	1113.67	189.278
Rolls-Royce Motors Cars LTD		413	2494.48	332.063
Santana Motor S.A.		382	1498.15	204.921
Great Wall Motor Company Limited	D	344	1919.52	224.314
Automobili Lamborghini S.p.A		265	1619.11	357.362
MG Motor UK Limited	D	264	1180.16	184.717
ALPINA Burkard Bovensiepen GmbH + Co. KG		173	1753.38	210.341
Think		144	1158.61	0.000
Caterham Cars Limited	D	135	712.15	179.826
Sovab		94	2162.34	230.138
OSV - Opel Special Vehicles GmbH		67	1595.36	136.836
KTM-Sportmotorcycle AG	D	57	882.89	179.000
Iveco S.p.A		49	2471.90	216.694
Mahindra Europe S.r.l.		48	2029.38	251.500
O.M.C.I. S.r.l.		46	1169.78	167.848
Shijiazhuang Shuanghuan Automobile Company		44	1874.20	267.682
Tesla Motors Ltd		40	1335.00	0.000
Potenza Sports Cars		31	715.00	178.000
Pgo Ingenierie		29	1058.14	189.828
Secma		26	658.00	155.000
Bugatti Automobiles S.A.S		8	2011.50	589.250
Wiesmann GmbH	D	8	1409.88	257.250
Micro-Vett SpA		4	1448.75	0.000
Westfield Sports Cars		3	715.00	178.000
Artega Automobil GmbH & Co. KG		2	1420.00	220.000
Gumpert Sportwagenmanufaktur GmbH		2	1435.00	310.000

The review clause

The co-legislators asked the Commission to review the Regulations and, if appropriate, amend the existing legal acts. Article 13(5) of the cars Regulation states:

"By 1 January 2013, the Commission shall complete a review of the specific emissions targets in Annex I and of the derogations in Article 11, with the aim of defining:

—the modalities for reaching, by the year 2020, a long-term target of 95 gCO_2/km in a cost-effective manner; and

—the aspects of the implementation of that target, including the excess emissions premium.

On the basis of such a review and its impact assessment, which includes an overall assessment of the impact on the car industry and its dependent industries, the Commission shall, if appropriate, make a proposal to amend this Regulation in a way which is as neutral as possible from the point of view of competition, and which is socially equitable and sustainable.."

Article 13(1) of the vans Regulation states:

"By 1 January 2013, the Commission shall complete a review of the specific emissions targets in Annex I and of the derogations in Article 11, with the aim of defining:

— subject to confirmation of its feasibility on the basis of updated impact assessment results, the modalities for reaching, by the year 2020, a long-term target of 147 gCO_2/km in a cost-effective manner, and

— the aspects of the implementation of that target, including the excess emissions premium.

On the basis of such a review and its impact assessment, which includes an overall assessment of the impact on the car industry and its dependent industries, the Commission shall, if appropriate, make a proposal to amend this Regulation, in accordance with the ordinary legislative procedure, in a way which is as neutral as possible from the point of view of competition, and which is socially equitable and sustainable."

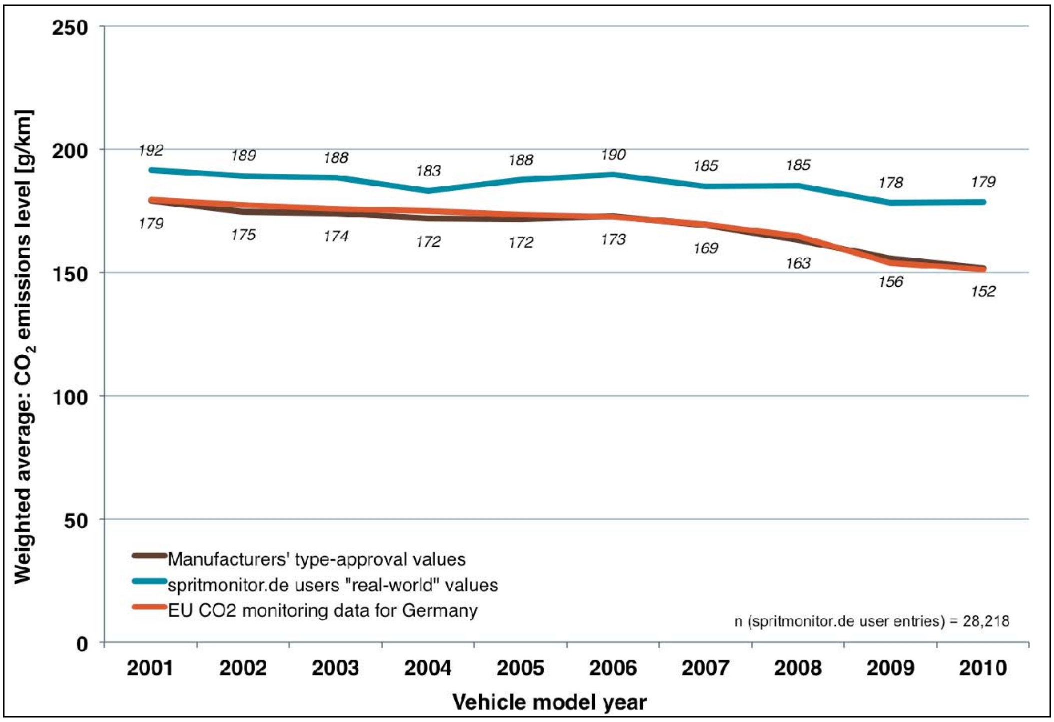
7.7. Test cycle CO_2 emissions

Vehicle type approval procedures include testing on a chassis dynamometer, to assess compliance with standards for exhaust emissions, and measure CO_2 emissions. The reported emissions provide the data to assess manufacturer compliance with the CO_2 Regulations

Diverging real world and test cycle emissions

It has for some time been reported that fuel consumption experienced in real world conditions is substantially higher than measured in the test cycle with comparable effects on CO_2 emissions. A comparison of type approval values for cars in Germany with user reported consumption is shown in the figure below. Over the decade the divergence is seen to have increased from 7 to 17% of type approval values.

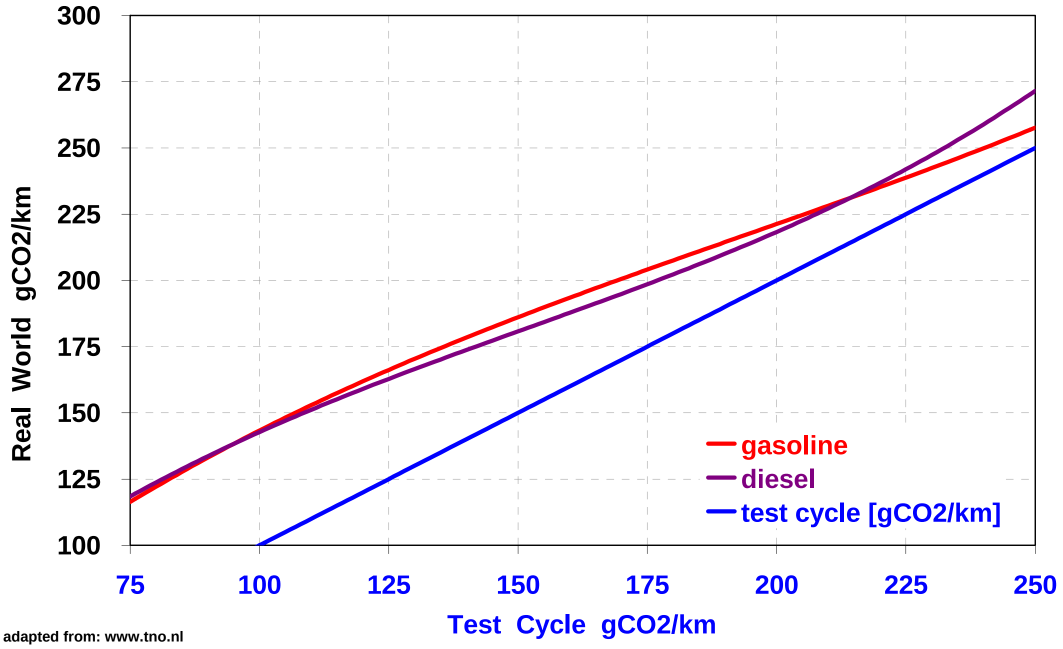
Figure 1 Illustration of discrepancy between the test-cycle and real-world emissions; Source ICCT[9]



An analysis in the Netherlands using fuel-card data illustrates a larger absolute divergence for lower than higher CO_2 emitting cars. The graph below illustrates this increasing divergence at lower test cycle emissions.

9 http://www.theicct.org/sites/default/files/publications/ICCT_EU_fuelconsumption2_workingpaper_2012.pdf

Figure 2 Illustration of discrepancy between the test-cycle and real-world emissions; data sourced from TNO[10]



Underlying reasons for divergence

Type approval tests do not require that all energy consuming devices in the vehicle are operating. Therefore the battery does not need to end up at the same state of charge at the end as the beginning, air conditioning does not need to be operated and other energy consuming options turned off. In aggregate these elements can result in a substantial reduction in fuel consumption and CO_2 emissions compared to real driving. As more energy consuming devices are incorporated in vehicle this will lead to a greater absolute divergence. However, the TNO data shows that the absolute divergence is greater for lower emitting cars (it is only around 20g for higher emitting vehicles) so this cannot be explained by only the unmeasured energy using equipment.

As average emissions reduce, any existing absolute divergence will become a higher percentage of the test cycle emissions. In the case of the German data, a 7% divergence in 2001 would be an 8.5% divergence in 2010 for this reason alone.

The vehicle type approval procedure is intended to represent a typical vehicle and driving conditions. Because this part of the procedure is performed on a single vehicle, manufacturers are allowed some flexibility in preparing vehicles and carrying out the tests. These flexibilities can also contribute to the divergence.

Flexibilities

Some examples of the potential flexibilities available cover issues such as:

– Preconditioning;
– Running-in period;
– Test track design;
– Reference mass;

10 http://www.tno.nl/downloads/co2_uitstoot_personenwagens_norm_praktijk_mon_rpt_2010_00114.pdf

– Brakes;
– Wheel and tyre specification, and rolling resistance;
– Tyre pressure;
– Ambient conditions;
– Laboratory altitude (air density);
– Temperature effects;
– Coast down curve or use of default load values;
– Battery state of charge;
– Gear change schedule and definition;
– Driving technique;
– DPF regeneration rates;
– Declared CO_2 value.

The aggregate effect of all these flexibilities if they were all employed to reduce measured CO_2 emissions might be substantial[11].

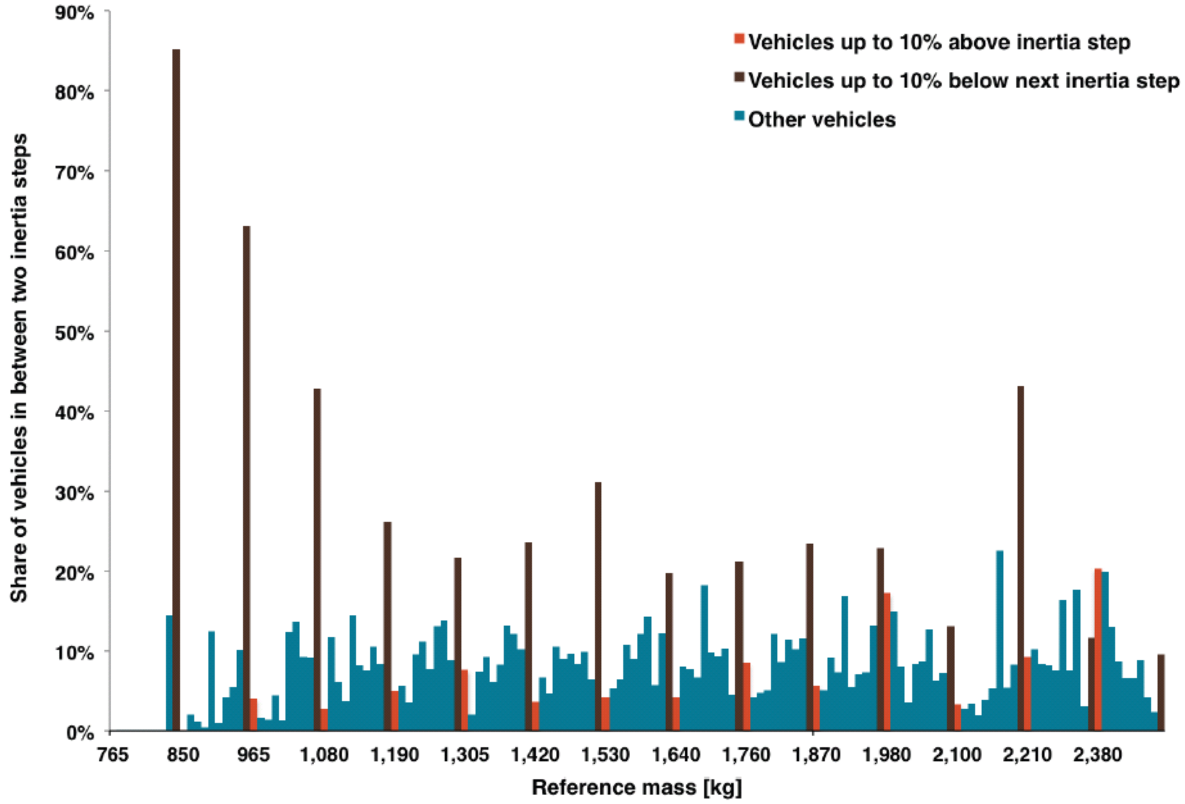
Illustration of the impact of one flexibility

Type approval tests are based on inertia class rather than actual measured mass. It is estimated to provide a few percent benefit to a manufacturer if the vehicle has a mass just below the inertia class threshold rather than being evenly distributed. Actual reported new car mass in 2010 illustrates clear bunching just below the inertia class thresholds as shown in the figure below and analysis shows the likelihood of mass being slightly below the thresholds is five times greater than being just above[12].

11 See for instance: '*Parameterisation of fuel consumption and CO2 emissions of passenger cars and light commercial vehicles for modelling purposes*'; JRC; 2011

12 http://www.theicct.org/sites/default/files/publications/WLTP3_2011.pdf

Figure 3 Distribution of vehicles in between inertia steps



Implications for the review

As shown, there has always been a deviation between test cycle and real world CO_2 emissions. However, the fact that test procedure and real world emissions remain correlated means that using test procedure emissions as a basis for the Regulations is sound. Assumptions about the divergence are incorporated in the modelling carried out by the Commission.

Nevertheless, the increasing divergence between real world and test cycle emissions has implications for the analysis performed. The German data shows that the real world – test procedure divergence has grown from 13g to 27g over the time period against which the car study is carried out (since that is based on a 2002 baseline).

It is not known what proportions of this divergence are due to greater deployment of energy using equipment in cars or to exploitation of flexibility in the test procedures. However, on the assumption that some part of the divergence is due to greater exploitation of flexibilities, it means that part of the progress seen since 2002 has not been delivered through the deployment of technology on vehicles. This with other factors leads to the "*unexplained progress*" when comparing vehicle CO_2 performance with the technologies deployed on them.

The original cost curve produced for the analysis did not take this factor into account. However alternative cost curves (shown in the study as (a) and (c) and referred to in this Impact Assessment as cost scenario 2 and 4) have been prepared that do take account of this. These show lower costs to achieve the targets because less technology is needed. These are described in Annex 7.13.

7.8. Description of the baseline modelling scenario

(1) Business as usual developments up to 2050

Modelling framework

The Commission has carried out an analysis of possible future developments in a scenario at unchanged policies, the so-called "Reference scenario". The "Reference scenario" was used in the impact assessment accompanying *A Roadmap for moving to a competitive low carbon economy in 2050*[13]*,* the impact assessment accompanying the *White Paper - Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*[14] and the impact assessment accompanying the *Energy Roadmap 2050*[15]. The Reference scenario is a projection of developments in the absence of new policies beyond those adopted by March 2010. In order to take into account the most recent developments (higher energy prices) and the latest policies on energy taxation and infrastructure adopted by November 2011, an additional scenario (named Scenario 0 here) was modelled to serve as a business as usual scenario for the present impact assessment.

The business as usual scenario (Scenario 0) is a projection, not a forecast, of developments in the absence of new policies beyond those adopted by November 2011. It therefore reflects both achievements and limitations of the policies already in place. This projection provides a benchmark for evaluating new policy measures against developments under current trends and policies.

Scenario 0 builds on a modelling framework including PRIMES energy model and its transport model (the PRIMES-TREMOVE model), PROMETHEUS and GEM-E3 models. All these models as well as other models used by the Commission in the context of energy-transport-climate modelling are described together with additional information on the website: http://www.euclimit.eu/Default.aspx?Id=2. The starting point for developing Scenario 0 is the "Reference scenario". This "Reference scenario" has already been extensively described in:

- The documentation on the website of DG Energy, Market observatory: *Energy Trends to 2030*[16].
- The impact assessment accompanying *A Roadmap for moving to a competitive low carbon economy in 2050*, which also provides in its Annexes additional information on PRIMES modelling undertaken in the decarbonisation framework.
- The impact assessment accompanying the *White Paper - Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*, Appendix 3 (pages 130-152). The list of policy measures included in the "Reference scenario" is provided in Appendix 4: *Inventory of policy measures relevant for the transport sector included in the 2050 Reference scenario* (pages 153-155).
- The impact assessment accompanying the *Energy Roadmap 2050*, Part A of Annex 1, which describes assumptions, results and sensitivities in many details with respect to the *Reference scenario* (pages 49-97)[17].

13 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2011:0288:FIN:EN:PDF
14 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2011:0358:FIN:EN:PDF
15 http://ec.europa.eu/energy/energy2020/roadmap/doc/sec_2011_1565_part1.pdf
16 http://ec.europa.eu/energy/observatory/trends_2030/index_en.htm

It is thus deemed not necessary to reproduce all information contained in the above listed references, but rather to discuss the common and different assumptions included in Scenario 0 relative to the "Reference scenario" and to provide the most relevant information with respect to the subject of this Impact Assessment.

Due to the detailed structure of the data by transport mode in the PRIMES-TREMOVE model and the lack of statistics, detailed data are not available for periods before 2005 and thus not shown in this section, even if data on aggregated level are shown prior to 2005 elsewhere.

(2) Key assumptions of Scenario 0

The **population** projections draw on the EUROPOP2008 convergence scenario (EUROpean POPulation Projections, base year 2008) from Eurostat, which is also the basis for the 2009 Ageing Report (European Economy, April 2009)[18]. The key drivers for demographic change are: higher life expectancy, low fertility and inward migration.

The **macro-economic** projections reflect the recent economic downturn followed by sustained economic growth. Scenario 0 assumes that the recent economic crisis has long lasting effects, leading to a permanent loss in GDP. The recovery from the crisis is not expected to be so vigorous that the GDP losses during the crisis are fully compensated. In this scenario, growth prospects for 2011 and 2012 are subdued. However, economic recovery enables higher productivity gains, leading to somewhat faster growth from 2013 to 2015. After 2015, GDP growth rates mirror those of the 2009 Ageing Report. Hence the pattern of Scenario 0 is consistent with the intermediate scenario 2 "sluggish recovery" presented in the Europe 2020 strategy[19]. The medium and long term growth projections follow the "baseline" scenario of the 2009 Ageing Report (European Economy, April 2009)[18], which derives GDP growth per country on the basis of variables such as population, participation rates in the labour market and labour productivity.

The population and macroeconomic assumptions used in Scenario 0 are common with those of the "Reference scenario".

Table 4: EU27 growth rates for key Scenario 0 assumption

annual growth rates [%]	2010 > 2020	2020 > 2030	2030 > 2040	2040 > 2050
Population	+0.29	+0.12	+0.00	-0.09
Number of households	+0.65	+0.40	+0.31	+0.23
GDP	+2.21	+1.74	+1.50	+1.45
Household income	+1.91	+1.43	+1.58	+1.55

17 Short-term projections for oil, gas and coal prices were slightly revised according to the latest developments in the Reference scenario as compared to the version used in *A Roadmap for moving to a competitive low carbon economy in 2050.*

18 European Commission, DG Economic and Financial Affairs: 2009 Ageing Report: Economic and budgetary projections for the EU-27 Member States (2008-2060). EUROPEAN ECONOMY 2|2009, http://ec.europa.eu/economy_finance/publications/publication14992_en.pdf . The "baseline" scenario of this report has been established by the DG Economic and Financial Affairs, the Economic Policy Committee, with the support of Member States experts, and has been endorsed by the ECOFIN Council.

19 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF

The **energy import prices** projections in Scenario 0 are based on a relatively high oil price environment and are similar to reference projections from other sources[20,21]. The Scenario 0 price assumptions for the EU27 are the result of world energy modelling (using the PROMETHEUS stochastic world energy model[22]) that derives price trajectories for oil, gas and coal under a conventional wisdom view of the development of the world energy system. The price development to 2050 is expected to take place in a context of economic recovery and resuming GDP growth without decisive climate action in any world region. Prices were derived with world energy modelling that shows largely parallel developments of oil and gas prices[23]. The actual assumed prices for fuel import prices are shown in **Table 5** and resulting end-user prices are shown in **Figure 4**.

Table 5: Energy import prices

$'10 per boe(*)	2010	2020	2030	2040	2050
Oil	85.2	89.0	106.6	116.9	127.6
Gas (NCV)	53.8	62.5	77.1	87.4	99.0
Coal	22.8	28.9	32.8	32.8	33.7

(*) $'10 = U.S. Dollar of year 2010; boe = barrel oil equivalent

Similarly to the "Reference scenario", the **price of the CO_2 emissions allowances** in the EU Emissions Trading Scheme reaches 15 €'10/tCO_2 by 2020 and is further projected to reach and stay around 50 €'10/tCO_2 in period 2040-2050 in Scenario 0. This price evolution is fully consistent with price evolution in Reference scenario used in the impact assessments referenced beforehand.

20 The US Energy Information Administration and the International Energy Agency.

21 Projections for oil, gas and coal prices as used in the "Reference scenario" in the *Energy Roadmap 2050*.

22 http://www.e3mlab.ntua.gr/e3mlab/PROMETHEUS%20Manual/prometheus_documentation.pdf

23 In PRIMES and PRIMES-TREMOVE models all monetary values are expressed in constant terms (without inflation). The economic modelling is based on Euro (€), for which the exchange rate is assumed to depreciate from the higher levels of around 1.4 $/€. Thus there will be a somewhat faster increase in energy prices expressed in Euro if compared to prices expressed in U.S. Dollar.

Figure 4: Fuel prices and taxes in Scenario 0

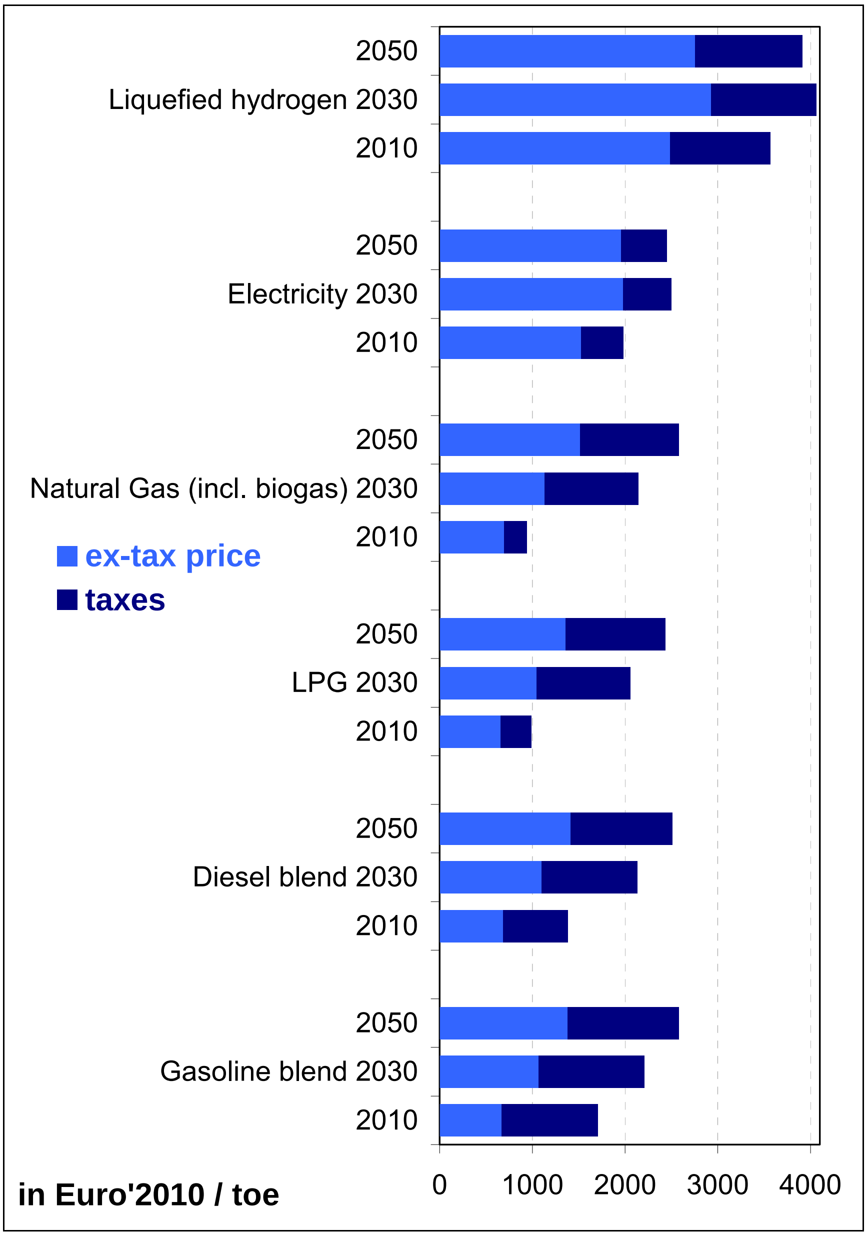


Table 6 lists the policy assumptions which are included in Scenario 0 in addition to the policy assumptions of the "Reference scenario".

Table 6: Additional policy assumptions

Area	Measure	How it is reflected in the model
Efficiency standards	Update of the CO_2 standards for vans according to the adopted regulation[24]	Implementation of CO_2 standards for vans (175 gCO_2/km by 2017, phasing in the reduction from 2014, and to reach 147 gCO_2/km by 2020).
Taxation	Energy Taxation Directive (proposed revision in 2011)	Changes to minimum tax rates to reflect the switch from volume-based to energy content-based taxation and the inclusion of a CO_2 tax component. Where Member States tax above the minimum level, the current rates are assumed to be kept unchanged. For motor fuels, the relationships between minimum rates are assumed to be mirrored at national level even if the existing rates are higher than the minimum rates. Tax rates are kept constant in real terms.
Internalisation of local externalities	Eurovignette Directive (Directive 2011/76/EU)	Introduction of infrastructure charges in Poland (starting with 2011) and the announced introduction of distance based infrastructure charges in Denmark and Belgium (from 2014).
Infrastructure	TEN-T guidelines (revision 2011) and Connecting Europe Facility	Reflected through the increase in the capacity and performance of the network resulting from the elimination of bottlenecks and addition of missing links, and increase in the train length (to 1.5 km) and maximum axle load (to 22.5 tonnes), reflected through decreases in operation costs and time costs and higher load factors for freight.
Internal market	Recast of the first railway package (2010)	Reflected through a reduction of average operating costs for railway undertakings.
Energy import prices		Short-term increase reflecting price evolution up to 2010 as in the Energy Roadmap 2050.
Technology assumptions	Higher penetration of EVs reflecting developments in 2009-2010 national support measures and the intensification of previous action programmes and incentives, such as funding R&D projects to promote alternative fuels.	Slightly higher penetration of EVs. Assumed specific battery costs per unit kWh in the long run: 390-420 €/kWh for plug-in hybrids and 315-370 €/kWh for electric vehicles, depending on range and size, and other assumptions on critical technological components[25].

24 Regulation (EU) No 510/2011 of the European Parliament and of the Council of 11 May 2011, setting emission performance standards for new light commercial vehicles as part of the Union's integrated approach to reduce CO_2 emissions from light-duty vehicles

25 International Energy Agency (2009), Transport, Energy and CO_2: Moving Towards Sustainability.

Figure 5: Real world emissions estimates implementations in Scenario 0

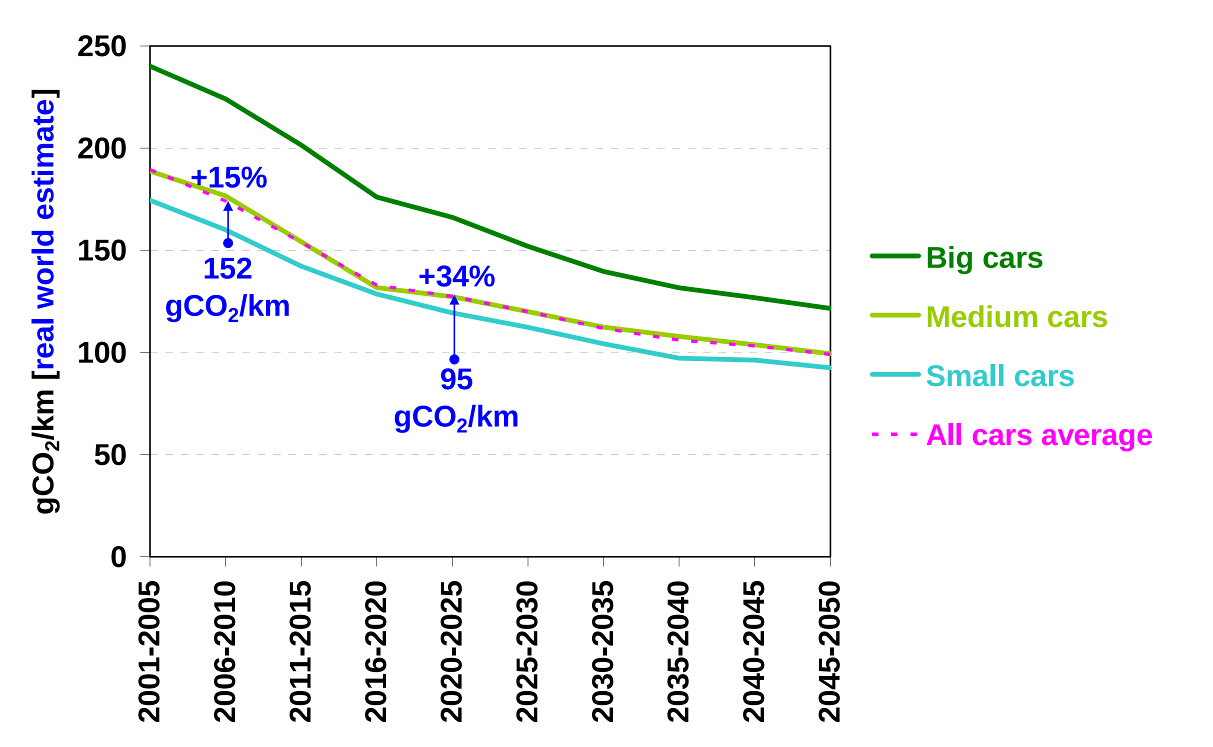
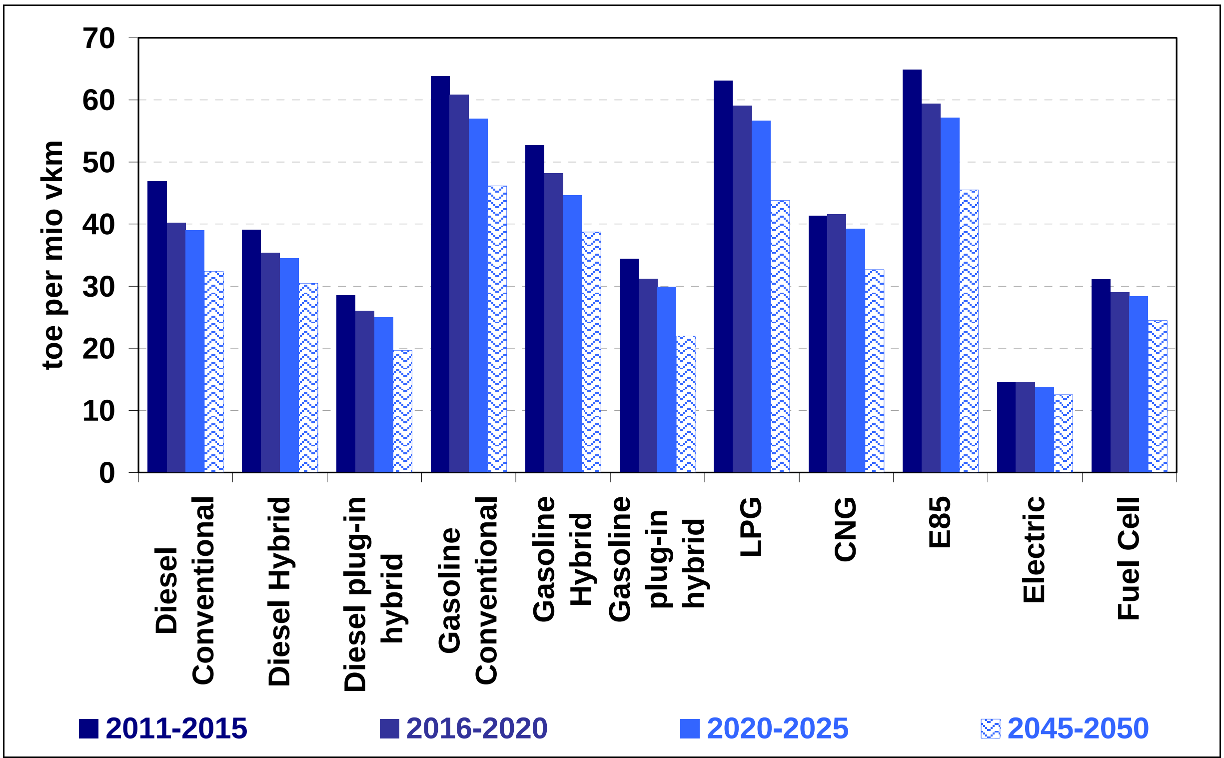


Figure 6: Real world efficiency of new medium sized passenger cars in Scenario 0



(b) Implementation of Regulations (EC) 443/2009 and (EU) 510/2011

Regulation (EC) 433/2009 and Regulation (EU) 510/2011 were discussed and agreed in the co-decision process while the previous modelling framework was updated. Since there were some adjustments to the Regulations before they were agreed, these Regulations might be implemented with some minor deviation from the implementation presented here in the impact assessments which accompany *A Roadmap for moving to a competitive low carbon economy in 2050, White Paper - Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system* and the *Energy Roadmap 2050*.

There is growing evidence of increased discrepancy between test cycle and real world emissions. These are for example described in a JRC study: *Parameterisation of fuel consumption and CO_2 emissions of passenger cars and light commercial vehicles for modelling purposes*[26]. Also real world evidence was documented and analyzed by TNO Industrie en Techniek: *CO_2 uitstoot van personenwagens in norm en praktijk – analyse van gegevens van zakelijke rijders*[27].

Figure 5 shows the discrepancy between estimated real world emissions and the test cycle emissions in Scenario 0 of the PRIMES-TREMOVE model.

Figure 6 shows an example of assumed development in the Scenario 0 of energy efficiency for medium sized passenger cars over time for various technologies. It has to be noted that this is tank-to-wheel efficiency and thus efficiency of the fuel manufacturing is not included. As noted in the impact assessment accompanying the Low Carbon Economy Roadmap: *There is a strong correlation between what can or should be done in the transport sector, and what can or should be done in the power sector if the economy is to be decarbonised, i.e. reduce GHG emissions with around 80%. ... This is due to the impact of electrification itself on both the emissions in the transport sector (a lowering effect on emissions) as well as the power sector (an increasing effect on emissions due to the increased demand for electricity). The sum of emissions from both sectors follows a rather consistent path towards decarbonisation, independent of the scenario chosen. ... in the future all ETS sectors will be impacted by developments in the transport sector, such as electrification, even if the road transport sector is not part of the ETS.* Thus it has to be kept in mind that transport evolution analyzed in our scenario is following the *Ceteris paribus* principle and in our analysis we do not assume any further decarbonisation of other economy sectors than those indicated in Scenario 0.

(c) Scenario 0 results (focusing on cars and vans)

Total **transport activity** is projected to grow in the next 40 years. Even though some decreases were observed recently as a consequence of the recent economic and financial crisis, the recovery foreseen is reflected by transport activity returning to its long-term trends. Road transport is expected to maintain its dominant role in both passenger and freight transport within the EU. Passenger transport by rail is projected to grow faster than passenger transport by road, while the growth rates in road and rail freight transport are expected to be in the long run more similar. Air transport and fast passenger trains are foreseen to grow significantly (and roughly at the same rate) and thus increase their shares in transport demand.

Table 7: Transport activity growth rates in Scenario 0

	2010 > 2020	2020 > 2030	2030 > 2040	2040 > 2050
Activity changes measured in Gvkm				
Road transport	1.35	0.68	0.60	0.38
Public road transport	0.87	0.44	0.41	0.24
Busses	1.76	1.18	0.43	0.22

[26] http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/22474/1/co2_report_jrc_format_final2.pdf
[27] http://www.tno.nl/downloads/co2_uitstoot_personenwagens_norm_praktijk_mon_rpt_2010_00114.pdf

Coaches	0.47	0.07	0.39	0.26
2Wheelers	1.39	1.02	0.60	0.41
Private cars (M1)	1.33	0.69	0.55	0.36
Small cars	1.22	1.10	0.67	0.40
Medium cars	1.93	0.27	0.27	0.22
Big cars	-2.02	1.76	1.80	0.95
Passenger LDV (N1)	1.58	0.78	0.62	0.38
Road Freight Transport	1.46	0.65	0.82	0.52
Trucks (HDV)	1.66	0.53	0.80	0.50
HDV 3.5 - 7.5 tons	1.52	-0.08	1.03	0.43
HDV 7.5 - 16 tons	2.10	0.67	0.63	0.52
HDV 16 - 32 tons	1.57	0.79	0.88	0.49
HDV >32 tons	1.56	0.55	0.62	0.54
Freight LDV (N1)	0.69	1.16	0.99	0.65
Activity changes measured in Gpkm for passenger and Gtkm for freight				
Passenger rail transport	1.87	1.95	1.05	0.72
Freight trains	2.34	1.35	0.78	0.58
Aviation	3.79	2.55	1.50	1.28
Passenger inland navigation	0.96	0.86	0.47	0.31
Freight inland navigation	1.45	1.43	0.56	0.27

As can be seen from **Figure 9**, the **energy use** of cars and vans is projected to continue to decrease between now and 2050, despite increased activity (**Figure 8**). This is due to the observed recent decrease in the efficiency of new cars and vans in the EU as well as the expected effects of the Regulation (EC) 433/2009 and Regulation (EU) 510/2011. The use of alternative fuels (LPG, CNG, electricity and hydrogen) is expected to remain limited in Scenario 0. Their share is foreseen to increase from 3.3% in 2005 to 8.0% in 2050. However this is not mostly due to increases in their energy quantities consumed, but rather due to decrease in gasoline and diesel use. The gasoline/diesel ratio for use in cars and vans (including respective biofuels blends) drops from 1.3 in 2005 to nearly 1 in 2020, but it is expected to rebound back to 1.2 by 2050.

Figure 7: Transport activity of light duty vehicles (cars & vans)

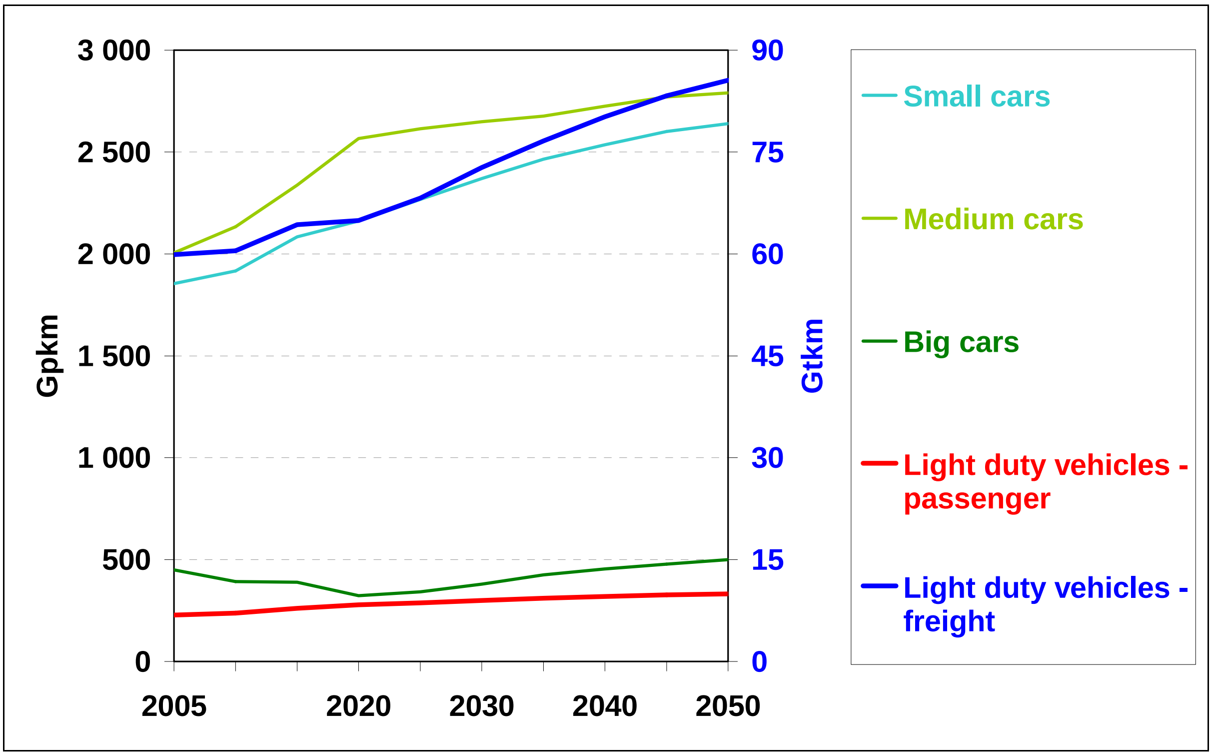


Figure 8: Energy use of light duty vehicles (cars & vans)

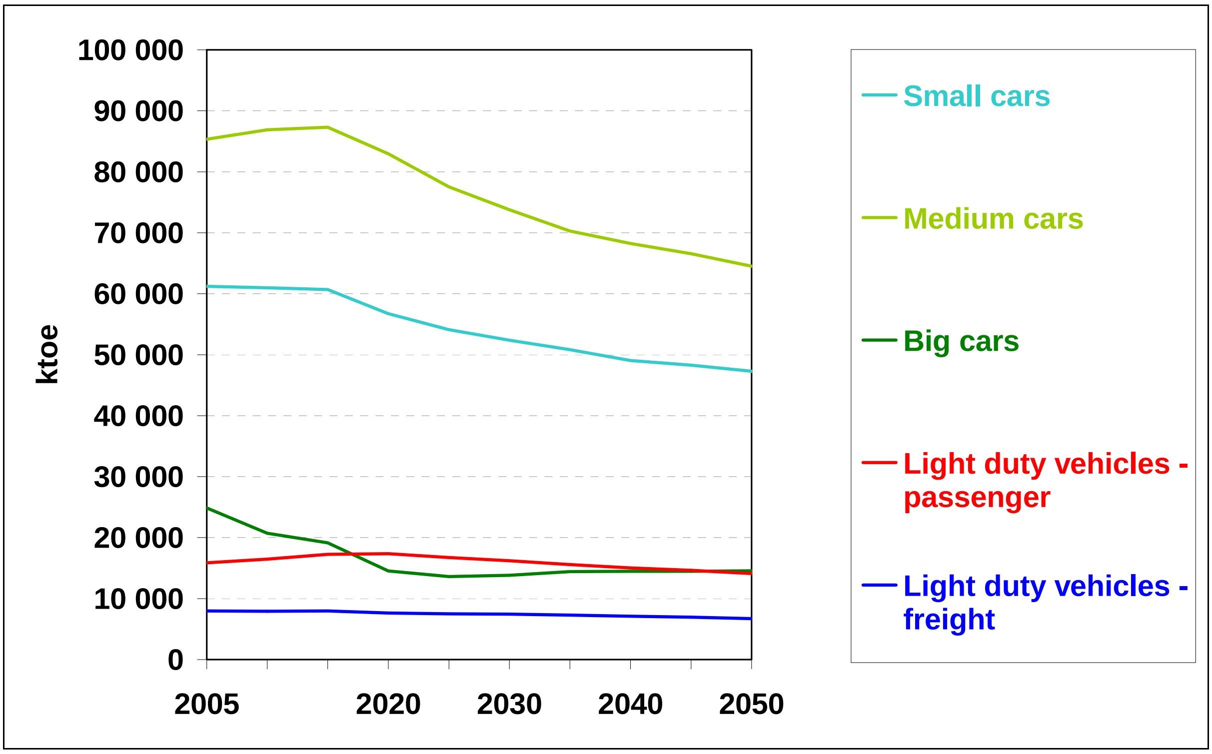


Figure 9: Energy use of light duty vehicles (cars & vans) by fuel

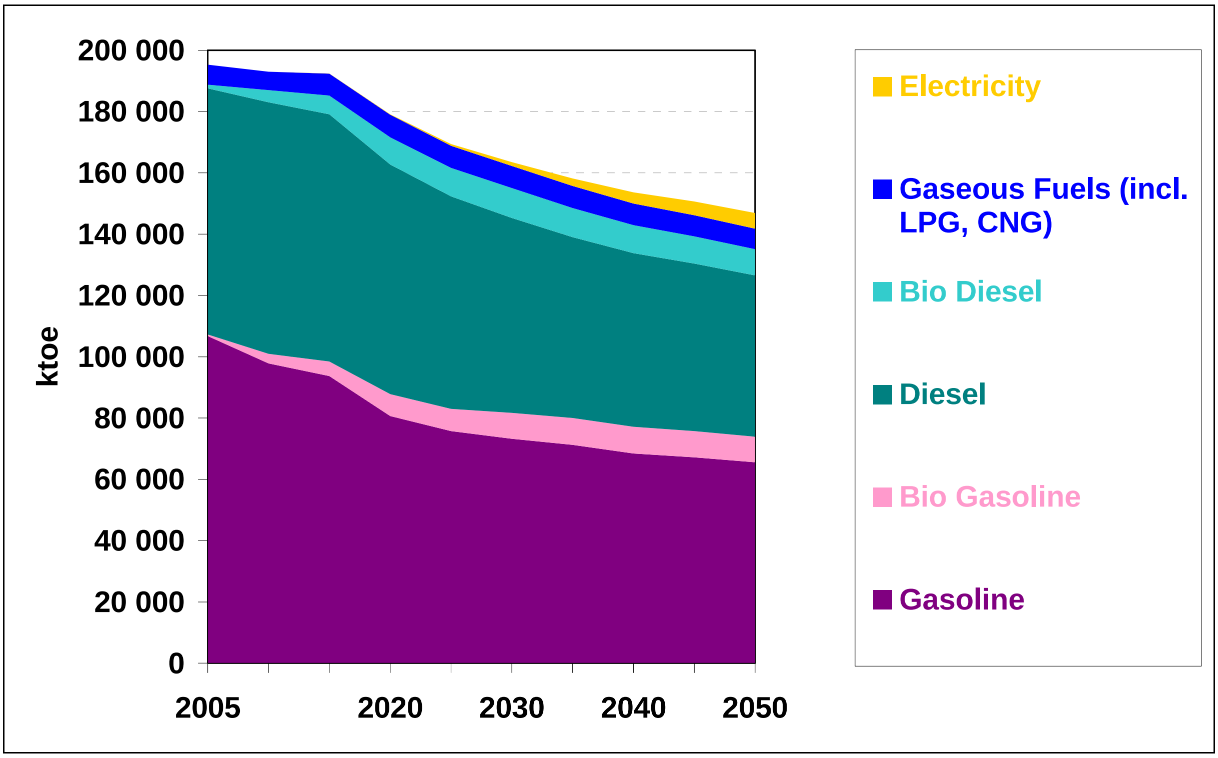


Figure 10: TTW CO2 emissions of light duty vehicles (cars & vans)

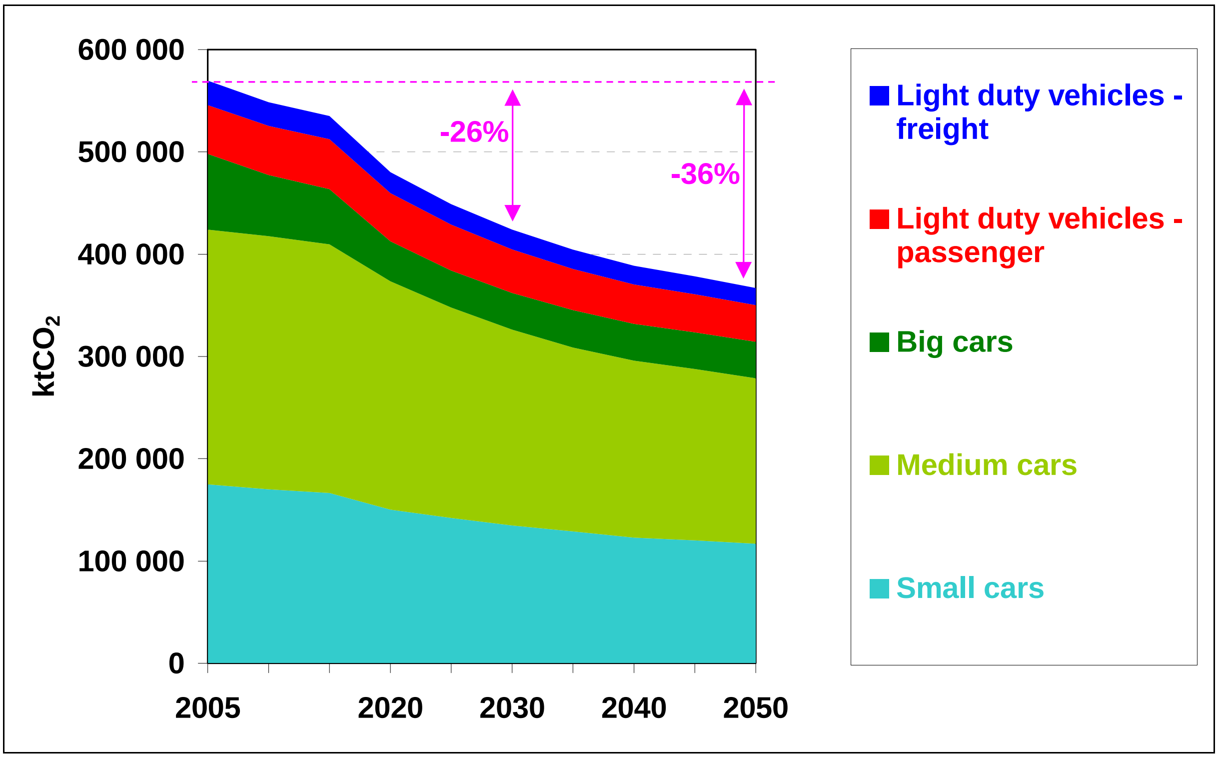
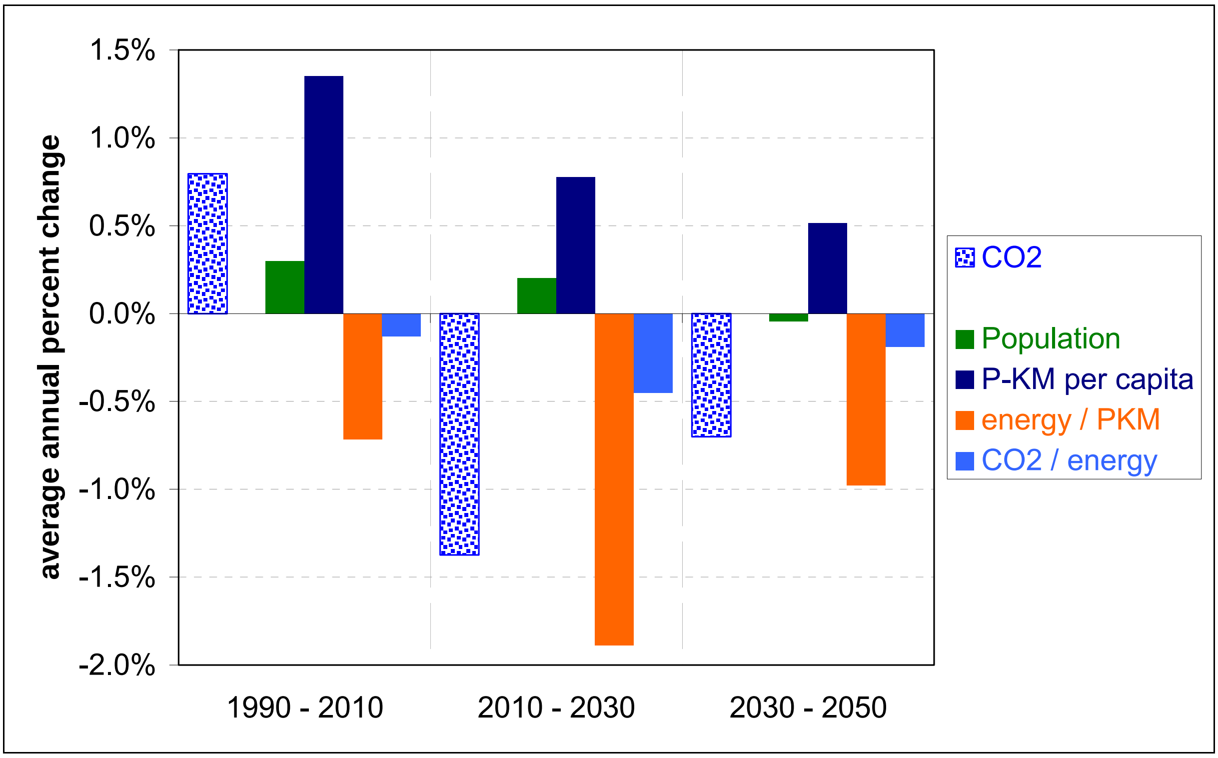


Figure 11: Decomposition of TTW CO2 emissions of cars



Reductions in **CO_2 emissions** (**Figure 10**) are somewhat bigger than reductions in energy use due to the anticipated small increase in the use of biofuels and expect future use of electricity in electric vehicles and plug-in hybrids (these fuels are counted as zero emissions fuels in transport sector as their emissions are accounted elsewhere). Compared to 2005, CO_2 emissions from cars and vans in Scenario 0 are 26% lower in 2030 and 36% lower in 2050. While detailed official historical statistics of CO_2 emissions from cars and vans within road transport sector are not available, estimates suggest that between 1990 and 2005 the CO_2 emissions of cars and vans increased by around 20%. With that in mind, one can roughly estimate CO_2 emissions changes with respect to 1990: in 2030 at around -10% and in 2050 at around -20%.

A **decomposition** of passenger cars CO_2 emissions into the product of population, average annual distance driven per capita, energy per kilometre (approximation for the energy efficiency) and carbon intensity of fuels is shown in **Figure 11** (variant of the Kaya identity). While in the last 20 years (period 1990-2010) the improvements in energy efficiency and carbon intensity of fuels where not able to offset the increases in population and distances driven, as a consequence of the implemented regulations and directives (on vehicles as well as on fuels) some significant improvements can be seen in the period 2010-2030. While several policies have long lasting effects even after 2030, the rate of efficiency improvements and fuel carbon intensity are assumed to slow down significantly (period 2030-2050) in the absence of any additional policy measures.

(3) Scenario 1 - sensitivity: lower efficiency improvements

Scenario 1 is a counter-factual scenario whereby a hypothetical situation without 2020 CO_2 regulation target for cars and vans in place and considerably lower efficiency improvements in cars and vans to those assumed in Scenario 0 up to 2050. Such scenario quantifies how much the 2020 targets and further efficiency improvements bring in terms of energy and CO_2 savings. In **Table 11** the exact rates of improvements in Scenario 0 and Scenario 1 are compared.

While in general the impact on total passenger transport activity is small, modelling results suggest that if there were no regulation standards in 2020 and beyond, there would be more transport activity of big passenger cars replacing some of the medium passenger cars' activity. Some shift to buses could also be observed but it would be very limited (slightly less than 1% additional activity by buses), as the transport by cars is more expensive. One has to keep in mind that Scenario 0 activity increase is slightly above 30% between 2010 and 2050 for passenger cars.

The increase in CO_2 emissions is roughly the same as the increase in energy use, however due to slightly different structure of fuel use there is a minor discrepancy between increased energy use and CO_2 emissions (the gasoline to diesel use ratio for cars and vans in Scenario 0 is 1.21 in 2050, however in scenario 1 this ration is 1.15).

Table 8: Key differences for passenger cars in Scenario 1 compared to Scenario 0

cars	2020	2030	2040	2050
vehicle-km	-0.6%	-0.8%	-0.9%	-1.0%
energy	+6.1%	+11.9%	+15.5%	+18.6%
TTW CO_2	+6.0%	+12.1%	+15.9%	+19.1%

There is no significant direct impact on air pollutant. Air quality standards (EURO) are assumed to be independent of fuel consumptions and CO_2 emissions in the modelling and as total distance driven is not significantly changed and is partly compensated by modal shift to buses, effect on air pollutant emissions is very small.

It is important to note that increased energy costs (fuel spending) in Scenario 1 are directly proportional to energy use increases as the change in fuel use composition is only very minor.

A similar magnitude of changes for light duty vehicles (vans) can be observed as for cars (**Table 9**).

Table 9: Key differences for light duty trucks (vans) in Scenario 1 compared to Scenario 0

vans: all	**2020**	**2030**	**2040**	**2050**
vehicle-km	-0.7%	-1.4%	-1.6%	-1.6%
energy	+2.9%	+8.5%	+14.6%	+17.8%
TTW CO_2	+2.9%	+8.4%	+14.6%	+17.8%
vans: passenger	**2020**	**2030**	**2040**	**2050**
vehicle-km	-0.8%	-1.3%	-1.3%	-1.2%
energy	+2.8%	+8.7%	+15.3%	+18.9%
TTW CO_2	+2.8%	+8.7%	+15.3%	+18.8%
vans: freight	**2020**	**2030**	**2040**	**2050**
vehicle-km	-0.6%	-1.6%	-2.3%	-2.5%
energy	+3.0%	+8.0%	+13.1%	+15.7%
TTW CO_2	+3.0%	+7.9%	+13.1%	+15.6%

Overall we can conclude that implementing 2020 targets for cars and vans saves 27 Mt CO_2 already in year 2020 due to the gradual adaptation of vehicles beforehand (difference in CO_2 emissions in Scenario 1 and Scenario 0). These savings increase to 39 Mt CO_2 in years 2025 and to 49 Mt CO_2 savings in 2030. The cumulative savings in period 2020-2030 can be estimated (based on the modelling results) at around 422 Mt CO_2, which is equivalent to annual CO_2 emission of passenger cars and vans in 2030 in Scenario 0 (424 Mt CO_2). Total cumulative savings in period 2020-2050 are at 1.6 Gt CO_2.

Compared to Scenario 0, the CO_2 emissions of passenger cars in year 2020 are 24.9 Mt CO_2 higher in Scenario 1 (aka in case 2020 targets are not implemented). For vans this difference is 1.3 Mt CO_2 and 0.6 Mt CO_2 for passenger and freight respectively. In 2030 the CO_2 emissions in Scenario 1 are further increased compared to Scenario 0: 43.6 Mt CO_2 for passenger cars, 3.7 Mt CO_2 for passenger vans and 1.6 Mt CO_2 for freight vans.

Table 10: Additional CO_2 emissions in Scenario 1 compared to Scenario 0

Mt CO_2	in year 2020	in year 2030	in period 2020-2030	in period 2020-2050
passenger cars	24.9	43.6	383.6	1 437.2
vans: passenger	1.3	3.7	26.5	140.8
vans: freight	0.6	1.6	11.7	57.8
Total	**26.8**	**48.9**	**421.8**	**1 636.7**

Table 11: Improvements in modelled average efficiency of new vehicle registrations shown by category and decade for the period between 2010 and 2050 for scenario 0 and 1

% p.a.	Scenario 0				Scenario 1			
	10>20	20>30	30>40	40>50	10>20	20>30	30>40	40>50
Small cars								
Diesel Conventional	-1.01	-0.80	-0.52	-0.63	-0.38	-0.18	+0.01	-0.16
Diesel Hybrid	-0.92	-0.60	-0.40	-0.58	-0.35	+0.02	+0.13	-0.03
Gasoline Conventional	-1.80	-0.62	-0.64	-0.08	-0.86	-0.26	-0.20	+0.04
Gasoline Hybrid	-0.77	-0.88	-0.53	-0.07	-0.26	-0.27	-0.03	+0.16
Medium cars								
Diesel Conventional	-2.99	-0.81	-0.53	-0.84	-1.67	-0.49	-0.11	-0.25
Diesel Hybrid	-2.15	-0.60	-0.33	-0.58	-1.24	-0.15	+0.14	-0.06
Gasoline Conventional	-1.39	-1.11	-0.89	-0.76	-0.66	-0.60	-0.27	-0.25
Gasoline Hybrid	-2.07	-1.20	-0.55	-0.45	-1.35	-0.49	-0.03	-0.01
Large cars								
Diesel Conventional	-1.84	-1.27	-0.21	-0.62	-0.96	-0.62	+0.35	-0.24
Diesel Hybrid	-1.69	-0.54	-0.55	-0.58	-0.88	+0.07	-0.02	-0.20
Gasoline Conventional	-1.10	-0.98	-0.88	-0.87	-0.52	-0.65	-0.23	-0.25
Gasoline Hybrid	-2.35	-0.88	-0.46	-0.52	-1.32	-0.45	-0.02	-0.03
Light duty vehicles-passenger								
Diesel Conventional	-1.11	-1.22	-0.84	-0.54	-0.45	-0.31	-0.22	-0.11
Diesel Hybrid	-1.19	-1.03	-0.81	-0.50	-0.50	-0.03	-0.20	-0.14
Gasoline Conventional	-0.89	-0.55	-0.64	-0.69	-0.36	-0.21	-0.23	-0.18
Gasoline Hybrid	-1.46	-0.80	-0.58	-0.54	-0.92	-0.24	-0.14	-0.02
Light duty vehicles-freight								
Diesel Conventional	-1.12	-1.18	-0.87	-0.56	-0.47	-0.28	-0.25	-0.14
Diesel Hybrid	-1.14	-1.10	-0.84	-0.52	-0.49	-0.12	-0.22	-0.15
Gasoline Conventional	-0.88	-0.35	-0.60	-0.61	-0.31	+0.02	-0.18	-0.13
Gasoline Hybrid	-1.21	-0.52	-0.51	-0.55	-0.66	+0.00	-0.06	-0.07

7.9. Impacts on competitiveness

Introduction

In analysing impacts on competitiveness a distinction should be made between different affected sectors and different markets. There may be an effect on the competitiveness of European businesses, relative to each other or to companies from outside the EU, on the European market and on other, global markets. Impacts on competitiveness may be viewed from the perspective of the European economy as a whole based on the competitiveness of European companies on global markets.

Overall economic impacts, as discussed in chapter 5, do not directly lead to impacts on competitiveness. To analyse these it needs to be assessed, for different categories of companies, whether various economic impacts are different for different companies operating on the same market.

All affected sectors will be discussed but the focus of this annex will be on competitiveness impacts in the automotive sector.

This annex first identifies the sectors which are possibly affected. Then an assessment is given of impacts with respect to general drivers that may affect competitiveness. In addition to that impacts on the capacity of affected companies to innovate are assessed. Based on these general evaluations and additional information from available studies the impacts on competitiveness of businesses in different affected sectors are analysed in more detail. After that specific attention is paid to impacts on SMEs.

Which are the affected sectors?

The main sectors directly affected are light duty vehicle manufacturers and component suppliers. These sectors need to develop and apply new technologies in order to reduce the CO_2 emissions of new passenger cars and light commercial vehicles. Many of the technologies included in the cost curves for 2020 are already available today and are being applied or are starting to be applied in production vehicles. The main actions required by the vehicle manufacturers and component suppliers therefore are to further increase the technical and commercial maturity of new technologies required to meet the 2020 targets and to timely develop vehicles in which these technologies are applied to the required extent.

There may be an effect on the competitiveness of European businesses in the automotive manufacturing sector, relative to each other or to companies from outside the EU, on the European market and on other, global markets.

Indirect impacts on other sectors in the vehicle manufacturing supply chain might e.g. arise due to demand for different materials.

While there may be economic impacts on car dealers and distribution networks (e.g. through pressure on dealer margins) it is not expected that their mutual competitiveness will be directly affected. Indirect effects could result from the impacts of the implementation of the 2020 targets on the car manufacturers represented by these dealers, but such effects are not considered intrinsic to the nature of the regulation.

Indirect impacts on sectors outside the supply chain are likely to be mainly felt in the fuel supply sector and in sectors using light duty vehicles.

The competitiveness of companies in the fuel supply sector might be affected as a result of the reduction in fuel consumption.

Users of passenger cars and light commercial vehicles will generally benefit from the lower total cost of vehicle ownership. This is especially the case for light commercial vehicle users, where the payback period of the additional vehicle costs associated with applying CO_2-reducing technologies is very short. These changes will lead to further indirect impacts as costs of using energy and of carrying out the transport elements of business will decrease. This is not expected to affect the competitiveness of companies competing on the European market, but may to some extent benefit the global competitiveness of internationally operating companies and of the European economy as a whole.

Overall changes in the price of passenger transport by car and goods transport by LCVs could affect the competitiveness of road transport relative to suppliers of alternative forms of passenger mobility or goods transport. This could result in modal shifts.

Overview of the affected sectors

The automotive industry is one of Europe's key industrial sectors, and its importance largely derives from its linkages within the domestic and international economy and its complex value chain. In 2007, the automotive sector had a turnover of over €780 billion[28] and value added in the automotive sector amounted to around €140 billion, representing about 8% of European manufacturing value added. The sector directly employs more than 2.3 million people (or around 6% of manufacturing employment) and is responsible in total for more than 12 million jobs across Europe, about 5.5% of EU-27 employment. Most of the employees (ca. 60-70%) are engaged in skilled (or semi-skilled) manual work, while 30-40% are trained professionals or technicians (e.g. engineers, business and sales specialists, IT, quality control, marketing, management).

Automotive industry employment in manufacturing is particularly important in Germany (≈ 13% of manufacturing employment), Sweden (≈ 9%) and in France, Belgium, the Czech Republic and Spain (≈ 8% each). Before the financial crisis, there had been a trend of increasing employment in the automotive sector in the new Member States, where some manufacturers have been installing substantial additional production capacity, while declines have been observed in some EU-15 countries. New Member States offered location advantages based on their skilled labour, lower labour costs and tax policy, which, combined with the EU regulatory framework context and proximity to major markets, led to a high level of automotive-related investment into the region. In recent years most of investment in new EU production capacity was in the new Member States.

A decline in demand and production since mid-2008, due to the financial crisis, brought a significant number of job cuts. The industry has strived to preserve its core and most-skilled staff by reducing its temporary and agency workforce and short-term measures (temporary shut-downs, shorter working weeks, salary cuts, voluntary departures and early retirement). In the first quarter of 2009, a net loss of more than 21,000 jobs in the sector was reported following a net loss of almost 32,000 in the last quarter of 2008. It should be noted that although these figures are heavily impacted by the crisis they also reflect the restructuring effort undertaken by the industry. Recent statistics, such as those in the European Competitiveness Report 2011, have indicated that market conditions improved in 2010 with a subsequent increase in production following the decline in the previous two years.

The number and distribution of firms in the automotive sector including the share of SMEs

The automotive sector can be divided into suppliers (who, in turn are split into different "tiers" depending on the complexity of the contribution to the automotive product) and Original Equipment Manufacturers (OEMs, who are responsible for the final product itself).

[28] Unless otherwise highlighted, figures in the following sections are taken from the DG Enterprise and Industry 2009 study on competitiveness of main industrial sectors entitled: *European Industry in a Changing World Updated Sectoral Overview 2009*

Supply chain management (process innovation) is one of the key strengths of the European automotive industry and major European suppliers are among the world leaders.

Typically, about 75% of a vehicle's original equipment components and technology are sourced from the automotive suppliers. According to CLEPA (the European Association of Automotive Suppliers), the supplier sector includes some 3000 companies, of which 2500 are SMEs employing over 3 million people. European suppliers are recognised as world leaders in technology and innovation, particularly in electronics, powertrain and driveline components. The automotive value-chain provides an important outlet for sectors such as mechanical and electrical engineering, electronics, steel, metal-working, chemicals and rubber. It is estimated that for €1 of value added by the automotive industry itself, supporting industries generate approximately €2.7 of additional value added.

The automotive aftermarket consists of approximately 665,000 companies[29], the vast majority of which are SMEs and employs approximately 3.5 million people and provides around €82 billion worth of components (spare parts, tyres, accessories, etc.). EU motorists are estimated to spend around €140 per year on components and services for passenger cars.

Labour productivity or total factor productivity

In 2010, the European automotive industry produced about 16.4 million cars and light commercial vehicles, equivalent to about 27% of total production worldwide (15 million of which were cars). The sector has on average produced 16.4 million passenger light duty vehicles over the period 2008-2010, which, considering that this covers the financial downturn, is an indication of overall strength and robustness.

For the recent past, it is difficult to disentangle the evolution of the industry from the effects of the economic downturn. In view of this the figures given below for the period 2005-10 should be treated with caution since they cover the period of extreme turbulence.

- Average annual growth rate of employees was -2.4%.
- Average annual growth rate of hours worked was -2.6%.
- Average annual growth rate of labour productivity per person employed, which measures output divided by the number of people employed was 1.4%.
- Labour productivity per hour worked average annual growth rate was 1.5%.
- Average annual growth rate of unit labour cost, which measures the average cost of labour per unit of output was 0.3%.

Market share of the world market

In 2007, the EU automotive industry held a global market share of about 27% and this remains relatively stable. Exports and imports vary but in 2010 it was estimated that EU-27 car exports amounted to €83 billion and imports €26 billion, giving a trade surplus of €57 billion[30]. Germany is by far the biggest vehicle exporting EU Member States, and is responsible for around half of the EU total. In 2008, only Japan exported more cars than the EU.

In terms of car trade the four main partners with which the EU has a surplus are NAFTA, EFTA, China and the Middle East. In 2009, more than 40% of EU car trade surplus came from EU exports to NAFTA, 21.4% to EFTA, 19.7% to China and 12.4% to the Middle East. Japan is the fifth largest destination of EU exports (5.6%) but is also the EU's biggest car trade deficit (€ -5.2 bn), as EU imports are about five times its exports. Other trading partners

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29 According to CECRA (customer services, repair and servicing, spare parts, accessories and tuning) statistics

30 EUROSTAT statistics.

with which the EU car trade balance is in deficit are South Korea (€ -1.8 bn), India (€ -1.4 bn) and Turkey (€ -1.2 bn), as its imports are 3, 15 and 1.5 times higher than the value of its exports to those countries.

Within the EU significant net exporters are Germany, France and Spain, whereas net importers are UK and Italy. Germany produces about 50% more vehicles than it sells domestically, while Italy has been producing about half the number of units sold in the country. Central and Eastern Europe countries have been producing about 11 vehicles for every 10 consumed in their markets (Czech Republic, Slovakia and Poland produce each at least twice as many vehicles as consumed domestically). However, due to the important and intensified international division of labour along the value chain, especially within the European Single market, the story-line behind production and trade figures is much more complex. Indeed, it is estimated that for car manufacturers in bigger EU countries such as Germany, France or Italy about 40% (in value terms) of the components of a car assembled has been imported, 25% of which from other EU countries. For manufacturers in smaller countries, this share is estimated to be significantly higher.

The revealed comparative advantage index, which compares the share of a given industry's exports in the EU's total manufacturing exports with the share of the same industry's exports of a group of reference countries, was 1.22 in 2007 and 2008 and 1.3 in 2009. In comparison, the revealed comparative advantage index in the USA in 2009 was 0.96 and in Japan was 2.13. An RCA index greater than one indicates that the EU vehicle manufacturing industry continues to be very competitive at an international level. The implementation of the 2020 targets is unlikely to change this position.

In the long-term, European manufacturers are therefore well placed to take advantage of any market opportunities and Community trade policy plays a supportive role in terms of enabling fair market access. In terms of market share, production volumes, value added, employment levels and net trade position, the industry has maintained its global competitiveness in recent years. The EU has traditionally enjoyed a significant trade surplus in automotive industry products and it is not expected that the 2020 targets will impact on this.

Foreign Direct Investment (ratio of inward/outward FDI stock to value added)

In 2008, Eurostat estimated that the level of inward FDI (stocks), which measures the direct investment from outside the EU in the EU27 in respect of vehicles and other transport equipment to be €22.9 billion. The outward investment, which indicates the level of investment of EU companies in foreign markets, was estimated to be €60.4 billion.

<u>Indirectly affected sectors</u>

Indirect impacts on sectors outside the supply chain are likely to be mainly felt in the fuel supply sector and also by vehicle users who will benefit from lower total cost of ownership. These changes will lead to further more indirect impacts as the cost of energy and the transport elements of business decrease.

Fuel supply sector[31]

In terms of the fuel supply sector, the two main types of enterprises which will be affected are filling stations and fuel refineries. In 2006 there were around 74,000 enterprises classified as retail sale of automotive fuel in the EU-27, less than 10% of all motor trade enterprises (which includes the wholesale, retail sale and repair of motor vehicles and motorcycles, as well as the retailing of automotive fuels and lubricants). These enterprises generated €178 billion of turnover, from which resulted €14 billion value added, 13.4 % and 8.6 % of the motor trades

[31] Source of figures on the retail sale of fuel - EUROSTAT

total respectively. The sector employed half a million people, 11.8 % of the motor trades workforce. Contributions from some Member States (e.g. France) may be low, due to a large proportion of fuel being sold through service stations that belong to retailers classified under retail trade rather than retailing automotive fuels.

The pattern of turnover for the retail sale of automotive fuels in the EU-27 was less steady than motor trade as a whole, particularly between 1998 and 2005. The retail sale of automotive fuels grew strongly to 1999 flattened out from 2000 to 2002, at a time of continued growth across motor trades as a whole. This was followed by much stronger growth through to 2005. However oil prices changes should be taken into account when analysing these findings, as the volume of automotive fuel may have fallen while sales in value terms rose (due to significant price increases).

In 2006 there were around 1100 enterprises classified as concerned with fuel processing and the refining of petroleum products in the EU 27, of these around 100 are refineries. Turnover was estimated to be around €476 billion with around €30 billion value added. Over 128,000 people were employed in the sector. Between 1997 until 2007 average growth for the refined petroleum products sector was 0.8% per year.

It is likely that implementing the 2020 targets will impact negatively on the fuel supply sector due to a lower demand for fuel. However, in the case of the filling stations, there is a trend of steadily reducing numbers of filling stations and increasing diversification with a major part of their revenues coming from activities other than selling fuel. Modelling indicates a reduction in demand for fuel resulting from the impact of the 2020 targets of up to 15% by 2030. However, there is no evidence to suggest that this will lead to a proportionate decline in turnover and employment in relation to filling stations and refineries.

What is the overall effect on cost and price competitiveness?

The impacts on costs are extensively discussed in chapter 5 of the main text. The total impact on costs comprises changes in the costs of manufacturing vehicles, possible additional compliance costs for manufacturers and changes in the usage costs of vehicles, mainly associated with possibly increased purchase prices and reductions in fuel consumption.

Does the assessed proposal cut or increase compliance costs of the affected sector(s)?

There is not expected to be any additional costs of compliance with the legislation over and above those associated with the development and application of the technologies required to meet the CO_2 target.

Existing legislation already contains monitoring provision so there are not expected to be any additional costs associated with this. No new monitoring equipment is needed and no additional staff time or business services are needed. No enterprises or sectors are at a disadvantage under the existing monitoring provisions. Derogations do give slightly different monitoring and reporting requirements but are judged to not be distortive of competition.

Does the proposal affect the prices and cost of intermediate consumption?

Intermediate consumption is an accounting flow which consists of the total monetary value of goods and services consumed or used up as inputs in production by enterprises, including raw materials, services and various other operating expenses. A distinction needs to be made between impacts on the amount of intermediate consumption (amount of products or services used in production) and the costs or price of intermediate consumption (cost or price of a given product or service used in production).

For vehicle manufacturers the amount of intermediate consumption is expected to increase relative to a situation without the implementation of the 2020 targets. A significant part of the additional technologies to be applied to new vehicles is likely to be purchased from suppliers. Whether this leads to a net increase in the cost of intermediate consumption depends on the extent to which additional technology costs are compensated by reductions in the costs of other supplied products and services due to other drivers. As part of the applied technologies (e.g. advanced transmissions or hybrid propulsion systems) may also provide added value to the user the gross added value may increase. If manufacturers are able to increase the sales price accordingly an increase in the cost of intermediate consumption, therefore, does not necessarily lead to an increase in the share of intermediate consumption in the gross turnover.

For sectors that use vehicles the costs of intermediate consumption are expected to decrease as the net cost of using vehicles decreases. As indicated earlier, however, this impact is considered to be small or negligible.

Does the proposal affect the cost of capital?

As the implementation of the 2020 targets does not directly affect the financial sector, there are no direct effects to be expected on the cost of capital. Indirect impacts could occur if the proposed legislation would lead to drastic (i.e. sudden or very large) changes in the need for investment capital by automotive manufacturers, suppliers or other affected sectors or if the risks associated with providing such investment capital would increase.

As there will be an acceleration in innovation and the application of new technologies an increased demand for investment capital is to be expected. However, compliance only involves the introduction and gradual increase in the level of application of additional technical adaptations in vehicles. It does not require major restructuring of the automotive sector's operations or structure.

There are no negative impacts expected on the demand for passenger cars and vans. Also, meeting the 2020 targets does not yet require large investments in alternative technologies such as electric, plug-in hybrid or fuel cell vehicles for which the market success is still uncertain. The additional investments therefore are not expected to increase the risk for financial institutions to provide investment capital.

As a consequence, and given the long lead time, there is no reason to believe that the implementation of the 2020 targets will lead to significant impacts on the cost of capital.

Does the proposal affect the cost of labour?

The only possible changes in the cost of labour would be those resulting from the additional or new labour demand (e.g. due to new skills requirements). In the automotive R&D departments there may be some shift in competences from mechanical to electrical engineering, but if shortages in new engineering disciplines would affect wages the impact on average labour costs for vehicle manufacturing of the manufacturing industry in general would be small. As far as requirements for labour skills in the actual manufacturing of components and vehicles are concerned, no significant deviations from the existing situation are expected.

As the implementation of the 2020 targets does not affect labour law or labour conditions, there would be no additional compliance costs related to employment.

Does the proposal affect the cost of energy?

The objective of the proposals is to reduce CO_2 emissions. The implementation of the 2020 targets does not directly affect the costs of producing energy carriers for the transport sectors or for other sectors. Achieving the CO_2 reduction goal, however, will indirectly reduce energy use. This will have a dampening or even lowering effect on energy prices, which will be beneficial to the transport sector as well as to other sectors.

Does the policy proposal affect consumer's choice and prices?

The proposals will not limit consumer choice directly. Cost assessments as presented in section 5 are carried out under the assumption that CO_2 emission reductions are achieved without affecting the performance of vehicles and the distribution of new vehicle sales over different marketing segments, and show that meeting the targets set in the proposals is technically and economically feasible without violating this assumption.

In their strive to meet the targets in a cost-optimal way manufacturers, however, may decide to adjust their product portfolio, and e.g. terminate production of specific types of vehicles or reduce the performance of specific models. But the implementation of the 2020 targets as such is technology neutral and does not prevent the placing on the market of any particular type of vehicle.

Companies using vehicles are likely to benefit indirectly since their costs of vehicle operation are expected to decrease.

In TNO et al. 2011[32] assessments have been made of the impact on vehicle prices relative to a reference situation without the 2020 targets. Compared to such a reference the implementation of the 2020 targets will increase costs of manufacturing vehicles and is thus in the end expected to lead to increased vehicle prices, as increased costs can only temporarily be absorbed by manufacturers and at some point need to be passed on to consumers. Price impacts of the 2020 targets, however, are superimposed upon autonomous price trends. As discussed in chapter 14 of TNO et al. 2011, there are a multitude of drivers that tend to have a downward effect on the price of cars. The net impact of regulation on the price of vehicles depends on the ratio of the additional manufacturing costs and the cost reductions due to other drivers, whereby the cost of applying CO_2 reducing technologies might even enhance the strive for achieving cost reductions. Recent evidence shows that while CO_2 emissions have been consistently declining over the last decade, so have vehicle prices. Public information from vehicle manufacturers suggests that vehicle prices have may also not increase in real terms as a result of the implementation of the 2020 targets.

Would the impacts above require a major restructuring of affected enterprises' operations?

For some of the technologies that are expected to be applied in some innovations in production processes may be necessary. But there is no reason to believe that any major restructuring of the automotive industry's operations would be required.

Effect on enterprises' capacity to innovate?

The automotive sector invests significantly in R&D. According to the 2011 EU Industrial R&D Investment Scoreboard the R&D expenses of European automotive manufacturers were just over €21 billion in 2010, 4.4% of their turnover. According to CLEPA, component suppliers invest about €15 billion in R&D, which is approximately 5% of turnover and receive the majority of the patents. This is complemented by investments in the production process and fixed assets amounting to over €40 billion per annum. European automotive firms are leaders in some transitional drive-train and fuel technologies and are investing in ground-breaking technologies, such as battery-powered hybrid vehicles, electric vehicles and hydrogen. As products are becoming increasingly complex from a technological point of view (e.g. the role of electronics), the industry is focusing increasingly on advanced, high technology products which necessarily rely on a highly skilled workforce.

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32 Support for the revision of Regulation (EC) No 443/2009 on CO_2 emissions from cars, Service Request #1, carried out by TNO, AEA, CE Delft, IHS Global Insight, Ökopol, Ricardo and TML under Framework Contract No. ENV.C.3./FRA/2009/0043. Final Report, November 2011. See: http://ec.europa.eu/clima/policies/transport/vehicles/cars/docs/study_car_2011_en.pdf

Overall the implementation of the 2020 targets promotes innovation and may as such be expected to increase rather than decrease the automotive sector's capacity to innovate. The issues are what the size of the additional demand for innovative capacity is that the regulation requires, whether the sector will be able to mobilise this in time, or whether increased focus on innovation with respect to efficiency improvement and CO_2 emission reduction would go at the expense of innovation in other important areas.

A significant proportion of this R&D will already be related directly or indirectly to measures reducing CO_2 emissions. This proportion may increase in future. However, given the rates of CO_2 reduction in the passenger car sector over the last decade (approximately 2% per year) and the projected ongoing rate of reduction needed to meet the target (approximately 3% per year) it seems unlikely that the amount of R&D required will exceed the existing capacity of the industry. Without expansion in R&D capacity the increased need for R&D into CO_2 reducing technologies, could require some shift in priorities of R&D departments at the expense of other innovations.

There is no evidence of a shortage of skills needed either for the development of the technologies required or for their application in vehicle production. There does not appear to be any issue relating to IPR protection specific to the automotive sector.

The automotive sector is constantly innovating its products. Marketing new vehicle types and new technologies forms a key aspect of encouraging vehicle purchase. This will continue and as a part of this trend CO_2 reducing technologies will be incorporated in a somewhat higher pace than before.

Overall it is considered that the additional demand for innovation with respect to CO_2 reducing technologies can be catered for within the industry's R&D capacity or by a manageable increase in this capacity.

Distribution, marketing and after-sales services are also well developed in the automotive sector and the necessary management and organisational skills and talents are demonstrably available and are expected to be able to adequately deal with the new technologies applied to reduce CO_2 emissions of vehicles.

In the on-line consultation, 72% of stakeholders and 83% of individuals supported the view that EU regulation of road vehicle emissions stimulates innovation in the automotive sector and helps keep Europe's automotive industry competitive. It is likely that the sector will continue to invest in similar levels of R&D to remain competitive and to develop more efficient vehicles.

<u>What is the effect on the competitiveness of car manufacturers?</u>

As discussed in section 5 there will be different impacts on different manufacturers. The additional manufacturer costs per vehicle for meeting the manufacturer specific target depend on a manufacturer's historical average CO_2 emissions (the 2002 resp. 2010 baseline) and on its product portfolio (division of sales over different segments).

Differences in the costs for meeting the 2015 / 2017 targets for cars and vans respectively are dominated by differences in the distance to target for different manufacturers, as their starting points were very different. In moving from the manufacturer average values in 2015 / 2017 for cars and vans to the manufacturer specific 2020 targets the differences in distance to target are greatly reduced. How much an individual manufacturer needs to reduce between 2015 / 2017 and 2020 depends on the choice of utility parameter and on the position (determined by target level and slope) of the utility based limit function for the 2020 target relative to the limit function for the 2015 / 2017 targets.

As a result of the non-linearity of the cost curves for CO_2 reduction, however, manufacturers which need to achieve similar relative reductions between 2015 / 2017 and 2020 may see markedly different costs depending on the amount of CO_2 reducing technologies they already had to apply in order to achieve their 2015 / 2017 targets. For manufacturers with a larger distance to their 2015 / 2017 target the additional vehicle costs for moving from the 2015 / 2017 target to the 2020 target will generally be higher. This results in a longer payback period (or higher increase / lower reduction of the total cost of ownership- TCO) for the users of their vehicles and thus a reduced attractiveness of these vehicles compared to products from other manufacturers. Changes in TCO can thus be a basis for assessing impacts of the implementation of the 2020 targets on mutual competitiveness of car manufacturers on the EU market.

In principle therefore the implementation of the 2020 targets may affect the mutual competitiveness of vehicle manufacturers on the European market. Such changes in mutual competitiveness may in turn affect the extent to which different companies are able to pass through the costs of additional technologies applied to meet the 2020 target. This impacts on the profitability of automotive manufacturers and may more indirectly also affect their competitiveness on global markets.

Figure 12 Change in TCO for the passenger car end user in the first five years of vehicle use with reference mass as utility parameter[33]

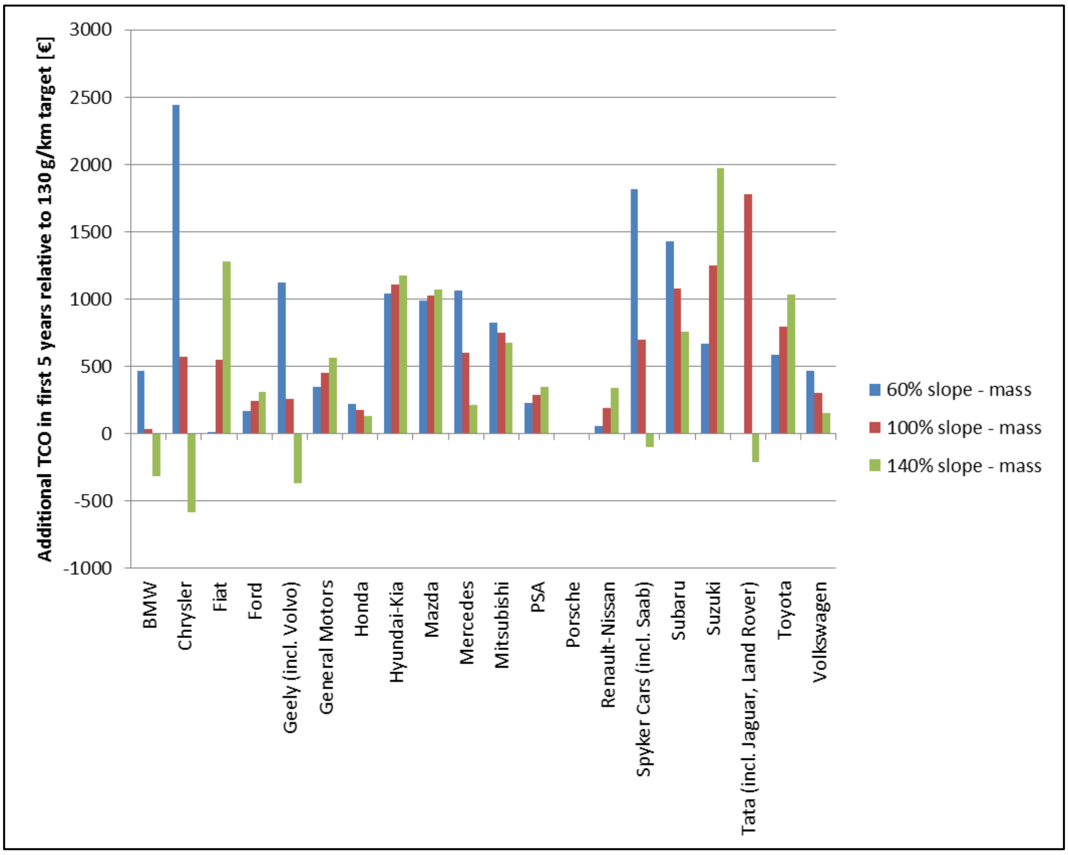


Figure 12 shows the change in TCO of passenger cars marketed by different manufacturers as a result of moving from their 2015 targets to the manufacturer specific targets for 2020 based on mass as utility parameter. Figures are based on the increased vehicle price minus the net

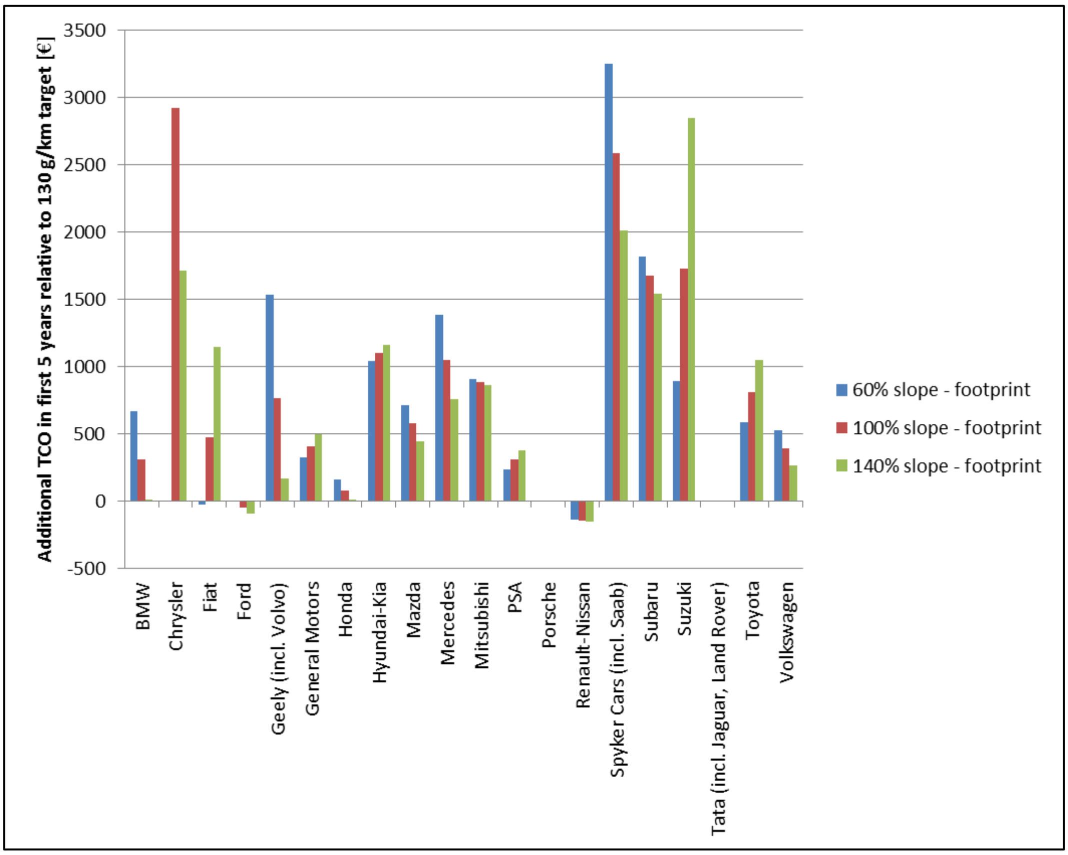
33 The oil price assumed is $ 120/barrel with an annual mileage for petrol vehicles of 14,000 km and 16,000 km for diesels. A factor of 1.195 is used to convert TA emissions into 'real world' emissions and the mark-up multiplication factor used to determine the vehicle price increase from the additional manufacturer costs is 1.235.

present value of the fuel cost savings achieved in the first 5 years. Generally the payback time of the additional vehicle price is shorter than the vehicle lifetime (see **Figure 16**), leading to net lifetime cost savings. But for this example savings over a shorter period are included to reflect consumer myopia, which generally leads to an increased TCO.

For mass as utility parameter changes in TCO are generally larger for Japanese and Korean manufacturers (with the exception of Honda) than for European manufacturers. TCO changes for manufacturers with a product portfolio focussing on smaller or larger cars are very sensitive to the slope of the limit function. TCO changes for BMW are markedly lower than for Mercedes. The mutual competitiveness of more mainstream manufacturers such as Ford, GM, PSA and Volkswagen is not significantly affected.

Following the same approach **Figure 13** presents the change in total cost of ownership of passenger cars from different manufacturers for a 2020 targets based on footprint as utility parameter.

Figure 13 TCO difference for the passenger car end user in the first five years of vehicle use with footprint as utility parameter[33]



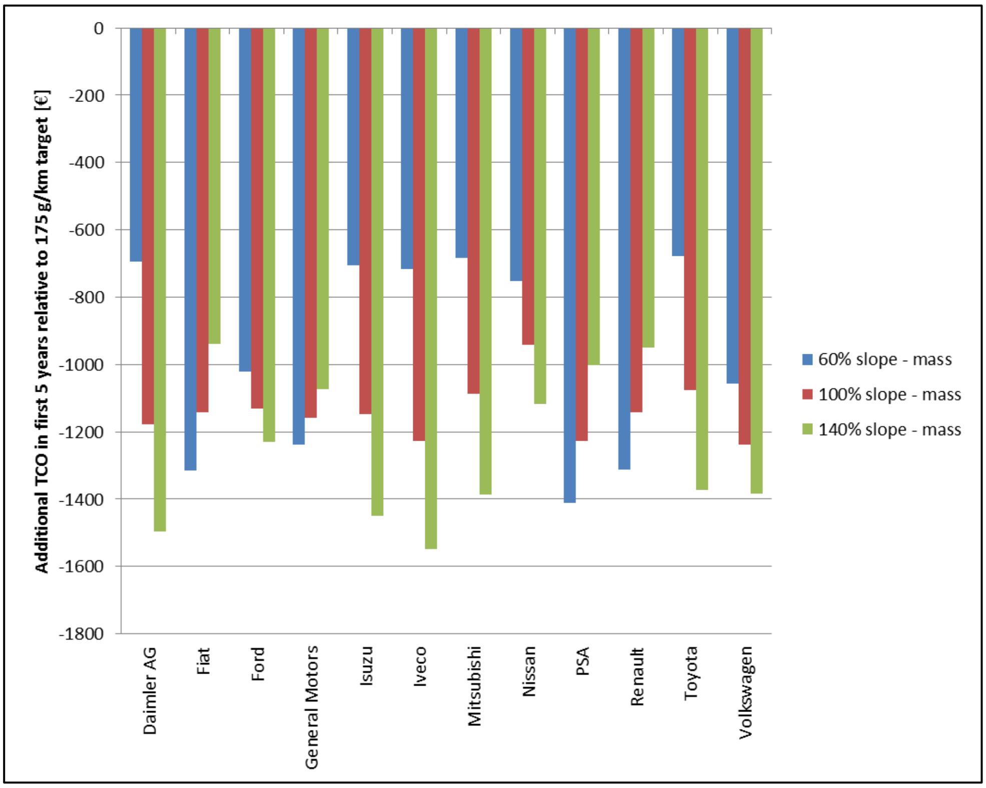
For footprint as utility parameter the picture is quite different. Still on average the changes in TCO seem larger for Japanese and Korean manufacturers (with the exception of Honda) than for European manufacturers, but the difference between Japanese and Korean manufacturers are larger. The TCO change for Mercedes is larger than for some Japanese and Korean manufacturers, but as these are not direct competitors this may have limited impact on mutial competitiveness.

Especially for manufacturers with a product portfolio focussing on larger cars TCO changes are less sensitive to the slope of the limit function than is the case for mass as utility parameter. TCO changes for BMW are again markedly lower than for Mercedes. The mutual competitiveness of more mainstream manufacturers such as Ford, GM PSA and Volkswagen is significantly affected with TCO changes for Ford much lower than for the other three.

Figure 14 and **Figure 15** show the change in TCO as seen by users of light commercial vehicles from different manufacturers, resulting from moving from the 2017 target of 175 gCO_2/km to the 2020 target of 147 gCO_2/km, based on mass resp. footprint as utility parameter.

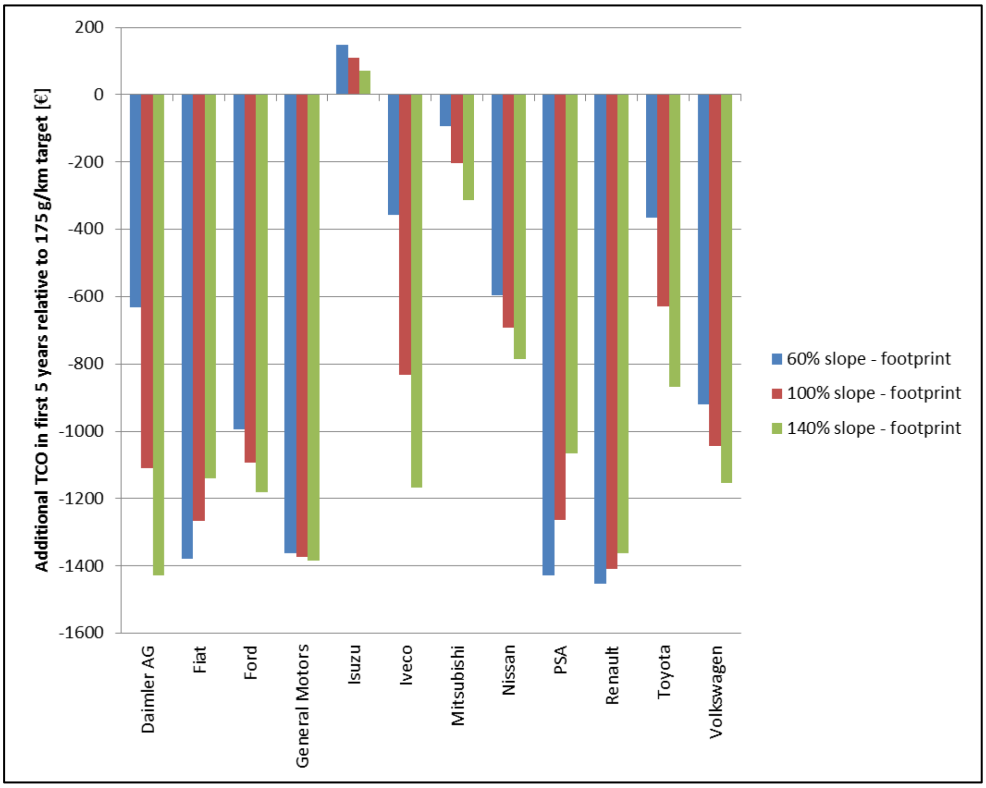
For mass as utility parameter the differences in impacts on TCO for different manufacturers are quite small. Sensitivities with respect to the slope are in line with the manufacturers' average mass compared to the overall average mass of vans sold in Europe. No distinction is visible between European manufacturers and Japanese and Korean companies. A target based on mass as utility parameter, therefore, does not appear to have significant impacts on mutual competitiveness of LCV manufacturers.

Figure 14 Change in TCO for the LCV end user in the first five years of vehicle use with reference mass as utility parameter[34]



34 The oil price assumed is $ 120/barrel with an annual mileage of 23,500 km. A factor of 1.195 is used to convert TA emissions into 'real world' emissions and the mark-up multiplication factor used to determine the vehicle price increase from the additional manufacturer costs is 1.11.

Figure 15 Change in TCO for the LCV end user in the first five years of vehicle use with footprint as utility parameter[34]



For footprint (**Figure 15**) the impacts on TCO are much more scattered. For this utility parameter the attractiveness of products from European manufacturers is markedly increased compared to those from Japanese and Korean manufacturers. Sensitivity to the slope of the limit function is particularly high for Daimler AG and IVECO, and to a somewhat lesser extent for Toyota.

<u>What is the effect on competitiveness of incumbents compared to new entrants?</u>

Incumbents on the EU market have the advantage of large sales and a wide product portfolio allowing them to optimise costs for meeting the target through internal averaging. This options is generally not or less available to new entrants.

New entrants could apply for derogation. In the absence of a historical sales-averaged CO_2 emission value the Commission shall determine an equivalent reduction target based upon the best available CO_2 emissions reduction technologies deployed in passenger cars of comparable mass and taking into account the characteristics of the market for the type of car manufactured.

New entrants focussing on electric or fuel cell vehicles could have an advantage, as these vehicles count as zero emissions. They also pool their target with other manufacturers. In this way the emission credits resulting from selling zero-emission vehicles could be "sold" to incumbent manufacturers. If these are willing to pay for such credits, this would prove that pooling is also beneficial for them, so that costs for compliance are reduced for both the new entrant and the incumbent manufacturers.

What is the effect on the competitiveness of component suppliers?

The implementation of the 2020 targets is expected to have positive economic impacts for component suppliers in the automotive industry, resulting from the demand for additional components. As the current Regulations are technology neutral and affect all manufacturers, further implementation of the 2020 targets is expected to have negligible impacts on the mutual competitiveness of European component suppliers.

Impacts on competitiveness between European suppliers and companies from outside on the European market and on foreign markets may depend on the extent to which other regions adopt similar CO_2 regulation. This aspect is more generally assessed in the next section.

The demand for new advanced components may spur competition among suppliers, whereby the most innovative companies are expected to be able to capture a larger share of the market. This is to be considered an indirect but generally positive consequence of the implementation of the 2020 targets.

What might be the effect on the automotive sector's international competitiveness?

What is the likely impact of the assessed option on the competitive position of EU firms with respect to non-EU competitors?

According to the Porter hypothesis advanced national / regional environmental policy stimulates innovation which in the longer term improves the competitiveness of the region / country. Whether this is also true for regulation on a market with a large number of foreign suppliers is debatable. Nevertheless, as a result of EU regulation on CO_2 emissions from light duty vehicles EU vehicle manufacturers might have a competitive advantage over non-EU companies, as the regulation affects their home market which generally represents a large part of their total sales. For manufacturers without or with less stringent CO_2 regulation on their home market it might be more expensive to adapt a small share of their production to comply with the EU regulation. However, as is shown in **Figure 6** CO_2 standards in different markets are rapidly converging. The Japanese standard for 2020 is close to the EU target. Only for South Korea the 2015 target is still in the proposal phase and no 2020 target has been proposed. In the short term this could mean a competitive disadvantage for Korean manufacturers on the EU market. It is likely, however, that Korea will adopt the 2015 and a target for 2020 may be expected.

This means that non-EU manufacturers have to achieve quite similar CO_2 emission values on their home markets, which reduces the possible competitive advantage of EU manufacturers on the EU market. At the same time, however, this also implies that the EU regulation does not place EU manufacturers in a disadvantageous position in markets outside the EU. The fact that the EU legislation is still slightly ahead of targets in other countries might even give them an advantage in other markets with CO_2 legislation. This would be most prominent on the US market, where many EU manufacturers are active, while US companies are generally niche manufacturers on the EU market.

The competitive position of European component suppliers relative to non-EU competitors might be improved. As the EU legislation is still slightly ahead of targets in other countries the technology-readiness of suppliers based in these countries may be expected to lag behind that of European companies. This improves the attractiveness of European suppliers for EU vehicle manufacturers and might also provide them a competitive edge in other markets. Given that EU manufacturers need the new technologies to meet the targets might also allow EU-based suppliers to increase their margins and improve their profitability. This would bring them in a better position to expand business to other markets.

As argued above the impacts of the implementation of the 2020 targets on the costs of purchasing and using vehicles affects the costs of business operations for all similar vehicle users alike. For EU firms using vehicles therefore no change in competitive position with respect to non-EU competitors on the EU market is to be expected.

What is the likely impact of the assessed option on trade and trade barriers?

In line with what is argued under the previous point, the regulation is not effectively causing trade barriers for non-EU manufacturers. The regulation is not expected to have an impact on existing trade barriers.

Possible impacts on trade volumes and balances could result from changes in competitiveness of vehicle manufacturers and component suppliers as described above. Improved competitiveness of EU-firms on the EU market may lead to lower imports, while improved competitiveness of EU-firms on non-EU markets may lead to higher exports.

Does the option concern an area in which international standards, common regulatory approaches or international regulatory dialogues exist?

There are no international standards for new vehicle CO_2 emissions. However, there are international approaches to measuring fuel consumption and CO_2 emissions established under UNECE. Development of a new World Light Duty Vehicle test procedure (WLTP) is on-going. The implementation of the 2020 targets is consistent with the existing, internationally agreed test procedure and is intended to be amended to become consistent with a new procedure as soon as this is adopted.

Is it likely to cause cross-border investment flows, including the relocation of economic activity inward of outwards the EU?

There are no constraints on cross-border investments in the automotive sector. Since projections are for a generally stagnant market for LDVs in the EU, it is unlikely that there will be substantial inward investment. What investment flows there are do not seem likely to be affected by the Regulations.

<u>What is the effect on the competitiveness of other sectors in the automotive supply chain?</u>

Indirect impacts on other sectors in the vehicle manufacturing supply chain might arise due to demand for different materials. However, the levels of light-weight construction assumed in the cost curves, used to assess the feasibility of the 2020 targets, do not yet require widespread application of alternatives for steel. In as far as advanced steels and innovative construction technologies are required, various projects by the steel industry have shown that this sector is ready and able to supply such new products and assist the automotive industry with their application[35]. Due to transport costs there might be some preference for European car manufacturers to source steel from steel companies within the EU. Innovations in light-weight construction might require closer cooperation between automotive and materials industry which could increase car manufacturer's interests to work with EU producers. Together with the fact that the regulation is spurring innovation in the materials production sector, this may improve the long term competitiveness of the European industry in this sector.

[35] See e.g. the projects Super Light car (http://www.superlightcar.com) and FutureSteelVehicle (http://www.worldautosteel.org)

What is the effect on the competitiveness of car dealers and distribution networks?

While the implementation of the 2020 targets may have economic impacts on car dealers and distribution networks (e.g. through pressure on dealer margins) it is not expected that their mutual competitiveness will be directly affected. Indirect effects could result from the impacts of the regulation on the car manufacturers represented by these dealers, but such effects are not considered intrinsic to the nature of the regulation.

What is the effect on the competitiveness of suppliers of complementary or alternative goods?

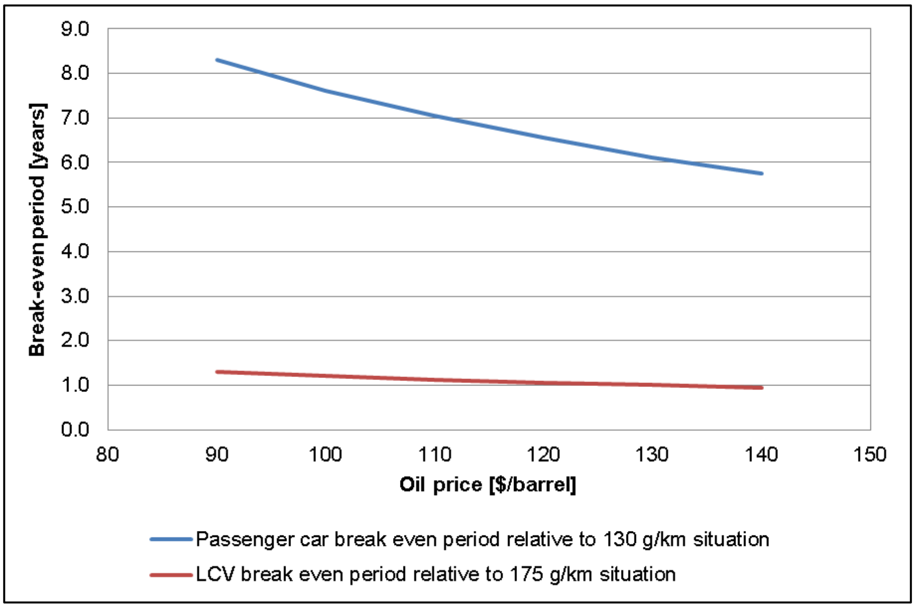
It is not expected that there will be major impacts on markets for complementary goods, i.e. suppliers of alternative forms of passenger mobility or goods transport. For passenger mobility alternatives are bicycles and motorcycles on one side and collective transport services such as public transport or aviation on the other side. Changes in the costs of driving cars are too small to have significant impacts on the modal split. For goods transport by means of light commercial vehicles there are hardly any alternatives.

What is the effect on the competitiveness of vehicle users?

The implementation of the 2020 targets may also directly or indirectly affect the competitiveness on the EU market of European businesses which use passenger cars and light commercial vehicles. Direct effects could exist for companies with a large share of transport activities in their operations. The use of light duty vehicles for passenger or goods transport or for providing other types of services, however, will mainly be part of operations undertaken by such companies on the European market or even on national markets. Possibly affected competitiveness of such companies using light duty vehicles will thus mainly concern competition relative to each other on the European and national markets. The implementation of the 2020 targets impacts on the costs of purchasing and using vehicles and may thus affect the costs of business operations, but it affects the costs of vehicles for all similar users alike, as companies competing on the same market will have similar fleets and vehicle use patterns. Consequently a change in overall costs resulting from the regulation is not expected to have significant impacts on the mutual competitiveness of companies which use light duty vehicles.

Users of passenger cars and light commercial vehicles will benefit from the lower fuel costs and the lower total cost of vehicle ownership. This is especially the case for light commercial vehicle users, where the payback period of the additional vehicle costs associated with applying CO_2-reducing technologies is of the order of 1 year (see **Figure 16**). These changes will lead to further indirect impacts as costs of using energy and of carrying out the transport elements of business will decrease. As mentioned above this is not expected to affect the competitiveness of companies competing on the European market, but may to some extent benefit the global competitiveness of internationally operating companies and of the European economy as a whole.

Figure 16 Period in which the fuel cost savings break even with the price increase resulting from the 2020 targets relative to the situation of maintaining the 130 gCO_2/km target for passenger cars beyond 2015 resp. the 175 gCO_2/km target for van beyond 2017.



What is the effect on the competitiveness in the fuel supply sector?

As mentioned in section 2.5.1 the proposed policy leads to a 25% reduction in the consumption of oil-based fuels by light-duty vehicles. This is to be considered a desired consequence of achieving the policy's goals with respect to reduction of GHG emissions and improvement of energy security. In first order this reduced demand is expected to affect different fuel producers alike.

The consequences for individual companies in terms of the resulting impacts on business (profitability, market share, etc.) will be different and will depend on their individual ability to respond to the challenge of declining sales in Europe. As such the impacts on individual fuel producers can be considered a consequence of the companies' current competitiveness rather than an impact of the regulation on their competitiveness. Nevertheless oil companies with a large market share in Europe might be affected more strongly than oil companies that are mainly focussed on the US or Asia. So from a global perspective, regulation may affect the competiveness of these companies. **Table 12** shows that there is a large number of smaller feul supply companies that operate largely or entirely on the European market. These companies might be expected to be affected more than larger, globally operating companies such as ExxonMobil, BP and Shell.

Table 12 Sales of petrol and diesel in Europe as share of the total petrol and diesel sales of various fuel supply companies[36]

	European fuel sales as share of total fuel sales
BP	38%
Cepsa	100%
Chevron / Texaco	-
Eni	100%
ExxonMobil	25%
Galp	100%
Hellenic Petroleum	100%
MOL	100%
Neste	95%
Omv	100%
Petroplus	-
PKN Orlen	100%
Repsol	90%
Shell	33%
Statoil	100%
Total S.A.	63%

What is the effect on the competitiveness of other businesses?

More generally the implementation of the 2020 targetsmay change the costs of intermediate products and hence also the costs of final products through changes in transport costs. On the EU market this will only affect the competitiveness of companies operating in the same market if they have very different shares of transport costs in their product costs. For products offered on a global market, the change in transport costs due to regulation may also affect global competitive position of European companies. For both situations, however, it must be stated that transport costs are generally a small share of overall product costs. Furthermore the implementation of the 2020 targets only affects the costs of transport by passenger cars and vans, which may be expected to be only a fraction of total transport costs. Direct or indirect impacts on competitiveness in the EU market through changes in the cost price of intermediate and final products are therefore assumed negligible.

In any case impacts on other businesses from the implementation of the 2020 target for vans can generally be considered positive due to the fact that the regulation reduces the total cost of ownership of light commercial vehicles in Europe. If at all significant, the impact on the competitiveness of European companies on the global market would improve as a result of this.

For companies using passenger cars as part of their operations the TCO may increase relative to the situation in which the 130 gCO_2/km is maintained, although this depends on the depreciation period (e.g. 3 or 5 years) and the extent to which the increased vehicle price also results in increased residual value. Generally, however, personnel costs vastly outweigh costs of driving in professional applications of passengers cars, so that impacts of the implementation of the 2020 targets on competitiveness can be considered insignificant for these applications.

36 Based on information from companies' websites

What is the effect on SME competitiveness?

There are two main categories of SMEs that might be affected by the implementation of the 2020 targets. One category is SMEs operating as small volume vehicle manufacturers or as suppliers to the automotive industry. The other category consists of SMEs which use passenger cars of light commercial vehicles.

ESCA, representing the smallest vehicle manufacturers, has been involved in the consultation process and has indicated that it does not have particular concerns with the 2020 targets. Small volume manufacturers are eligible for derogation and will be allowed to set individual targets that are compatible with their innovative and economic capabilities. As already mentioned in section 4.4.2, this will avoid strong increases in production costs for these SMEs, so that competitiveness of their projects with respect to purchase price will not be affected or could even be improved. At the same time the derogation will imply that fuel consumption of vehicles manufactured by SMEs will not go down at the same pace as that of products from large volume manufacturers. From the perspective of usage costs, therefore, the competitiveness of products from SMEs may deteriorate. In the light commercial vehicle market, which is more sensitive to fuel costs, this could be a relevant impact. In the passenger car market small volume manufacturers mainly produce sports vehicles, for which fuel consumption is less of an issue.

The main indirect effects could arise for SMEs that supply components to vehicle manufacturers. SMEs represent a significant number of companies in this sector (≈ 3000). The main impact will be an increased demand for CO_2 reducing technologies and other measures to be deployed in vehicles. However, it is difficult to foresee how that would affect the competitiveness of such SMEs.

First of all it should be noted that the technologies required to meet the 2020 targets only concern a limited share of all components supplied to the automotive manufacturing industry. And many of the key-technologies, especially those related to engine and powertrains, may be expected to be produced by the larger Tier-1 suppliers. Only the drive to reduce weight could affect specifications of a larger number of vehicle components (e.g. including seats, dash-boards, etc.). SMEs seem equally well placed to cater for such innovations as large companies. In general SMEs are more flexible with respect to minor changes in products and production processes. On the other hand they may have more difficulty to obtain financial means to deliver more radical product innovations or invest in major changes their production process.

Other indirect effects can arise from the use of vehicles. Since the impact of the implementation of the 2020 targets is beneficial in terms of total vehicle cost of ownership (with especially short payback times for vans) this indirect effect is likely to benefit SMEs along with other vehicle operators. Overall their competitiveness compared to other SMEs or to larger companies is not expected to change as a result of this regulation.

As European SMEs may be assumed to be mostly operating on the European market, impacts on competitiveness in other, global markets is less relevant for this category of companies.

Conclusions - the conclusions of this annex are outlined in section 2.5.1.

7.10. Impacts on the economy and employment – input-output model

An input-output model is essentially based on the work of Leontief, who developed a way to connect changes in final demand to changes in output, based on matrices of monetary flows between industries. Leontief used a matrix of intermediate demand coefficients (A), of final demand (D) and of output (X).

Given that demand and production need to be in balance (correcting for import and export), the basic equation is:

$$AX + D = X \quad (1)$$

Equation (1) can be inverted, to give (2)

$$(I - A)^{-1} D = X \quad (2)$$

Equation 2 is the basis of a methodology to analyse effects of changes in final demand (consumer demand) and its effect on output. It results in the level of output necessary to satisfy a certain final demand. On the basis of equation 2 multipliers can be calculated showing how 1€ extra demand leads to additional expenditure in production.

The numbers shown in the two scenarios in **Table 13** are based on the inverse of the Leontief matrix for the EU-27 matrix. The tables show how extra consumption changes macroeconomic indicators relating to production, labour, GDP, exports and imports. Each column represents a weighted increase in household consumption, keeping the demand for other goods constant. 'Other goods' category covers all sectors except fuel and vehicles.

Two tables are presented because of the difficulty to know how the targets will impact on imports and exports. The two scenarios show the extremes of the range. In Scenario A, both imports and exports are set to zero as shares of production and demand. In Scenario B it is assumed that exports are a fixed share of production and imports are a fixed share of final demand. In reality the impact will be somewhere between these scenarios, and so they can enable the likely range of impact to be calculated.

Table 13: Total effect of extra consumption on macro-economic indicators in two scenarios

Scenario A*	Vehicles	Fuels	Other goods
Consumption	1	1	1
Labour	0,55	0,31	0,45
Production	3,00	2,73	1,98
GDP	1,17	1,13	1,21
Export	0,00	0,00	0,00
Import	0,00	0,00	0,00

* **In scenario A** exports and imports are set at zero for the affected sectors.

Scenario B*	Vehicles	Fuels	Other goods
Consumption	1	1	1
Labour	0,82	0,18	0,46
Production	4,36	1,47	2,01
GDP	1,69	0,68	1,22
Export	0,70	0,19	0,14
Import	0,19	0,63	0,13

* In scenario B exports and imports remain a fixed proportion of expenditure in the sectors as overall expenditure varies.

Table 13 shows that fuel consumption has only a small effect on production, relative to other sectors. Increased vehicle consumption has a proportionally large effect on production, labour and demand. In scenario B, replacing €1 of fuel expenses by €1 of vehicle purchase causes a total effect on labour expenditure of €0.64 (0.82€ – 0.18€), the total effect on GDP is 1.01€ (1.69€– 0.68€). The comparable effects in scenario A are €0.24 impact on labour and €0.04 on GDP. Where there is no perfect substitution between fuel and vehicle purchase the multiplier for other goods is used in the calculation.

It should be noted that there are limitations with this type of analysis, in particular:

- Input-output tables are partial models and do not take full market equilibrium into account.
- The impacts demonstrated are short term. Over the longer term adjustments will take place in the economy which will adjust the underlying consumption relationships.
- The changes are assumed to take place at the same time. However fuel savings accrue over the life of the vehicle. To adjust for this the NPV of the fuel savings is used.
- Leontief methodology assumes fixed input-output coefficients, meaning that no substitution between inputs to the production process is possible. The same is true for labour and capital. The effect on labour is calculated by multiplying the change in output from the Leontief inverse, with the share of wage.
- The numbers presented are scale independent, no returns to scale are taken into account.
- The analysis calculates the effect on trade surplus and government budget, but does not calculate the secondary effects of changes in these accounts on expenditures and/or investment. This requires additional assumptions which increase the complexity of the analysis substantially.
- The calculations do not take into account potential losses in consumer utility, as consumer preferences are forced from fuel to vehicle purchase.
- The impact on exports should be treated with caution since this factor is assumed to remain constant for each sector. It cannot necessarily be assumed that this will remain the case if vehicle technology changes.

Despite these limitations Input-Output analysis gives a good insight into the macro-economic linkages flowing from improvements in vehicle fuel efficiency. A number of Input-Ouput based studies have been performed exploring the macro-economic impacts of vehicle efficiency standards[37], many of which look at the US market. These studies tend to show comparable effects to those reported here.

To establish the impact of the 2020 car target for one car, the net present value (NPV) fuel savings are taken from **Table 3** assuming an oil price of $110/barrel. Tax is excluded since tax reductions would need to be compensated elsewhere and would not be expected to affect the overall government expenditure. The additional car purchase cost of €1158 is the average of the cost scenario 2 values given in **Table 8**. The excess fuel savings over vehicle purchase cost are assumed to be spent on other goods. These values are multiplied by total car sales to establish the aggregate impact on the economy. In 2011 some 13,111,209 cars were registered in the EU and this value is used.

The impact of these changes on the indicators is shown in **Table 14** below.

Table 14: Aggregate macro-economic impact of implementing 2020 targets

	Scenario A	**Scenario B**	**Central value**
Labour	€5,5bn	€13bn	€9bn
Production	-€5bn	€50bn	€22bn
GDP	€1,6bn	€22bn	€12bn

As can be seen there is predicted to be a substantial increase in production, labour, and GDP. Since it is clear that the correct result is between both scenarios, a central value is given as the best estimate.

These macro-economic changes can be disaggregated across different sectors. **Table 15** shows how changes in fuel or vehicle production will impact on other sectors, enabling a calculation of which would benefit from increased fuel demand or vehicle purchase respectively. The table illustrates the clear link between vehicle manufacturing and demand for basic metals, wholesale trade, chemicals and rubber. Fuel consumption has relatively limited effect on other sectors.

[37] For example: 'More jobs per gallon: how strong fuel economy/GHG standards will fuel american jobs'; CERES, 2011; 'Potential long term impacts of changes in US vehicle fuel efficiency standards'; Bezdek, R.H., Wendling, R.M., 2005; 'Energy efficiency and job creation: the employment and income benefits of investing in energy conservation technologies. Report no ED922, American Council for an Energy-Efficient Economy'; Geller, H., DeCicco, J., Laitner, S., 1992; 'Employment impacts of achieving automobile efficiency standards in the United States'; Dacy, D.C., Kuenne, R.E., McCoy, P., 1980

Table 15: Disaggregated impact of extra fuel or vehicle technology consumption

Sector	*Leontief multiplier for fuel*	*Sector of economy*	*Leontief multiplier for vehicle purchase*
Refined petroleum	0.52	Motor vehicles, trailers and semi-trailers	1.63
Crude petroleum	0.30	Basic metals	0.32
Other business	0.08	Other business services	0.27
Chemicals	0.07	Fabricated metal products, except machinery and equipment	0.19
Trade	0.04	Wholesale trade and commission trade services, except of motor vehicles and motorcycles	0.15
Auxiliary transport	0.03	Chemicals, chemical products and man-made fibres	0.15
Electrical energy and gas	0.03	Machinery and equipment n.e.c.	0.14
Other sectors	0.39	Rubber and plastic products	0.13
TOTAL	1.470	Electrical machinery and apparatus n.e.c.	0.12
		Auxiliary transport	0.08
		Other sectors	1.190
		TOTAL	4.37

7.11. The limit value curve – explanation of the slope

The limit value curve approach

The utility based approach adopted in the legislation results in the CO_2 reduction obligation being defined as a linear function of a so-called "utility" parameter (e.g. mass or footprint) reflecting the utility of vehicles. The Regulation targets are set according to this limit value function expressed as a formula (annex I to the Regulations). The limit value curve approach ensures that vehicles with a larger utility parameter (currently mass) are allowed higher emissions than lower utility vehicles while ensuring that the overall fleet average meets the target.

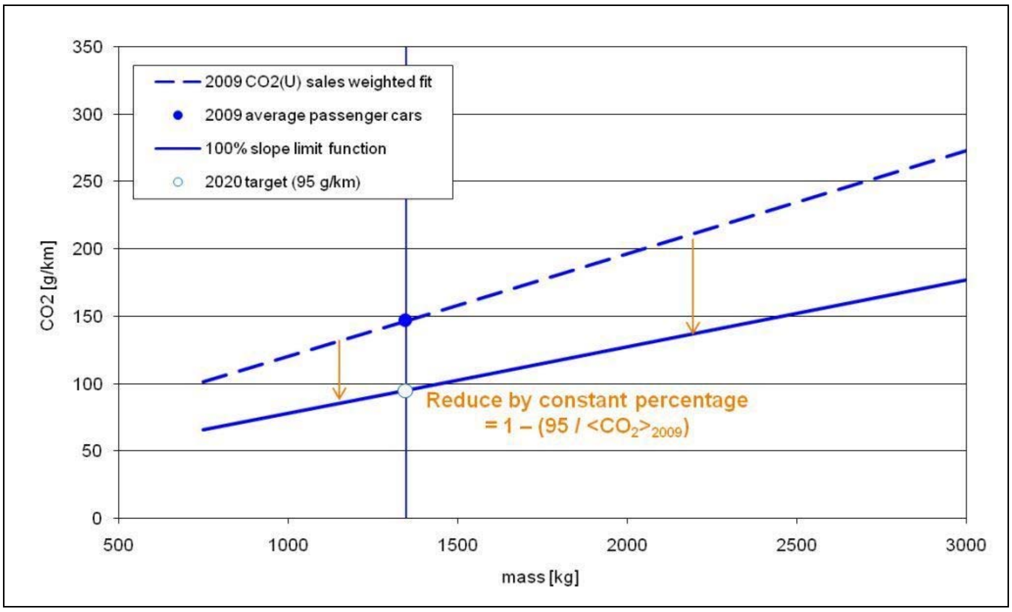
The result of this approach is that only a manufacturer's fleet average is regulated, they are still able to make vehicles with emissions above their indicative targets if these are offset by other vehicles which are below their indicative targets. To comply with the Regulation, a manufacturer has to ensure that the overall sales-weighted average of all its new cars or vans does not exceed the point on the limit value curve for its average utility parameter.

Defining the slope

To define the slope, the starting point is the observed trend in terms of market distribution of vehicles' sales in a base year. For the current car study, the analysis performed was in comparison to the average slope of the 2009 fleet. This line is the 100% limit value function for 2009.

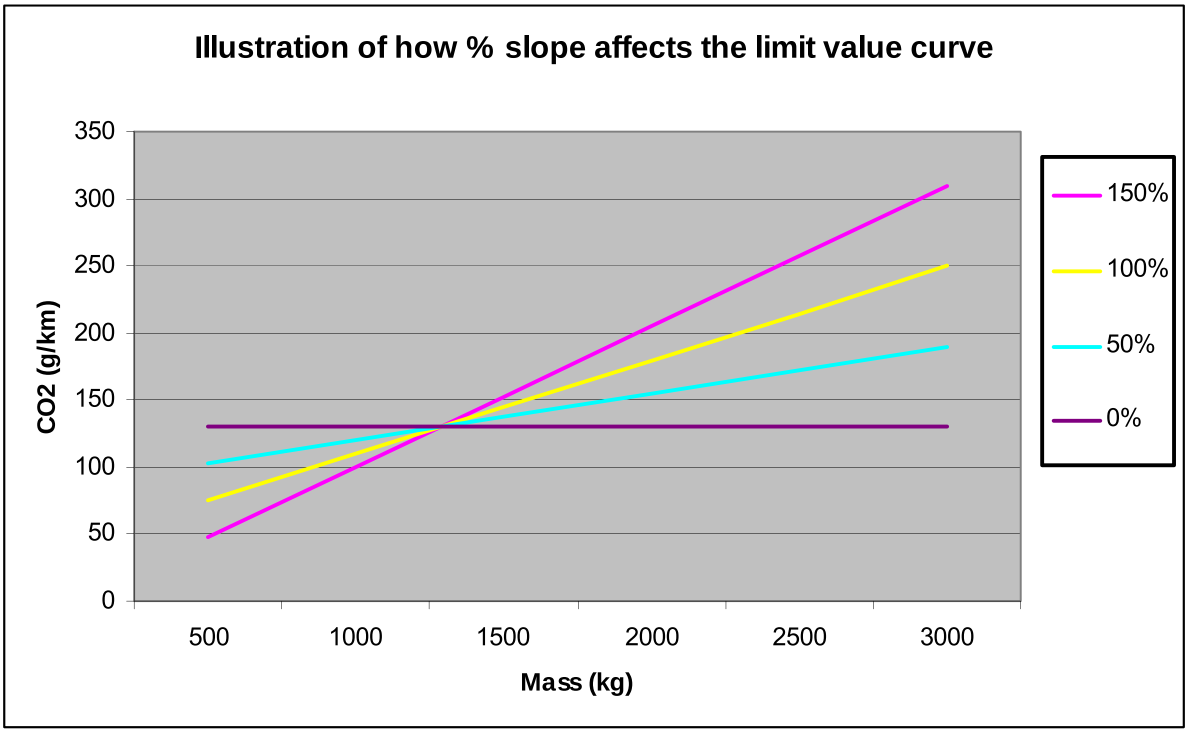
To translate that to the 100% limit value function for a future year with a given target, the base year line is moved downwards by an equal percentage emissions reduction across the range of the utility parameter to reach the desired limit value. The effect of this is to slightly rotate the curve clockwise. This is shown in **Figure 17**. The resulting line is the 100% limit value function for the target year and new fleet CO_2 target.

Figure 17 100% limit value function for 2009 baseline (dotted) and translation to 95 gCO_2/km target limit value function (solid)



To facilitate discussion and setting the relevant slope of the curve, a horizontal line which passes through the fleet average utility parameter and CO_2 target is defined as the 0% limit value function. This is shown for illustrative purposes in **Figure 18** below. For such a limit value function every manufacturer regardless of the composition of their fleet would need to achieve the target level of CO_2 emissions and there would be no account taken of utility.

Figure 18 Illustrative curves showing variation between 0 and 150% slope



The straight line function is described mathematically with a formula of the form Y = **a**X + b. The parameter **a** determines how steeply the line slopes. If **a**=0 the line is horizontal (called 0% slope). If **a** has the value determined by establishing the 100% slope then the line is the 100% function. If **a** is greater than this the slope is greater than 100%, if it is less then the slope is less than 100%.

The formula in the legislation

Within the legislation, the limit value function is described in a formula. The limit value curve for the 130 gCO_2/km target for cars is: Permitted specific emissions of CO_2 = 130 + a × (M – M0)

Where:

- M = mass in kg
- M0 = 1372.0
- a = 0.0457

Parameter 'a' in the formula determines the slope of the limit value function.

Effect of the slope

The slope of the utility curve affects the distribution of effort between vehicles depending on their position on the curve. The slope of the curve does not change the overall outcome in terms of average gCO_2/km, it only defines the distribution of reduction effort between vehicles with different values of utility parameter (currently mass). This is because it is rotated around the point set by the average vehicle parameter (1372 kg in case of cars) and the average CO_2 target to be achieved by the overall fleet (130 gCO_2/km for cars).

If the curve has a lower slope (below 100%), the degree of effort required is proportionately greater from vehicles with a larger parameter (e.g. mass). If the curve is steeper (above 100%)

then the effort required is proportionately greater from vehicles that have a smaller parameter. Because of this differential effect on different vehicles, changing the slope alters the amount of effort required from different manufacturers. For the current studies, the range from 60 to 140% has been analysed.

Changes since the legislation was adopted

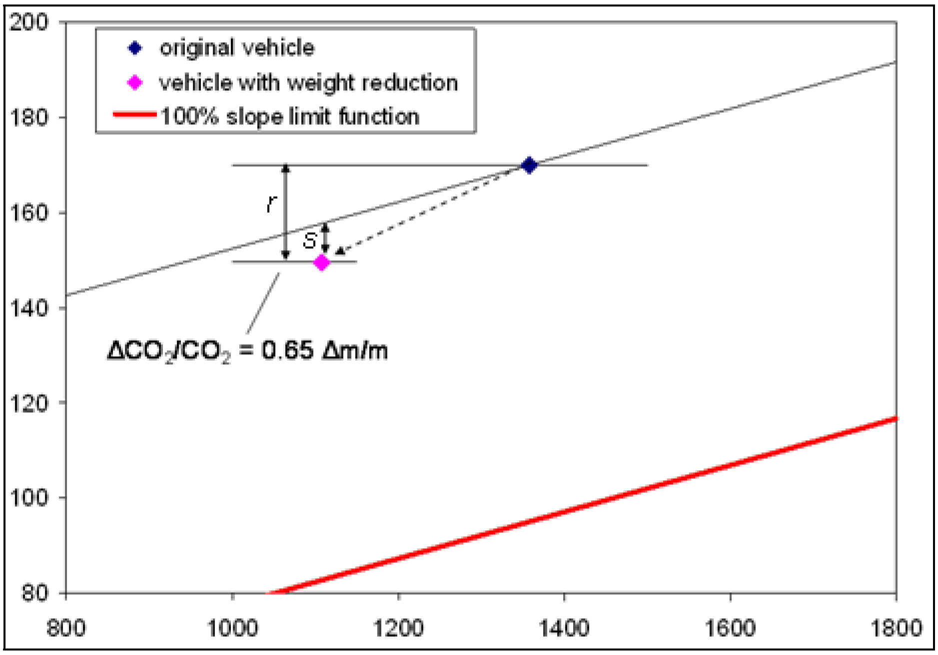
The slope of the curve in the current car Regulation is a 60% slope based upon the car fleet distribution in 2006. As a result of the way manufacturers have responded to the legislation, the current (2009) data shows a flatter line of best fit through the fleet data. So the 100% line through the 2009 data has a similar slope to the 60% line based on the 2006 data. This change in baseline year can cause confusion. The slope of the limit value function is ultimately selected on the basis of an appropriate burden sharing amongst manufacturers. This choice can as easily be made on the basis of 2006 fleet data, 2009 data or indeed an average of the two because ultimately what counts is a mathematical slope which delivers an acceptable burden sharing amongst manufacturers which limits the impact on inter-manufacturer competition and which is socially equitable. In simple terms, any desired slope of the limit value function can be expressed in terms of the 100% slope line of the vehicle emission data plotted as a function of mass (or footprint) of any particular year. For example, the 60% slope of the 2006 fleet data which delivers the 95 g/km target (in absolute terms 0.0333) is the equivalent of a 67% slope relative to the 2009 fleet data.

7.12. Explanation of the effective change of the distance to target when applying light-weighting technologies in case of a mass-based limit function, and its impact on costs for meeting the 2020 target.

In a CO_2 regulation system differentiating the target by manufacturer based on mass as the utility parameter, CO_2 reductions resulting from light-weighting (vehicle weight reduction) are not fully counted towards achieving the manufacturer's target. Since applying weight reduction to a vehicle lowers the vehicle-specific (or equivalently the manufacturer's specific) target (see **Figure 19**), the distance to target of the manufacturer is effectively reduced (*s* in **Figure 19**) less than the reduction in CO_2 emissions (*r* in **Figure 19**).

The fact that under a mass-based regulation the target changes with reduced vehicle weight reduces the cost-effectiveness of light-weighting as a CO_2 emission reduction technology. Under a footprint-based regulation the change in distance to target would equal the full CO_2 emission reduction resulting from light-weighting. In the assessment that has been carried out in support of the current review, identical cost curves were used to assess both mass and footprint based limit functions. It is desirable to understand what the impact on the cost of meeting the target would be if the reduced effectiveness of weight reduction under a mass-based limit function is taken into account.

Figure 19 Schematic representation of the effective reduction of the distance to target when applying a weight-reducing technology under a CO_2 regulation using a mass-based limit function.



This is a 1st order assessment. The fact, that the regulation allows the value of M_0 to be adjusted periodically in the limit function CO_2 = overall target + a × (M – M_0) if a change in average weight is observed, provides the possibility to at least on average reward the full impact of applied weight reduction. Nevertheless it creates a first mover dilemma. The first manufacturers that start applying weight reduction are confronted with a more stringent target. If all manufacturers apply weight reduction to the same extent and M_0 is subsequently adjusted, then mass reduction would be fully rewarded. But if only a few apply weight reductions and many manufacturers don't, then a correction of M_0 only partially compensates the reduced effectiveness for the first movers, while providing a more lenient target to all other manufacturers that did not apply weight reduction.

The assessment here therefore applies only to the situation in which the utility-based limit function is not adjusted in response to observed changes in average vehicle mass. By analogy it will also apply to a lesser extent to the situation where unequal mass reduction takes place.

Methodology

The mass reduction ΔM of a vehicle translates into a reduction ΔCO_2 of the vehicle's CO_2 emissions reduction (under the assumption that engine power is adjusted to maintain constant vehicle performance) according to the following formula:

$$\Delta CO_2 / CO_2 = 0.65 * \Delta M / M \quad (1)$$

In order to determine the extra costs resulting from the stricter target caused by applying mass reduction, new cost curves are constructed that simulate the eroding of the effective reduction of the distance to target resulting from applying mass-reducing technologies under a mass-based limit function. In these cost curves, the CO_2 reductions from light-weighting are corrected (lowered) for the stricter CO_2 target they induce. This is done by replacing the actual CO_2 emission reduction associated with weight reduction with the effective change in the distance to target. In detail this is done using the following method, analogous to Figure 19 and reported in **Table 16**:

- The average mass M and average CO_2 emissions CO_2 are calculated per segment.
- Application of these average values in the 100% slope mass-based utility function results in the average distance to target for all vehicles sold within a segment.
- For each level of weight reduction, defined in the technology tables, the ΔM in [kg] can be determined by inserting the initial relative reduction potential of the mass reducing technologies into equation 1 for ΔCO_2 (e.g. 2% for mild weight reduction for a small petrol vehicle). For M the average mass of the segment is used and for CO_2 the average CO_2 emissions per segment.
- Subtracting the initial CO_2 emission reduction of the mass reducing technologies from the average CO_2 emissions of every segment gives the remaining average CO_2 emissions within every segment when that technology is applied.
- The average CO_2 emissions that have to be met within every segment are determined by applying the corrected average mass (M - ΔM) of every segment in the limit function.
- The alternative distance to target, resulting from applying a mass reducing technology, is the result of subtracting the adjusted average CO_2 emission targets that have to be met within every segment from the remaining average CO_2 emissions within every segment after application of weight-reducing technology.
- Finally, the effective relative reduction of the distance to target is determined by dividing the difference between the distance to target with and without the mass reducing technology applied by the initial average CO_2 emissions per segment. As can be seen in **Table 16**, these 'new' reduction potentials (reductions of the distance to target) are lower than the actual CO_2 reduction of that technology.

Impact on the effectiveness of light-weighting

In **Table 16** below the 2009 average values per segment for mass and CO_2 emissions were chosen as baseline for calculating the adjusted potential for light-weighting under a mass-based limit function. Formally reduction potentials of technologies are defined relative to 2002 baseline vehicles. The reason to deviate from that definition here lies in the fact that according to formula (1) the absolute impact of a given mass reduction on CO_2 emissions decreases with decreasing CO_2 emissions of the baseline vehicle. Using the 2002 baseline data would thus lead to a smaller erosion of the potential of light-weighting under a mass-based limit function than when 2009 data are used.

Based on the assessment made in the car study[38], light-weighting is a relatively expensive technology which only becomes cost effective higher up the cost curves. As cost effectiveness further decreases when the effect of distance to target relative to a mass-based limit function is taken into account, it is expected that light-weighting would only be applied later towards 2020. In order not to underestimate the erosion of light-weighting potential it was considered appropriate to base the assessment on the 2009 baseline CO_2 values.

Table 16 Estimated CO_2 reduction potential and costs for light-weighting technologies relative to a 2009 baseline vehicle.

Calculation of adjusted CO_2 reduction potential for mass reducing technologies	**pS**	**pM**	**pL**	**dS**	**dM**	**dL**
Mass [kg] - average 2009	1039	1349	1829	1153	1491	1948
CO2 [g/km] - average 2009	134.8	165.6	247.6	118.5	148.8	201.6
Distance to mass-based limit function with 100% slope [g/km]	55.4	71.0	129.5	33.5	47.2	77.7
Mild light-weighting - reduction potential	2%	2%	2%	2%	2%	2%
Medium light-weighting - reduction potential	6%	6%	6%	5%	5%	5%
Strong light-weighting - reduction potential	12%	12%	12%	11%	11%	11%
ΔMass mild light-weighting [kg]	32	42	56	27	34	45
ΔMass medium light-weighting [kg]	96	125	169	89	115	150
ΔMass strong light-weighting [kg]	192	249	338	195	252	330
Resulting CO2 mild light-weighting [g/km]	132.1	162.3	242.7	116.8	146.5	198.6
Resulting CO2 medium light-weighting [g/km]	126.7	155.7	232.8	112.6	141.3	191.5
Resulting CO2 strong light-weighting [g/km]	118.6	145.7	217.9	105.5	132.4	179.4
Adjusted target mild light-weighting [g/km]	77.8	92.6	115.4	83.7	99.8	121.7
Adjusted target medium light-weighting [g/km]	74.7	88.5	109.8	80.6	95.9	116.6
Adjusted target strong light-weighting [g/km]	70.0	82.4	101.6	75.4	89.2	107.8
Adjusted distance target mild light-weighting [g/km]	54.3	69.7	127.3	33.1	46.7	76.9
Adjusted distance target medium light-weighting [g/km]	52.0	67.2	122.9	32.0	45.4	74.9
Adjusted distance target strong light-weighting [g/km]	48.6	63.3	116.3	30.1	43.2	71.6
Adjusted reduction potential mild light-weighting	0.84%	0.77%	0.89%	0.40%	0.37%	0.41%
Adjusted reduction potential medium light-weighting	2.51%	2.32%	2.66%	1.33%	1.22%	1.36%
Adjustedreduction potential strong light-weighting	5.03%	4.63%	5.32%	2.94%	2.69%	2.99%

Impact on cost of meeting the target

Applying the adjusted reduction potentials to the technology packages results in modified cost curves. These show that the cost to reach a certain reduction potential is higher than the original cost curve. This is only the case from the first point on the curve that includes a mass reducing technology. These adjusted cost curves result from the necessity for a manufacturer to apply extra CO_2 reduction technologies to meet their target.

Application of the adjusted cost curves in the assessment model used to determine the lowest possible costs for every manufacturer to meet its target, leads to average additional manufacturer costs shown in **Table 17**. The impact of a mass-based limit function on the effectiveness of light-weighting is found to lead to an increase in the average additional manufacturer costs for meeting the target from € 2188 to € 2249 per sold vehicle for the highest cost scenario compared to the 2009 situation.

[38] Tables 8 and 9 in the car study

Table 17 Comparison between the average additional manufacturer costs based on the original cost curves and those based on cost curves that are corrected for the effectively reduced impact of mass reducing technologies under a mass-based limit function.

Average additional manufacturer costs relative to 2009	**Cost [€]**
Original cost curve	2188
Adjusted cost curve corrected for the effective reduction in distance to target for light-weighting options under a mass-based limit function	2249

Conclusions

In the assessment of mass as utility parameter presented in the car study this was considered not to affect the cost-effectiveness of light-weighting technologies used by manufacturers to reach their targets under the CO_2 regulation. However, use of light-weighting technologies under a mass-based limit function not only reduces a vehicle's CO_2 emissions but also its target. As a result light-weighting is a less attractive option when a mass-based limit function is used. The reduced effectiveness of light-weighting would lead to increased costs of meeting the target, relative to use of a footprint-based limit function under which the effects of light-weighting are fully rewarded. For the 95 gCO_2/km 2020 target, the impact on the additional costs per vehicle is of the order of €60 per car on a total additional manufacturer cost compared to 2009 of around €2200 per vehicle, ie about 3%.

The impact is limited due to the relatively high costs assumed for the light-weighting technologies. If light-weighting would be cheaper, this option would appear lower on the cost curve and the change in effectiveness due to a mass-based limit function would be greater. Now the impact only occurs higher up the cost curves, with the additional costs amounting some €1000 at the end of the cost curves.

Therefore, the impact of a mass-based limit function on the cost of meeting the target could be higher than assessed here if light-weighting technologies are cheaper than currently estimated. Studies underlying the US car CO_2 regulation indicate that this might be the case.

7.13. Cost scenarios in the car analysis

The cost curves are constructed on the basis of information regarding the CO_2-reducing technologies and their application in different types of vehicles, their CO_2 reduction potential and the associated cost.[39]

Cost scenario 1 (referred to on **Figure 20** and **Figure 21** as the 2020 cost curve) is the basic scenario and concerns cost curves constructed on the basis of information obtained from the main stakeholders concerned, including the automotive manufacturers (incl. ACEA) and component suppliers, information from the literature review and expert judgement within the consortium led by TNO.

Further to the critical evaluation of the cost curves under cost scenario 1, three more alternative cost scenarios were developed:

Cost scenario 2 (referred to in **Figure 20** and **Figure 21** as scenario a) is based on scenario 1 but takes into account the observed significant progress in CO_2 reduction in the European new passenger car fleet in the 2002-2009 period. Since this progress had not been accompanied by the vehicle price increase, and does not appear to be explained through deployment of new technologies, it could be interpreted as an indication that part of the observed reductions in type approval CO_2 emissions in that period may need to be attributed to other causes than application of technologies included in the cost curves in cost scenario 1. Due to the strong non-linearity of the cost curves the possibility that other causes may be responsible for part of the observed reductions between 2002 and 2009 could have a significant impact on the assessment of cost for moving from the 2009 values to the 2020 target values. This results in cost curve in scenario 2 which is lower than scenario 1 for a given level of reduction.

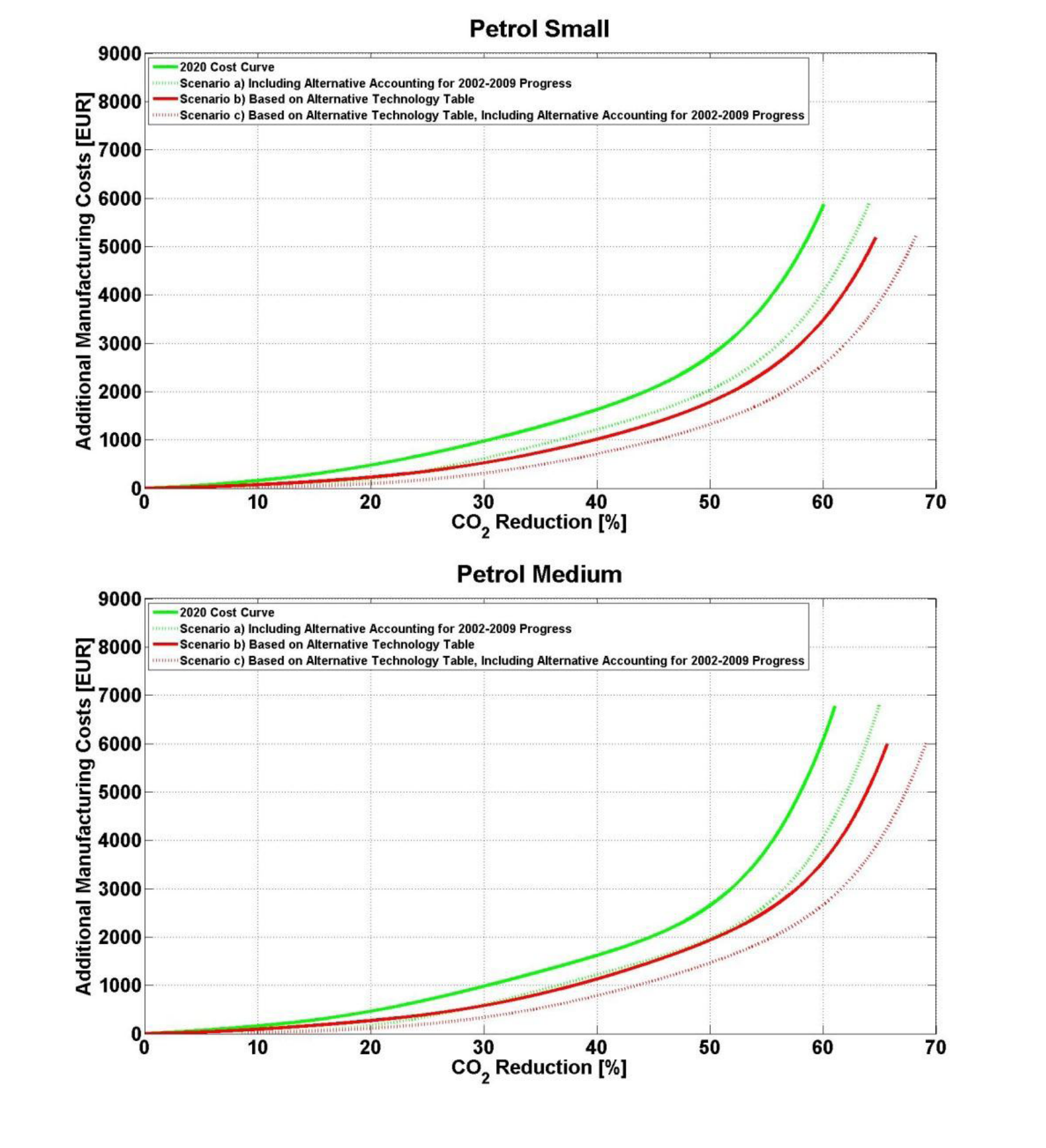
Cost scenario 3 (referred to in **Figure 20** and **Figure 21** as scenario b) takes into account the technical input to the US Environment Protection Agency's (EPA) studies in support of the US legislation on CO_2 emissions from light duty vehicles which seem to suggest that the costs of reducing CO_2 emissions in passenger cars could be lower than estimated in cost scenario 1. To test the possible impact of the most striking differences between US data and cost and reduction figures used in scenario 1, a selection of data on cost and reduction potential derived from the EPA studies, specifically for full hybrids and the various levels of weight reduction, has been used by the contractors to construct a modified technology table. Using the same methodology as in the basic scenario alternative cost curves have been constructed on the basis of the table based on the EPA data. This variant was created to allow for an indicative assessment of the possible implications that information from the EPA studies underlying the US CO_2 legislation for cars might have for assessment of the costs of meeting the European target for 2020. This approach results in a cost curve lower than scenario 2.

Cost scenario 4 (referred to on **Figure 20** and **Figure 21** as scenario c) is a combination of cost scenario 2 and 3 using the alternative cost assumptions based on the EPA study and taking into account the progress in CO_2 reduction in the European new passenger car fleet in the 2002 - 2009 period that is not attributed to application of technologies included in the cost curves in scenario 1. This approach results in the lowest cost curve as compared to scenarios 1-3.

[39] For details of this methodology see section 2 of the car study.

The following figures depict these differences for different car segments.

Figure 20 Comparison of cost scenarios 1 - 4 for petrol cars



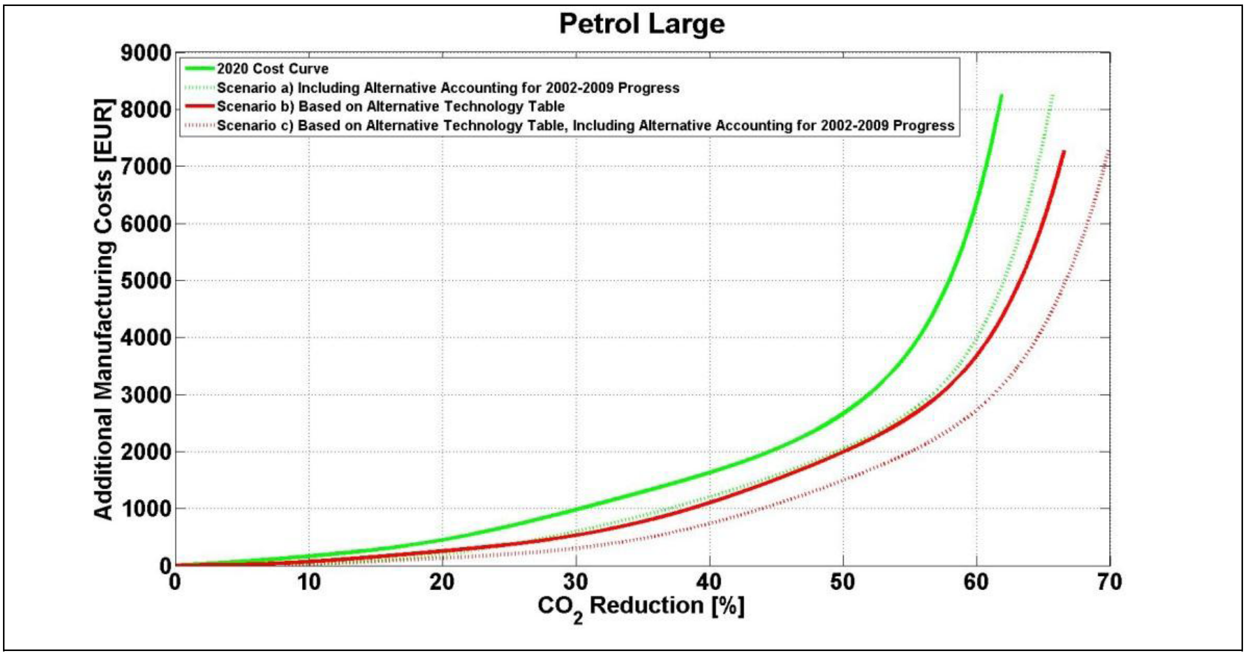
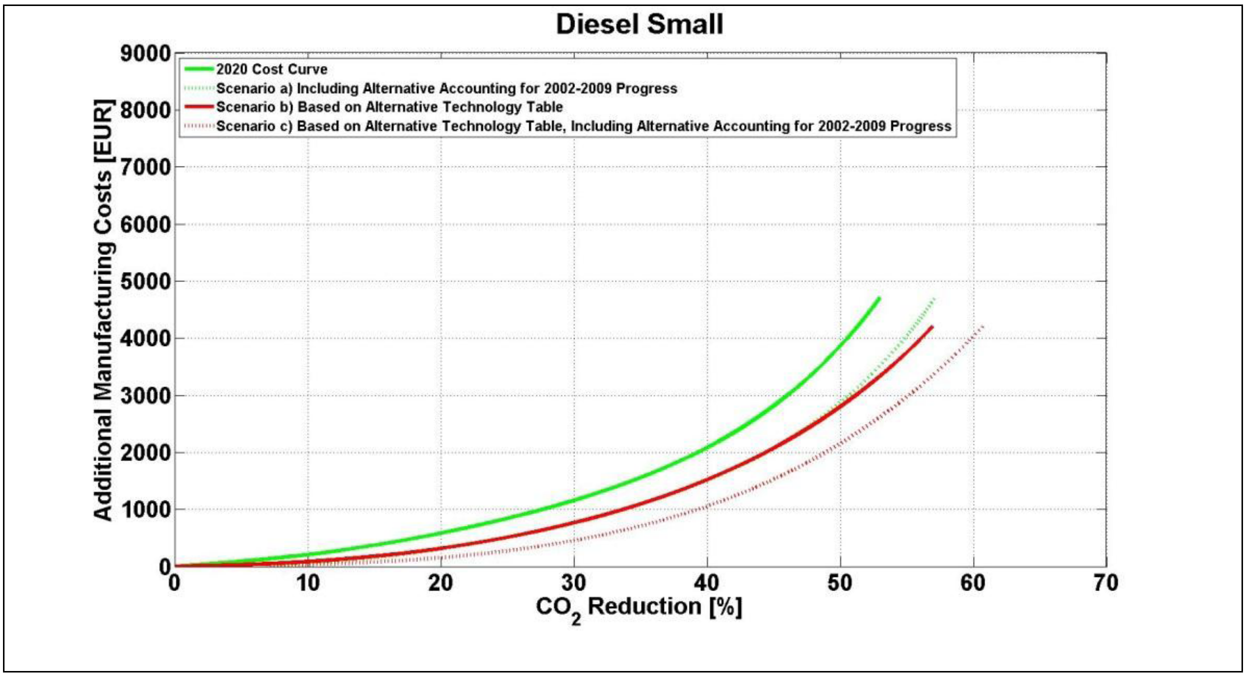
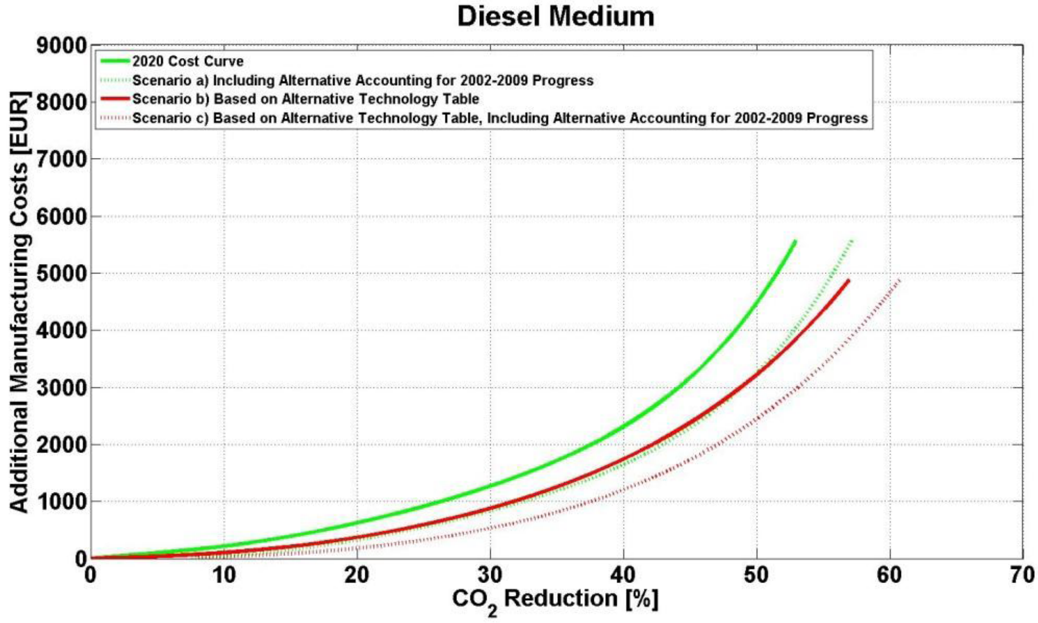
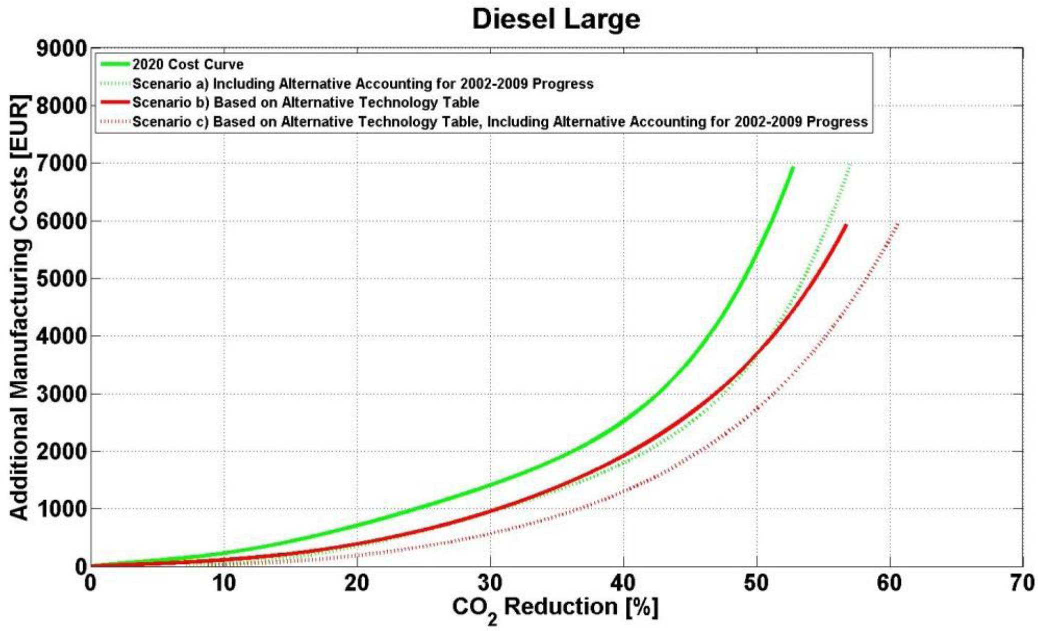


Figure 21 Comparison of cost scenarios 1 - 4 for diesel cars







There are a number of reasons for believing that the lower rather than the higher cost scenarios are more credible.

Information is available that certain important technologies are available at lower cost than assumed in the underlying analysis. For example stop-start systems are assumed to have a 2020 cost of €200 yet these are reportedly supplied for around €40. Hybrid systems are one of the more expensive technologies and a system offering 15% CO_2 reduction is assumed to cost around €1500. However it is reported that Valeo has developed such a system which will cost around €800[40] to manufacturers.

The US based cost analysis was much more extensive than that which has been performed for the Commission. A major aspect of the work was a tear-down analysis of lower CO_2 emitting

40 http://www.decisionatelier.com/Valeo-l-hybridation-a-moins-de-800.html

vehicles to assess the additional manufacturing costs. The ICCT has undertaken a study to convert these US assessments to EU conditions and to supplement it with additional data on technologies more specific to the EU market. This analysis results in a cost curve that is lower than that in scenario 4 of the Commission analysis.

The cost curves relate to the cost of reducing CO_2 emissions from a vehicle on a standard test cycle under test procedures. However, there is considerable evidence that some part of the reductions that have been reported may arise from the flexibility inherent in the test procedures rather than deployment of technology. This is discussed in more detail in Annex 7.7.

In view of these various factors suggesting that lower cost curves may be more appropriate, and in recognition of the uncertainties that exist, it seems most sensible to use the central cost curves, i.e. scenario 2 and 3 as providing the most probable scenario within this impact assessment.

7.14. Discarded options

Phase-in

The options considered for this modality are:

(1) No phase-in of the 2020 target

(2) Inclusion of phase-in of the 2020 target over the period 2017 - 2020 or 2020 - 2023

Option 2 would involve a phasing-in of the 2020 target. This might be carried out over a period of 3 years as with the previous targets. Two variants are considered: a) the phase-in occurs over the period 2017-2020; b) the phase-in occurs over the period 2020-23.

Cars

The assessment[41] of variant a) of option 2 is based on step-wise declining targets leading to 95 gCO_2/km in 2020, which is similar although not identical to a percentage of the fleet complying in earlier years with 95 gCO_2/km. This reduces total CO_2 emissions compared to a "worst case". However, in view of the current trajectory of new car emissions (shown in **Figure 1**), it might have no practical impact. In contrast, it would make the obligation on manufacturers more onerous since they would have to comply in multiple years with a target, not just in 2020, reducing their flexibility.

By contrast variant b) of option 2 would lead to increased CO_2 emissions compared to compliance in 2020. This undermining of the level of ambition in the Regulation would run contrary to the intention of the Council and Parliament and to the desire for regulatory certainty for the automotive sector which is keen to recoup investments in CO_2 reducing technology. A weakening is not warranted since manufacturers will have had 11 years to prepare their plans for compliance and as shown[42], this is more than adequate. Any combined variant (phase-in starting before 2020 and ending after) would suffer the negative aspects of both variants (more CO_2 and less flexibility).

Vans

The 2020 target for vans requires less reduction from the first target (i.e. 16% for vans vs. 27% for cars), although this is distributed over 3 years, compared to 5 for cars. However, 2010 van baseline emissions at around 181 gCO_2/km are much closer to the 2020 target than the equivalent 2010 car emissions. Given the current trajectory, the first target for vans can be expected to be met before 2017 increasing the time to reach the second target. Similar to cars, in view of the reduction trajectory variant a) of option 2 might have no practical impact. Manufacturers are expected to reduce their average emissions smoothly rather than in abrupt steps.[43] As with cars, this variant would be more onerous for manufacturers. However, the short time between the two targets would even more significantly reduce flexibility.

41 Section 15 of the car study

42 Section 5 of the car study

43 If the OEMs were to reduce the average emissions from 2010 to comply with the 2017 and 2020 targets exactly when these become fully mandatory, it would mean on average less than 1 gCO_2/km yearly reduction until 2017 and more than 9 gCO_2/km from 2017 to 2020. This is rather unlikely and a smoother reduction path over the period 2010-2020 is more probable leading to certain overachievement of the 2017 target.

Variant b) of option 2 has the same weaknesses as for cars. Manufacturers will have had 9 years to prepare for compliance and as shown[44], the 2020 compliance cost is expected to be lower than estimated in 2009[45].

In view of these assessments option 2 is discarded for both cars and vans.

Super-credits

The options considered for this modality are:

(1) No prolongation of super-credits

(2) Prolongation of super-credits

(3) Modification of super-credits

The Regulations are based upon CO_2 emissions from the vehicle and ignore those from other parts of the energy supply chain. Therefore certain types of vehicles, essentially using substantial proportion of hydrogen or electricity for their propulsion during the test procedure will be measured as having very low emissions[46]. The Regulations incorporate provisions that count vehicles with emissions below 50 gCO_2/km a multiple number of times for the period up to 2016 for cars and 2018 for vans. It was argued that this multiplier would provide a strong incentive for vehicles meeting this criterion to be marketed. Option 2 would introduce multipliers for low emission vehicles up to 2020 for cars and vans.

The effect of introducing such a multiplier depends on the proportion of vehicles complying with it and is assessed for various scenarios[47]. Depending on the scenario, total CO_2 emissions will increase by between 3% and 15% using a multiplier of 3.5. This is because conventional vehicles are allowed to emit more CO_2 if low-emitting vehicles count as more than one. Option 3 would also result in increased CO_2 emissions although the impact would be somewhat smaller if a lower multiplier was used.

The CO_2 increase shows that super-credits weaken the stringency of the Regulation. This runs counter to the need to provide certainty for the industry that there is a market and need for CO_2 reducing technology. This increase has longer term implications since the higher emissions continue during the period when those vehicles are used i.e. till around 2030. The effect of introducing a multiplier is identical for vans apart from the fact that the negative impacts are somehow mitigated by the limited number of vehicles that can benefit from it[48].

These negative impacts can be limited by introducing low multipliers and a threshold on the number of vehicles which can benefit from super-credits, e.g. by capping it at a low share of the manufacturer's registrations. The Vans Regulation already includes such provision for the short-term target by capping the cumulative number of vehicles which can use super-credits over 4 years at 25,000 vehicles per manufacturer. Finally, in view of lower 2020 targets (95 and 147 gCO_2/km) and to reflect expected technical progress in the development of advanced hybrid and electric vehicles by 2020, the threshold of 50 gCO_2/km would be too high as it would cover too large a share of the overall fleet.

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44 Section 3 of the van study

45 The impact assessment accompanying the Commission's proposal for a regulation setting emission performance standards for light commercial vehicles SEC(2009) 1454

46 For example the Opel Ampera has combined test cycle emissions of 27 gCO_2/km.

47 Section 13.3 of the car study and section 6.2.3 of the van study

48 According to the Vans Regulation a maximum of 25,000 vans per manufacturer registered over 4 years can benefit from a super-credit.

While promoting extremely low CO_2 emission vehicles may be a desired policy goal, it should not be pursued through a measure that undermines the overall CO_2 savings of the policy and reduces its overall cost-effectiveness. This approach runs counter to the aim of ensuring technology neutrality since it advantages manufacturers deploying very low tailpipe technologies for a small part of their fleet and fewer reductions for the rest compared to another who achieves reductions across the whole of their fleet.

Because options 2 and 3 increase CO_2 emissions, reduce the stringency of the target below that politically agreed, reduce the cost-effectiveness of the Regulations and do not respect the principle of technological neutrality these options are discarded for both cars and vans.

Banking and borrowing

Banking and borrowing is familiar from different regulatory environments. The rationale is that a desired level outcome should be achieved by a certain time, but the optimal route to that point may differ between economic actors. In view of this, allowing those actors to bank over-compliance in some years and borrow by under-complying in others, while still achieving the end goal increases flexibility and therefore should lower the cost of achieving the goal. To enable banking and borrowing it is necessary to define an expected trajectory of compliance and then assess borrowing or banking against that baseline. This option is mutually exclusive with phase-in and excess emissions premia.

The most appropriate baseline against which banking and borrowing could be compared is a straight line trajectory towards the objective. However the starting point of the trajectory has a substantial impact on the outcome. Car CO_2 monitoring shows that manufacturers are likely to exceed their target in 2015. This implies that if the starting point for the baseline is taken as 130 gCO_2/km in 2015, manufacturers can be expected to be in over-compliance and therefore able to bank surplus savings. In follows that their overall fleet would not need to meet the 95 gCO_2/km target in 2020 but only later - if borrowing were permitted beyond 2020. Similarly simply assuming that the 2015 target is the baseline to 2019 would create a large surplus of borrowing which would effectively halve the 2020 ambition. A more appropriate baseline for comparison is between the current emissions from monitoring and the 2020 objective.

The time period for which banking and borrowing would be permitted is an important parameter. The longer, the more the flexibility undermines the CO_2 reduction goal. The car study makes clear that this should be limited to 5 to 10 years. If borrowing were permitted beyond 2020, it would be necessary to know what trajectory would be followed and this cannot be done in the absence of a post 2020 target.

Cars

The banking and borrowing option assessed will finish with a neutral balance in 2020, i.e. manufacturers must still comply with their 2020 emission target. The trajectory to be assessed follows a straight line between monitored emissions in 2010 and the 95 gCO_2/km target in 2020.

The assessment[49] shows that banking and borrowing slightly reduces manufacturer compliance costs. This is because more, cheaper technology can be implemented early in the reduction trajectory, and then less effort made towards the end of the period when costs would be higher. The illustrations show a cost saving of some 1% per car.

Against this potential benefit are a number of risks. Manufacturers that over-comply early in the period may be less able to introduce the innovations needed for 2020 models to meet their target. There will be less competitiveness benefit and reduced certainty for suppliers of

[49] Section 15.3 of the car study

advanced technology. There is a risk that some manufacturers might under-comply early in the period but then not manage to over-comply sufficiently to return to a neutral situation in 2020. Banking and borrowing would prevent the application of excess emissions premia in the period to 2020 which removes a strong incentive for manufacturers to ensure they are on a good path to meeting their 2020 target. Complications also arise in how banking and borrowing would apply to pooling. Finally banking and borrowing would introduce additional bureaucratic and administrative procedures.

Vans

Banking and borrowing has not been analysed in detail for vans. It has also been discarded as an option because of the 3-year gap between the two targets which is fairly short, and expectation of greater stability in the market distribution of sales between van classes. In view of the lower stringency of the 2020 van target compared to that for cars, the scheme would bring little benefit in terms of flexibility and carry administrative burden. As for cars, banking and borrowing prevents use of excess emissions premia up to 2020 removing a strong incentive for manufacturers' compliance and creates problems in relation to pooling.

In view of the above considerations, the option is discarded for both cars and vans.

Combining car and van targets

Until now CO_2 legislation has been implemented separately for cars and vans. A reason for that is that these vehicle categories represent different markets with to a large extent unrelated vehicle models. Given the different characteristics and applications of cars and vans, the two categories may have different CO_2 emission reduction potentials from a technical and economic perspective. On the other hand there is some overlap between the categories. A large share of class I and II vans are car derived. Even dedicated van platforms often share engine and other powertrain components with cars. Some vehicles could in theory be covered by either the van or car Regulation depending on how they are registered. However, at present, the limit value curve slopes of the two Regulations differ. This means it is attractive for manufacturers to register small vans below 1157,5 kg as cars, since they will benefit from a less stringent target, and to register cars above this threshold as vans. However, there are legal limitations to how far this can be done[50].

There are several possibilities to combine the targets for these two categories which are assessed[51]:

- Allow pooling between cars and vans.
- Combine the van and car Regulation with a single limit value curve
- Bring car derived vans under the car Regulation.

Pooling between the two categories could in principle ensure a cost-effective means of meeting a target for light-duty vehicles. However, there is no such overall target. Also in view of the differences in stringency of the 2020 targets for cars and vans and thus significant differences in marginal costs, manufacturers would be likely to over-comply with the van target rather than try to fully meet the car target. This flexibility would benefit those manufacturers producing both categories of vehicles and thus not be competitively neutral.

50 According to Commission Regulation (EU) No 678/2011 amending Directive 2007/46/EC a vehicle can be categorised as N1 if, inter alia, the seating compartment is separated from the loading area and vehicle's bodywork meets certain criteria regarding the loading and cargo areas.

51 Section 12 of the car study

Setting a combined linear limit value curve for both categories of vehicles would result in either unattainable van targets (in case of mass-based function) or unachievable car targets (in case of footprint-based function). Such combined functions would be detrimental to manufacturers of only one category of vehicles.

The main drawback to the option addressing the technical overlap between cars and car-derived vans is the need for a precise legal definition of which vans would qualify for inclusion in the (possibly adapted) car target. This would be very difficult to establish and would require subjective judgment as to the status of a vehicle. This could give rise to arbitrariness and provide perverse incentives. Also, this option reduces the room for manufacturers' internal averaging to meet the target for the remaining vans.

In view of these conclusions this option is discarded.

Mileage weighting

The legislation is based upon average new vehicle CO_2 emissions per km. In reality different classes of vehicles are driven different distances annually and over their lifetime, which means that overall CO_2 reductions can differ depending on the distribution of CO_2/km reductions across the vehicle fleet. The ultimate goal of lowering total vehicle CO_2 emissions might be more cost effectively achieved from a larger reduction in vehicles that travel further and a corresponding reduction in effort for vehicles that travel less. In view of this, the option considered is to introduce a mileage weighting factor to the CO_2 emission values based on an estimate of the relative distances travelled by different vehicle classes and fuels.

Cars

Broadly speaking the assessment[52] shows that larger cars drive further than smaller cars and diesel further than petrol. Mileage weighting based upon the estimated values could lead to slightly lower overall costs of compliance. Total overall cost savings amount to around 2%.

However, there are significant distributional impacts. Diesel cars, because they must make substantially more reduction effort, have costs between €300 and €1100 higher per car. In contrast petrol cars have compliance costs between €400 and €650 lower per car.

The approach could be open to challenge due to the lack of sufficiently strong evidence on the mileage of different vehicle classes. Implementation of the measure could be complex. Since the mileage distribution between small and large cars is similar for petrol and diesel, a comparable effect for size could be achieved by lowering the slope of the limit value curve. In view of these factors it is thought unwise to proceed with the option. In addition, as summarised in section 5 of annex 7.4, the stakeholders were not in favour of this modality. It is therefore concluded that this approach should be discarded.

Vans

Over 90% of vans are diesel, therefore mileage weighting is unnecessary to take account of mileage differences between different fuel types. There is also insufficient evidence on the mileage of different van classes making the suitability of this measure highly uncertain. Furthermore, its implementation could be complex due to data requirements. There is a risk of a differential impact on manufacturers so in view of these factors this option is also discarded for vans.

[52] Section 16 of the car study

Vehicle based limits

This provision would mean setting a limit curve exceedance of whose values by any vehicle placed on the market would require payment of a penalty. This was assessed for application in addition to the fleet wide average target[53].

Cars

Four variants of the vehicle based limit curve were explored – flat, linearly sloped, truncated linear and curved. Of these the linear has the lowest compliance costs and buy-out premia while the flat has the highest. Whichever approach is adopted, some manufacturers would have high buy-out costs. This would result in a large cost burden on these manufacturers without necessarily leading them to develop further technology since at present the study has not identified technologies adequate to enable their compliance.

Vans

While for cars it can be argued that there is no additional transport utility for higher emissions, this logic does not apply to vans. Larger vans offer more transport utility by offering more payload or loading space and thus may reduce the number of vehicles needed to transport a given amount of goods. Applying vehicle based limits to vans could therefore perversely lead to lower transport efficiency.

It is concluded that this approach should be discarded for both cars and vans.

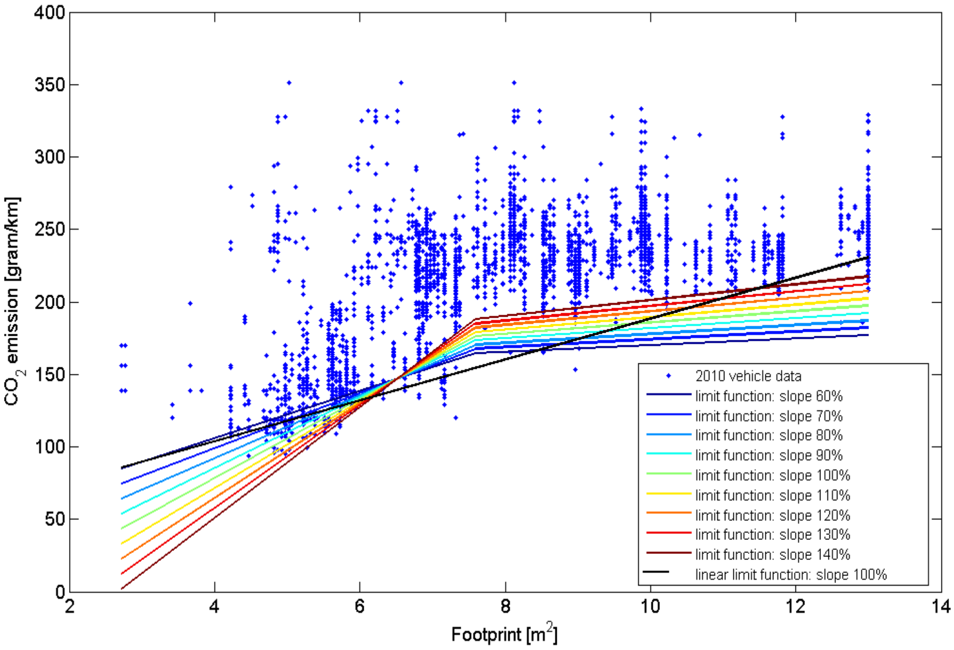
[53] Section 11 of the car study

7.15. Description of non-linear limit value curve for LCVs

The relationship between the measured CO_2 emissions and footprint is of quite a different format for vans and cars. In case of vans whose footprint is above around 8 m^2 the relationship levels off giving similar CO_2 emissions, even when their footprint is 13 m^2. The reasons for this are not fully understood, but are thought to arise, at least in part, from the characteristics of the test procedure, e.g. the equivalent inertia dynamometer load setting does not increase beyond 2,270 kg for any vehicle weighing above 2,210 kg. Therefore, the supporting study on LCVs concludes that a non-linear function better describes the relationship between footprint and CO_2 for the van fleet.

Figure 22 shows the non-linear equivalent of the 100% footprint-based limit function and a number of non-linear alternatives with different slopes. The value of the footprint where the gradient changes from being relatively steep to very shallow, is 7.6 m^2, and is described as the interception point. The other notable point in the graph occurs at 6.5 m^2, the value where all the lines go through the same pivot point.

Figure 22 The non-linear equivalent of the 100% footprint-based limit function and a number of alternatives between 60% and 140% slopes. The interception point is 7.6m^2 and the pivot point is 6.5m^2.



7.16. List of possible environmental impacts

Environmental Impacts	Key Questions	Answer
The climate	• Does the policy affect the emission of greenhouse gases (e.g. carbon dioxide, methane etc.) into the atmosphere? • Does the policy affect the emission of ozone-depleting substances (CFCs, HCFCs)? • Does the policy affect our ability to adapt to climate change?	Yes No No
Transport and the use of energy	• Will the policy increase/decrease energy and fuel needs/consumption? • Does the policy affect the energy intensity of the economy? • Does the policy affect the fuel mix (between coal, gas, nuclear, renewables etc.) used in energy production? • Will it increase or decrease the demand for transport (passenger or freight), or influence its modal split? • Does it increase or decrease vehicle emissions?	Yes Yes No Yes Yes
Air quality	• Does the policy have an effect on emissions of acidifying, eutrophying, photochemical or harmful air pollutants that might affect human health, damage crops or buildings or lead to deterioration in the environment (soil or rivers etc.)?	Yes (secondary effect)
Biodiversity, flora, fauna and landscapes	• Does the policy reduce the number of species/varieties/races in any area (i.e. reduce biological diversity) or increase the range of species (e.g. by promoting conservation)? • Does it affect protected or endangered species or their habitats or ecologically sensitive areas? • Does it split the landscape into smaller areas or in other ways affect migration routes, ecological corridors or buffer zones? • Does it affect the scenic value of protected landscape?	No No No No
Water quality and resources	• Does the policy decrease or increase the quality or quantity of freshwater and groundwater? • Does it raise or lower the quality of waters in coastal and marine areas (e.g. through discharges of sewage, nutrients, oil, heavy metals, and other pollutants)? • Does it affect drinking water resources?	No No No

Environmental Impacts	Key Questions	Answer
Soil quality or resources	• Does the policy affect the acidification, contamination or salinity of soil, and soil erosion rates? • Does it lead to loss of available soil (e.g. through building or construction works) or increase the amount of usable soil (e.g. through land decontamination)?	No No
Land use	• Does the policy have the effect of bringing new areas of land ('greenfields') into use for the first time? • Does it affect land designated as sensitive for ecological reasons? Does it lead to a change in land use (for example, the divide between rural and urban, or change in type of agriculture	No No
Renewable or non-renewable resources	• Does the policy affect the use of renewable resources (fish etc.) and lead to their use being faster than they can regenerate? • Does it reduce or increase use of non-renewable resources (groundwater, minerals etc.)?	No No
The environmental consequences of firms and consumers	• Does the policy lead to more sustainable production and consumption? • Does it change the relative prices of environmental friendly and unfriendly products? • Does it promote or restrict environmentally un/friendly goods and services through changes in the rules on capital investments, loans, insurance services etc.? • Will it lead to businesses becoming more or less polluting through changes in the way in which they operate?	No No No No
Waste production / generation / recycling	• Does the policy affect waste production (solid, urban, agricultural, industrial, mining, radioactive or toxic waste) or how waste is treated, disposed of or recycled?	No
The likelihood or scale of environmental risks	• Does the policy affect the likelihood or prevention of fire, explosions, breakdowns, accidents and accidental emissions? • Does it affect the risk of unauthorised or unintentional dissemination of environmentally alien or genetically modified organisms?	No No

7.17. Effect on emissions of slope and autonomous mass increase

As concluded in section 5.3 changes to the slope do not directly cause any change in overall new car or van fleet CO_2 emissions per km. This annex explains a secondary effect on CO_2 emissions linked to a potential autonomous mass increase (AMI) in passenger cars. AMI is an increase in mass linked to other factors than CO_2 standards, such as demand for larger vehicles, additional safety requirements etc.

This is illustrated by comparing the impact of two slopes of the curve (60% based on 2006 data (a=0.0333) and 100% based on 2009 data (a=0.0494)) which would lead to a change in target CO_2 as a function of mass in running order as illustrated in Figure 23. This would not lead directly to an aggregate change in CO_2 emissions provided the average mass of vehicles remained unchanged, although it would present different challenges to different manufacturers dependent on the average mass in running order of their vehicles.

However, this situation would be different if the autonomous mass increase (AMI) was observed and the average mass increased. If the AMI would amount to 0.82% per year, by 2030 the average mass in running order for passenger cars would have increased from 1,372 kg (as in the car Regulation) to 1,608 kg. This would lead to an increase in average mass in running order of the new car fleet of 236 kg. Even though the Regulation allows for the overall average mass to be adjusted every 3 years starting from 2016, a small secondary effect would occur for the two years between these adjustments.

From Figure 23 it is seen that the target for a heavier average fleet is greater for the slope with a=0.0494 than for a=0.0333. The effect of two years' worth of autonomous mass increase (22.5 kg) would be to increase the average CO_2 emissions (gCO_2/km) by 1.25 gCO_2/km for the slope with a=0.0494, and by 0.75 gCO_2/km for a slope with a=0.0333. Consequently the use of a=0.0494would for this year allow a 0.5 gCO_2/km larger increase in emissions. The corresponding figures for the previous and subsequent years would be: 0.25 gCO_2/km additional emissions and no additional emissions because of the adjustment of mass in the third year. On average, this secondary effect would result in around 0.25 gCO_2/km additional emissions when averaged over the 3 year mass adjustment cycle. Relative to an average emissions value of around 100 gCO_2/km, this secondary effect is a +0.25%, a very small change relative to the -26.9% change caused by the implementation of the 95 gCO_2/km 2020 target.

Figure 23 The 2020 target CO_2 as a function of mass in running order for slopes of 60% and 100%