EN

COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 28.10.2009
SEC(2009) 1454

**COMMISSION STAFF WORKING DOCUMENT**

***IMPACT ASSESSMENT***

***Accompanying document to the***

Proposal for a

**REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL**

**Setting emission performance standards for new light commercial vehicles as part of the Community's integrated approach to reduce $CO_2$ emissions from light-duty vehicles**

{COM(2009) 593 final}
{SEC(2009) 1455}

# TABLE OF CONTENTS

# 1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

## 1.1. Background in the development of the proposal

The proposal for the regulation on reduction of $CO_2$ emissions from light commercial vehicles (LCVs) is a continuation of the Commission's regulatory process to address the climate change impacts of road vehicles. This policy initiative started with the publication in February 2007 of two Communications: a Communication on the revised $CO_2$ and cars strategy[1] and a Communication on a Competitive Automotive Regulatory Framework for the 21st Century CARS 21[2] (referred to as "*the earlier Communications*" in this document). On the basis of these Communications, the Commission proposed an integrated approach to achieve the EU objective of 120 $gCO_2$/km from new passenger cars by 2012. Under this approach, legislative proposals would focus on mandatory reductions of $CO_2$ emissions to reach an average objective of 130 $gCO_2$/km for new passenger cars by means of improvements in vehicle motor technology. A further reduction equivalent to 10 $gCO_2$/km would be achieved by other technological improvements and increased use of bio-fuels. These include[3]:

– setting minimum efficiency requirements for air-conditioning systems;

– the compulsory fitting of accurate tyre pressure monitoring systems;

– setting maximum tyre rolling resistance limits;

– use of gear shift indicators;

– fuel efficiency progress in light commercial vehicles (vans and minibuses) with the objective of reaching 175 g $CO_2$/km in 2012 and 160 $gCO_2$/km by 2015.

In 2007 the Commission adopted a proposal for a Regulation[4] setting emission performance standards for new passenger cars with the aim of limiting $CO_2$ emissions from new passenger cars to an average of 130 $gCO_2$/km. The proposal was accompanied by an extensive impact assessment[5] (referred to as the *'impact assessment on $CO_2$ and cars'* in this document) that included a detailed analysis of the economic, social and environmental impact of the regulation. The Council adopted the legislative text agreed in co-decision in April 2009[6], further referred to as regulation on $CO_2$ and cars.

---

1 COM(2007) 19, 07.02.2007

2 COM(2007) 22, 07.02.2007

3 Several of these measures are estimated to have a negative cost so their absence in the market has to be considered as a market failure, possibly linked to the level of return that they provide.

4 COM(2007) 856 final. Proposal for a regulation of the European Parliament and of the Council setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce $CO_2$ emissions from light-duty vehicles

5 Accompanying document to the Proposal from the Commission to the European Parliament and Council for a regulation to reduce $CO_2$ emissions from passenger cars (SEC(2007)1723).

6 Regulation of the European Parliament and of the Council setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce $CO_2$ emissions from light-duty vehicles (EC) no 443/2009

Light commercial vehicles were not included in the regulation on $CO_2$ and cars due to the necessity to gather more data on LCVs. The current legislative proposal on the reduction of $CO_2$ emissions from light commercial vehicles therefore supplements the regulation on $CO_2$ and cars and supports achievement of the overall EU objective to cut $CO_2$ emissions from the new light duty vehicle fleet, by putting in place measures to reduce $CO_2$ emissions from light commercial vehicles. Light commercial vehicles make up around 12% of the light duty vehicle fleet.

For the purposes of better regulation and administrative simplicity, the proposal on $CO_2$ and light commercial vehicles should, where possible, be aligned with the legislation setting emission performance standards for cars. Therefore similar policy options will be reviewed to regulate $CO_2$ emissions from the light commercial vehicles fleet.

Correspondingly, this impact assessment is similar to the impact assessment developed for passenger cars. The policy options applicable for passenger cars and the resulting impacts were discussed in depth in the impact assessment on $CO_2$ and cars. In order to avoid repetition, this impact assessment will include cross-references to that assessment.

### 1.2. Consultation and expertise

For the preparation of this legislation an inter-service group was set up and a meeting was organised on 23 July 2008 and 18 March 2009 in order to collect the views of various services. The services involved in this group included: DG Environment, the Secretariat General, DG Enterprise and Industry, DG Transport and Energy, DG Economic and Financial Affairs and Joint Research Centre. The timing of the proposal development and the key aspects of the proposed legislation were discussed in this inter-service consultation.

Stakeholder consultation process included a public internet consultation and two stakeholders meetings.

- Between May and July 2007, an internet public consultation was carried out, aimed at gathering the views of all stakeholders and members of the public on the implementation of the revised $CO_2$ and cars strategy. This included measures to reduce emissions from light commercial vehicles. The majority of consultation responses are available at: http://ec.europa.eu/reducing_co2_emissions_from_cars/index_en.htm.
  The results of the consultation were presented in Annex III of the Impact assessment on $CO_2$ and cars therefore it will not be repeated here.

- To complement the internet consultation, two stakeholder meetings were organised by the Commission on 02 September 2008 and 09 March 2009. This provided the stakeholders directly concerned by the upcoming legislation (automotive industry, suppliers, environmental NGOs, social partners and Member States) the opportunity to present their positions. The summaries of both meetings are attached in Annex I and Annex II.

In addition an external study investigating possible regulatory approaches to reducing $CO_2$ from light-duty vehicles was carried out and a study consisting of two reports:

'*Assessment of options for the legislation on $CO_2$ emissions from light commercial vehicles*'[7]and '*Assessment with respect to long term $CO_2$ emission targets for passenger cars and vans*'[8], has been developed. This study was part of a project 'Impacts of regulatory options to reduce $CO_2$ emissions from cars, in particular on car manufacturers' under the framework contract ENV.C.5/FRA/2006/0071 (Service request ENV C5/GK/ak/D(2007)17850). Analysis of alternative policy options is based on findings of the two reports, further referred to as *'the supporting study on light commercial vehicles (LCVs)'*.

Input from stakeholders has been taken into account in assessing the different possible options to regulate $CO_2$ emissions from light commercial vehicles, 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 hearings).

### 1.3. Results of the consultation of the Impact Assessment Board

A draft version of the impact assessment report was submitted to the Impact Assessment Board on 25 March 2009 which issued its opinion on the document on 28 April 2009. The final opinion stated that the impact assessment should assess potential effects of pooling the $CO_2$ reduction targets for cars (Ml) and light commercial vehicles (LCVs) in more depth, including impacts on the current market structure and on administrative burden. The Board also requested that the implications of the changes introduced by the Legislator to the regulation on cars, which were not assessed in the corresponding IA, should be discussed more explicitly. Finally, further analysis of the potential impact on the external competitiveness of EU car manufacturers was demanded.

These comments have been taken into account in the final impact assessment as follows:

- Impacts of pooling between cars and LCVs on the level of excess emissions premium as well as on manufacturers producing cars and vans, or only vehicles of one category, were clarified in section 5.2.7.

– The link of this proposal to the overall Strategy, including other measures of the integrated approach (incl. $CO_2$ from cars proposal), has been clarified in section 5.2.8.

– More attention has been given to the analysis of potential impacts of the legislation on the competitiveness of the EU industry in the third countries (section 5.2.2).

---

7 This report is available on Europa website under the following link: http://ec.europa.eu/environment/air/transport/co2/co2_studies.htm

8 This report is available on Europa website under the following link: http://ec.europa.eu/environment/air/transport/co2/co2_studies.htm

– In addition, the aspects related to the type approval and monitoring of passenger cars and LCVs, and the impact of the scheme on administrative burden, have been described in more detail in sections 2.4.3 and 5.5.

## 2. CONTEXT AND PROBLEM DEFINITION

### 2.1. The context of the initiative

The overall rationale for the revised $CO_2$ and cars strategy, based on an integrated approach, and implemented through a legislative framework, has been analysed in detail in the earlier Communications and the impact assessment on $CO_2$ and cars. Key aspects are summarised here:

- All sectors must contribute to the fight against climate change: The EU has made a commitment to achieve at least a 20% reduction of GHG emissions by 2020 compared to 1990 levels, increasing to 30% as part of a comprehensive international agreement. To avoid distortions, and for the sake of economic and social fairness, all sectors must contribute to the reduction effort, including transport. While there is no binding EU target for transport sector, transport covers major part of the emissions under the Effort Sharing Decision[9] which requires a 10% reduction from 1990 levels by 2020;

- The $CO_2$ performance of new vehicles should improve at a faster rate: While the EU27 as whole has reduced its emissions of greenhouse gases (GHG[10]) by 5.2% over the 1990-2006 period, the GHG emissions from transport have increased by 35.8% and in particular from road transport, GHG emissions have increased by 29.3%[11]. This trend is partly linked to the limited progress in real world improvements in fuel efficiency (the average reduction of emissions over 2002-2007 for light commercial vehicles amounted to 0.4-0.5% per year), and partly linked to the increase in transport activity. Existing policies to reduce $CO_2$ emissions and improve the fuel efficiency of new cars sold in the EU have not been able to deliver the progress needed for reaching the long-standing EU objective to reduce the average emissions of the new passenger car fleet to 120 g/km.;

- Road transport needs to use less oil: There is a direct link between improved fuel efficiency and lower $CO_2$ emissions. Road transport relies heavily on oil for which the EU's import dependency is higher than 80%. This has a significant impact on the EU's security of energy supply and makes the EU economies more susceptible to oil shocks. In 2006, road transport accounted for 25.8% of the final energy consumption in the EU27;

- Further reductions in $CO_2$ emissions must be achieved cost-effectively without undermining sustainable mobility and the car industry's competitiveness: Light duty vehicles are an important part of the everyday lives of a large number of Europeans. Vehicles provide mobility, which is essential to European society and economy. In

---

9 Decision 2009/406/EC

10 In road transport, $CO_2$ emissions account for 98% of all GHG in this sector.

11 Source: EC, DG for Energy and Transport, EU energy and transport in figures: Statistical pocketbook 2009. Figures are including International Bunkers but excluding LULUCF.

2005, road transport accounted for around 86% of passenger transport activity and approximately 70% of freight transport activity in Europe. Europe is the world's largest producer of passenger cars and light commercial vehicles with around 30% of these vehicle types produced in Europe. The European automotive industry is a major component of Europe's manufacturing base. The vehicle industry accounts for about 20% of Europe's manufacturing R&D investment (over €20 billion), contributed about €60 billion to Europe's trade balance and contributes more than €350 billion in fiscal revenues, which represents about 8% of the European Union's total general government revenues. Legislation to reduce the GHG emissions of light duty vehicles should not undermine the competitiveness of the automotive industry in Europe.

### 2.2. Legal basis

The proposal on light commercial vehicles is similar to the Regulation on $CO_2$ emissions from passenger cars. The legal basis of that Regulation is Article 175 EC. The first recital of the Regulation states "*The objective of this Regulation is to set emission performance standards for new passenger cars registered in the Community which delivers part of the Community's integrated approach to reducing $CO_2$ emissions from light-duty vehicles while ensuring the proper functioning of the internal market*". The same applies to the current proposal on light commercial vehicles. Therefore the legal basis for the proposal is Article 175.

### 2.3. Problem definition

The main problem, concerning $CO_2$ emissions from all light duty vehicles was described in the impact assessment on $CO_2$ and cars. It states that:

**'The overarching problem as identified in the earlier Communications is that existing policies to reduce $CO_2$ emissions and improve the fuel efficiency of new cars sold in the EU have not been able to deliver the progress needed for reaching the long-standing EU objective of an average new light duty vehicles fleet $CO_2$ emission of 120 g/km.'**

The regulation on $CO_2$ and cars addresses $CO_2$ emissions from passenger cars as the main part of the implementation of the integrated approach. At present light commercial vehicles, which make up around 12% of the light duty vehicles fleet, are not covered by the Community policies to reduce $CO_2$ emissions. However, the revised strategy COM(2007)19 identified fuel efficiency progress in light-commercial vehicles as part of the integrated approach to achieving the Community objective of reducing emissions from new passenger cars to 120 g/km.

A consultants report[12] revealed that the number of light commercial vehicles (LCV) has been slowly increasing in European transport fleet (now making up 12% of the total road transport fleet[13]), and consequently that the share of $CO_2$ emissions from LCV is rising. Therefore, in order to reduce $CO_2$ emissions from the transport sector, it is necessary to introduce fuel efficiency measures for light commercial vehicles. Further, in the absence

---

12 TNO Automotive, Measuring and preparing reduction measures for CO2 emissions from N1 vehicles. Final report. (contract no. 04.OR.VM.050.1/DE)

13 See Figure 3

of a regulation for light-commercial vehicles, there is a risk of a regulatory gap which could undermine the effectiveness of the regulation on passenger cars (explained in more detail in section 2.4.3).

The specific problem therefore is to design a legislative instrument to limit emissions of $CO_2$ from light commercial vehicles.

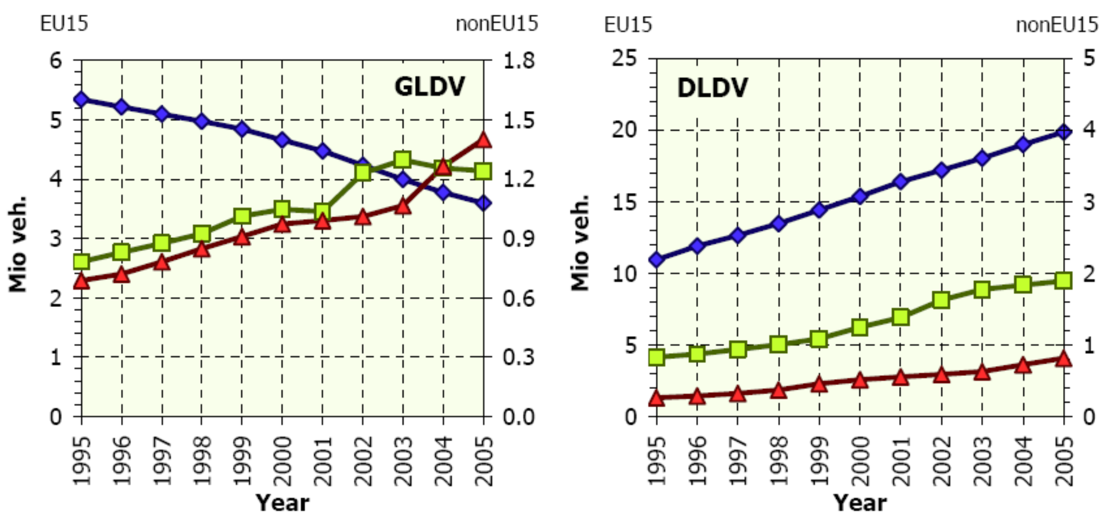
## 2.4. What are the underlying drivers of the problem?

As far as overall $CO_2$ emissions from road transport are concerned, a wide range of factors influence the observed and predicted growth in $CO_2$ emissions from passenger cars and light commercial vehicles.

### *2.4.1. Vehicle stock of LCVs is increasing*

According to the FLEETS[14] report, the number of light duty vehicles has been increasing in Europe since 1995 (with the exception of gasoline vehicles in EU-15). The development of the stock is presented in Figure 1.

Figure 1 **Development of the LDV stock in Europe** (Source: FLEETS 2008)

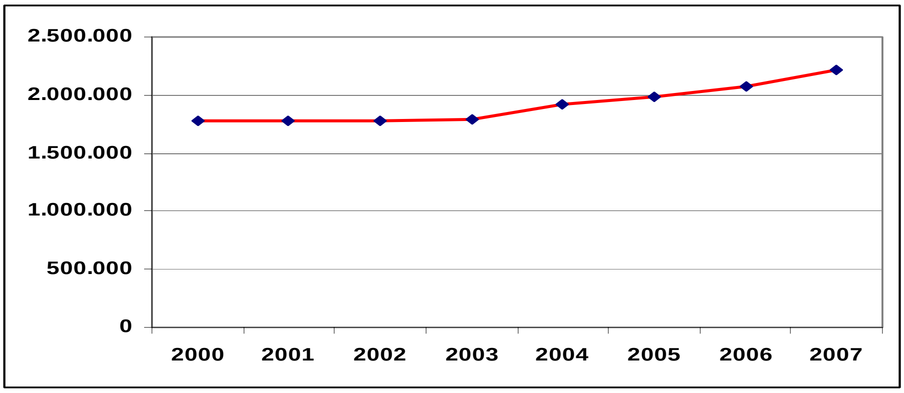



Note: GLDV = Gasoline LDV; DLDV = Diesel LDV

Sales of light commercial vehicles according to Global Insight have been growing since 2002. Figure 2 shows that in total sales of light commercial vehicles increased by 24% during the period 2000-2007.

14 European Database of Vehicle Stock for the Calculation and Forecast of Pollutant and Greenhouse Gases Emissions with TREMOVE and COPERT (Contract No 070501/2006/451259/MAR/C5); Final report, 2008

Figure 2 **Development of number of sales of light commercial vehicles in EU-27 (source: Global Insight)**



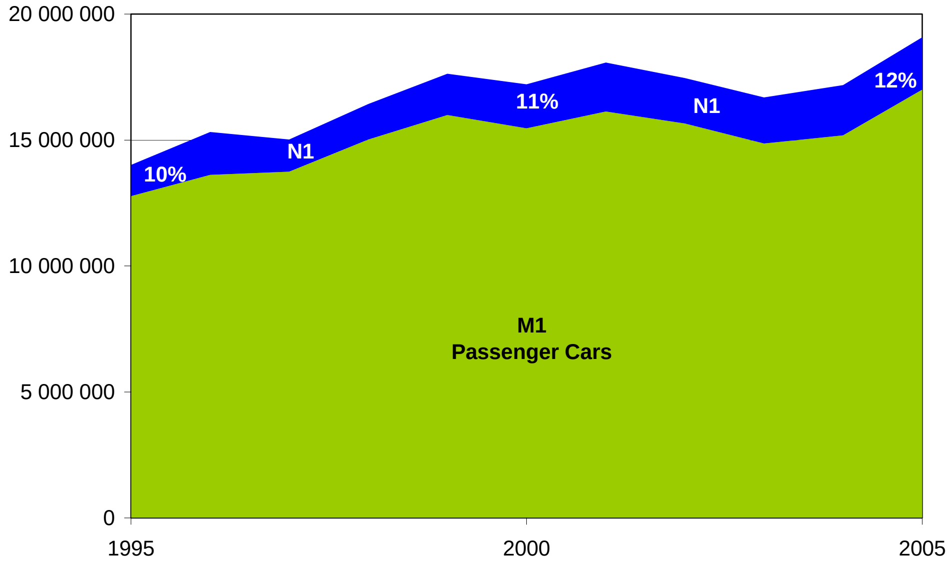

This trend is also clearly visible in both, EU-15 and the new Member States (Figure 3) with share of diesel powered vehicles growing at the expense of petrol engines in both groups of countries.

Table 1 **N1 registrations in EU-15 and EU-12** (source: FLEETS report, **http://lat.eng.auth.gr/copert/data.php**)

| | EU15 N1 registrations | | | EU12 N1 registrations | | |
|---|---|---|---|---|---|---|
| | 1995 | 2000 | 2005 | 1995 | 2000 | 2004 |
| **Stock ('000):** | **16 323** | **20 050** | **23 506** | **1 611** | **2 293** | **3 093** |
| Diesel | 10 950 | 15 357 | 19 854 | 781 | 1 047 | 1 255 |
| Gasoline | 5 342 | 4 657 | 3 596 | 830 | 1 245 | 1 836 |
| LPG | 31 | 35 | 55 | | | |
| **New registrations ('000):** | **1 241** | **1 739** | **2 076** | **386** | **211** | **301** |
| Diesel | 1 073 | 1 575 | 1 958 | 186 | 127 | 220 |
| Gasoline | 165 | 162 | 106 | 200 | 84 | 81 |
| LPG | 4 | 2 | 12 | | | |

The share of N1 vehicles (vans) in the total registrations of light-duty vehicles has been increasing at a steady rate from 1995 to 2005. This phenomenon can also be explained to some extent by growing number of large passenger cars (e.g. SUVs) being registered as light commercial vehicles, mainly for tax purposes (see section 2.4.3). This trend is likely to be reinforced when the regulation on $CO_2$ from passenger cars starts applying and no similar legislation on light-commercial vehicles is in place.

Figure 3 **Registrations of vans (N1) and passenger cars (M1) in EU27 (1995-2005)** (source: EC)




### *2.4.2. LCV driving pattern and mileages*

The driving patterns for LCVs are slightly different than for cars. FLEETS study analysis 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 very close for LCVs and passenger cars (M1), i.e. 13 971 km and 13 303 km respectively. This is also the case for new fleet whereby EU average annual mileage for passenger cars amounts to 17 113 km whereas for light commercial vehicles it is around 20 000 km.[15]

### *2.4.3. Potential regulatory gap linked to type approval and registration procedures*

According to the Directive 70/156/EEC (amended), the light commercial vehicle (N1) category contains vehicles with maximum mass not exceeding 3,5 tonnes which are used for the transport of goods. However, in practice many vehicles that are homologated as passenger cars (category M1) are registered as N1, often to take advantage of reduced taxation or other fiscal incentives. The decision under which category the vehicle is registered may be made independently from the homologation. Cars can also be easily adapted by distributors in order to allow the users to register these vehicles as LCVs. Therefore, the exact mix of N1 vehicles in total vehicle fleet is not entirely certain.[16]

The 2008 report "European Database of Vehicle Stock for the Calculation and Forecast of Pollutant and Greenhouse Gases Emissions with TREMOVE and COPERT" (FLEETS report) concluded that in EU15 passenger cars make up 4-58 % of N1 registrations. Data

---

15 TREMOVE baseline scenario 2005

16 The database used in the supporting study was corrected in view of eliminating M1 vehicles registered as N1 from the dataset.

show that these are SUVs but also other luxury and smaller vehicles, which are mainly used for the transport of passengers. Based on the FLEETS report analysis, it is clear that the number of N1-registered vehicles which are primarily used for the transport of people and not goods is quite significant.

Table 2 **EU15 sales and actual registrations of N1 vehicles in 2005** (source: FLEETS report)

| **EU15** | Total sales of | N1 models | Total N1 | M1 models | share in |
|---|---|---|---|---|---|
| AT | 32 285 | 8 004 | 28 878 | 4 597 | 16% |
| BE | 74 879 | 24 374 | 62 672 | 12 167 | 19% |
| DE | 322 801 | 129 019 | 202 335 | 8 553 | 4% |
| DK | 29 730 | 5 249 | 58 079 | 33 598 | 58% |
| ES | 240 213 | 3 051 | 387 203 | 150 041 | 39% |
| FI | 17 609 | 2 230 | 16 211 | 832 | 5% |
| FR | 347 898 | 77 583 | 420 065 | 149 750 | 36% |
| IT | 163 391 | 26 059 | 218 514 | 81 182 | 37% |
| LU | 4 387 | 1 621 | 3 064 | 298 | 10% |
| NL | 68 978 | 7 794 | 66 236 | 5 052 | 8% |
| PT | 33 518 | 1 260 | 66 774 | 34 516 | 52% |
| SE | 34 106 | 4 438 | 35 095 | 5 427 | 15% |
| UK | 291 475 | 17 975 | 330 436 | 56 936 | 17% |

In addition, there are no constraints on drivers consequent on the type approval of a passenger car as N1 because the same driving licence is required and insurance premiums are not significantly higher.

The scope of the legislation on passenger cars, and also of the proposed legislation on light commercial vehicles, is linked to the type of vehicle (M1 or N1) as homologated under Directive 2007/46/EC. Therefore, the registration practice in the Member States regarding M1 versus N1, as described above, does not affect the scope of the legislation. This means that even vehicles type approved as passenger cars but registered as LCVs will fall under the scope of the regulation on $CO_2$ and cars. However, the presence of a certain degree of overlap between the registrations for passenger cars and light commercial vehicles suggests that there is a risk of market responses if one category of vehicles is subject to legislation on $CO_2$ emissions whereas the other is not, leading to the risk of an unintended regulatory gap. The absence of regulation for LCVs could create incentives for manufacturers to type approve large passenger cars as light commercial vehicles in order to avoid the mandatory $CO_2$ standards for passenger cars.

For this reason, the legislation for M1 category and N1 category should preferably enter into force in the same time – the longer the gap between the legislation, the bigger the incentive for inappropriate type approval.

### 2.5. Stakeholders affected

The proposed regulation will have an impact on a number of stakeholder groups, however the scale of the effect should not be as large as in the case of passenger cars. The share of light commercial vehicles produced by the automobile manufacturers in Europe is much smaller than the share of cars. According to ACEA statistics, light commercial vehicles (below <3.5 t) amount to 10% of total motor vehicle production in the EU.

Major stakeholder groups affected include the general population, vehicle consumers, car manufactures, automotive component suppliers and fuel suppliers:

- The population of the European Union is increasingly affected by climate change through the increased climate variability and more frequent extreme weather events, and their related impacts.

- The buyers of vehicles are affected by possible increases in the price of new vehicles and reductions in their running costs, due to stricter requirements on $CO_2$ emissions and the related improvements in fuel consumption. The regulation on light commercial vehicles (LCVs) however will have a less important impact on private consumers than the regulation on $CO_2$ and cars, because there are fewer LCVs purchased for individual use. On the other hand, users with specific applications (police and security organisations, postal and parcel delivery services; telecommunications and other infrastructure services suppliers) will be affected.

- The manufacturers of LCVs will be affected by the obligation to comply with the new regulatory scheme to reduce $CO_2$ emissions. Manufacturers 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, given that demand for low carbon vehicles is likely to increase throughout the world as climate change policies continue to develop, manufacturers have an opportunity to gain first mover advantage, providing them with a possibility to export advanced low carbon vehicles to other markets.

- Component suppliers will also be affected by increasing demand for advanced technologies. They are likely to benefit from the higher demand for low carbon technologies. As with the automotive manufacturers they may also benefit from the possibility to export these advanced technologies to other markets around the world.

- Fuel suppliers will also be affected. They are likely to see lower demand for transport fuels as a result of the legislation.

- Small and medium enterprises (SMEs), using light commercial vehicles will be affected by possible increases in the price of new vehicles and will benefit from reductions in their running costs that will result from the legislation.

## 2.6. Current economic situation

The financial crisis that began in the second half of 2008 has had profound impacts on the economy, including the automotive sector. In February 2009, the Commission adopted a Communication on "Responding to the crisis in the European automotive industry" (COM(2009)104). The Communication notes three major reasons for the difficulties being experienced by the European automotive industry:

1. A sharp and uniform drop in demand for passenger and commercial vehicles both in the EU and worldwide. In the last quarter of 2008 new car registrations in Europe declined by an average of 20%. New passenger car sales fell by 1.2 million in 2008. In January 2009, the European passenger car market was 27% lower than a year before.

2. Parts of the automotive industry are reporting problems with access to credit financing and fears of liquidity shortages. In addition, suppliers are expressing an additional concern about money not moving down the supply chain.

3. The industry suffers from longer-term structural problems pre-dating the crisis including a very competitive business environment, high fixed costs, structural overcapacity and intensive price competition. The average overcapacity in Europe is estimated to be at least 20%. Globally, vehicle production capacity is currently at ca. 94 million per year at a time when demand for 2009 is estimated at ca. 55 million.

The accumulative figures of new car registrations in Europe (EU-27 and EFTA) in the period from January to August 2009 showed an 8.2% drop as compared to the same period in 2008.[17] This trend is even more severe for light commercial vehicles. The number of registrations of new light commercial vehicles[18] in the same period in 2009 was 37.4% lower than in the previous year[19]. A reduction in demand is likely to lead to continued production decreases, following estimates of reductions by 25% in the first two quarters of 2009 alone. This exceeds a forecast made in autumn of 2008 although the downturn expected is of a comparable magnitude (see Figure 4 below). This figure also illustrates that if the downturn turns out to be as anticipated, it will be comparable to earlier such events although on a higher overall sales level.

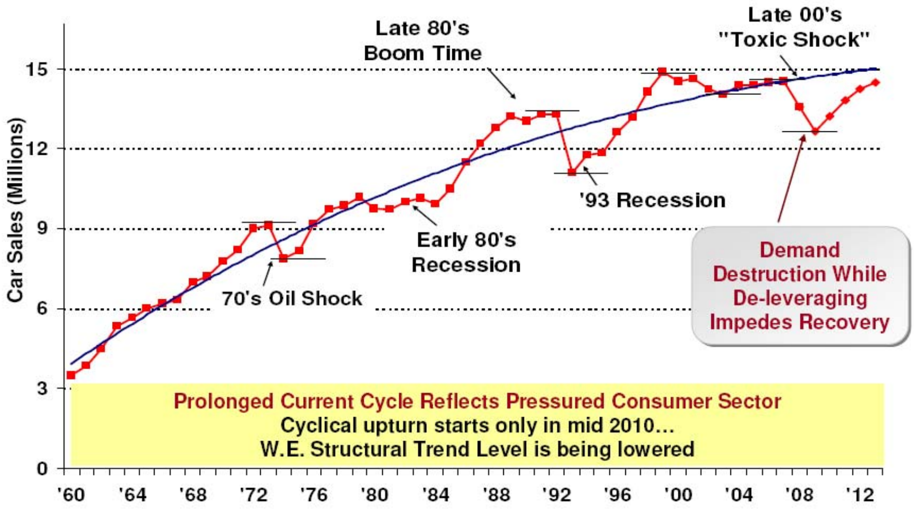
---

17 ACEA

18 In ACEA's statistics vans are defined as LCVs up to 3.5t.

19 ACEA

Figure 4 **Trend level of car sales on the western European market (1960 – 2012)** [Source: Global Insight]




On a more positive note, the Communication also points out that the long term global outlook for the automotive industry is promising as world-wide demand for vehicles is projected to double or even triple in the next 20 years, and that the imperative of a "greener" car fleet will bring new opportunities for innovative technology.

Building on the re-launched Lisbon partnership for growth and jobs in 2005, the European Economic Recovery Plan[20] identified the automotive sector as requiring a strong policy response. As noted in the Communication, a key priority for the automotive industry in this context will be to master the triple challenge of technological leadership with an environmental and safety performance that is world class.

In the Communication the Commission undertook to weigh up the costs and benefits of any new legislative initiative and seek, as far as possible, to avoid creating new economic burdens. It also announced that, together with the European Investment Bank and the Member States, which are increasingly undertaking measures to support the automotive industry (e.g. scrapping schemes), it would support industry in their efforts to maintain investments into future technologies (particularly green technologies such as fuel efficiency and alternative propulsion) throughout the economic downturn. This support will be provided primarily through the European Investment Bank as well as through the 7th Research Framework Programme.

On 5 March 2009, the Competitiveness Council adopted conclusions on the automotive industry in which it stressed that "*the main principles of the* [CARS-21] *mid-term review should remain the guiding forces for the future decision-making process, while applying thoroughly the better regulation principles, namely through impact assessments, in order to guarantee predictability and legal certainty for the businesses*". In this respect, the Council invited the Commission to "*thoroughly assess any possible new legislative*

[20] Communication from the Commission to the European Council of 26.11.2008, "A European Economic Recovery Plan" - COM(2008) 800.

*initiative in line with these principles and avoid unnecessary administrative burdens on businesses*".

In the context of the considerations outlined above, the arguments for making a proposal now or at a later stage have to be weighed up against each other.

On the one hand, it can be argued that in a time of economic crisis the focus of action should be on addressing the short-term issues and that, given the difficulties being experienced by the industry to access finance, new action should be postponed.

However, there are a number of arguments in support of making a proposal now. First, there is a need for planning certainty in the industry. The need to reduce $CO_2$ emissions from all sources including road transport is undisputed and has not changed as a result of the economic crisis. It is therefore clear that emissions will have to come down, and the industry needs to know as soon as possible what is required. Given that demand for low carbon vehicles is likely to increase throughout the world as climate change policies continue to develop, there could be some first mover advantage for European based manufacturers, providing them with ability to export advanced low carbon vehicles to other markets.

Second, the Decision on Effort Sharing[21] that has been agreed as part of the package on energy and climate in December 2008 puts an obligation on Member States to reduce their greenhouse gas emissions from the sectors not included in the Emissions Trading Scheme. Failure to address one source of emissions implies more effort in other parts of the non-ETS sector, which are probably affected by current crisis as well.

Third, the regulation of emissions from light commercial vehicles is an outstanding element in the implementation of the Commission's Integrated Approach to reducing $CO_2$ emissions from light-duty vehicles.[22] As the boundary between cars and light commercial vehicles is not fully clear-cut, there is a risk of creating a loophole in the legislation on $CO_2$ and cars unless light commercial vehicles are also subject to similar legislation (see section 2.4.3).

## 2.7. Baseline scenario

The existing historical data on the development of $CO_2$ emissions from light commercial vehicles is very limited. This provides challenges for projecting the trends of the emissions development in the future.

The supporting study on light commercial vehicles revealed that the new fleet average emissions in 2007 amounted to about 203 g $CO_2$/km whereas the average of emission level of the whole fleet was 230 g/km[23]. To develop baseline scenario going forward, estimations of the development of $CO_2$ emissions in light commercial vehicles between 2002 and 2007 were made. The same study suggested that manufacturers applied efficiency improvements to passenger cars in the context of the voluntary agreements. As these agreements do not apply to light commercial vehicles, it is likely that the amount of

---

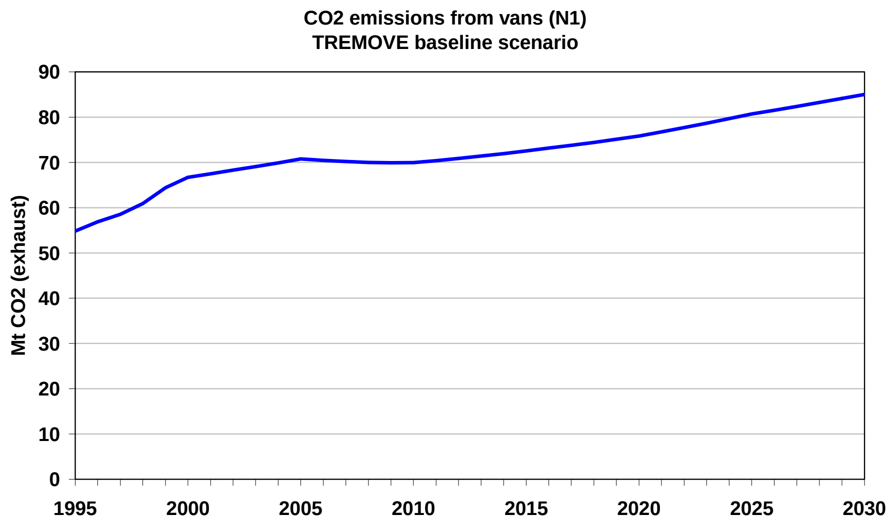
21 Decision 2009/406/EC
22 COM(2007)19
23 Source: TREMOVE

$CO_2$ reduction measures applied in vans and minibuses is lower. According to the TNO 2006 study the baseline value for 2012 in the absence of a policy aimed at efficiency improvements in light commercial vehicles, based on the 2002 average of 201 g/km, is expected to be around 190 g/km for newly registered vehicles. This estimate is based on assumed autonomous efficiency improvements stemming partly from technology improvements diffusing into light vans from equivalent passenger cars. This corresponds to a decrease of the average $CO_2$ emissions by about 0.5-0.4% per year, or 1 gram per year. However, the analysis of the 2007 data in the supporting study shows that the average $CO_2$ emissions for light commercial vehicles increased to 203 g/km and concluded that the majority of vans and minibuses are diesel vehicles. It is expected that implementation of additional efficiency improvements for diesel vehicles will generally be more costly to manufacturers than improvements to petrol vehicles. Therefore, it should be assumed that it is unlikely that many improvements will occur in the absence of regulatory incentives to manufacturers.

Further, it is possible that an inverse trend could develop in the absence of legal constraints, potentially resulting in an increase in average $CO_2$ emissions. This would occur if the benefits of improved engine technology were offset by an increase in engine power and vehicle mass. However, measures developed by Member States to address transport emissions, including fiscal measures, rising prices of fuel and technological improvement in passenger cars resulting from the adopted $CO_2$ and cars legislation (likely to be also applied to smaller car-derived vans) could be expected to trigger a more rational approach to fuel efficiency of LCVs.

To understand the baseline scenario in terms of total $CO_2$ emissions from light commercial vehicles, it is necessary to take into account the demand for these vehicles. The FLEETS report suggests that the number of light commercial vehicles has been increasing in Europe for the last ten years and this trend is confirmed by the data from Global Insight (see Figure 2) on the increase of sales of LCVs.

Figure 5: **TREMOVE baseline scenario for $CO_2$ emissions from N1 (source: TREMOVE)**



As a result, the overall $CO_2$ emissions from light commercial vehicles will also increase in a business as usual scenario. These results are confirmed in the TREMOVE baseline scenario (see Annex V for details on TREMOVE) on Figure 5.

### 2.8. Does the Union have the right to act?

Similarly to the Regulation setting $CO_2$ emissions standards for passenger cars, the subsidiarity principle is respected by this proposal, as the policy objectives cannot be sufficiently achieved by actions of the Member States and can be met more efficiently at the Community level. 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. The absence of action at the European level risks resulting in a series of national schemes to reduce $CO_2$ emissions of light commercial vehicles. This would be of particular disadvantage to vehicle manufacturers as differing ambition levels and design parameters would require a wide range of technology options and vehicle configurations. Such market fragmentation would also affect consumers who would not benefit from lower costs and economies of scale that an EU wide policy would deliver.

## 3. OBJECTIVE

### 3.1. Policy objectives

The general policy objectives applicable for the legislative proposal on light commercial vehicles are similar to those developed for the cars proposal. These are:

- Providing for a high level of environmental protection in the European Union and contributing to reaching the EU's climate change targets; and
- Reducing oil consumption and thus improving the security of energy supply in the EU.

The specific objective is:

- To reduce the climate change impacts and improve the fuel efficiency of light commercial vehicles by means of a specified emission reduction for new vehicles in line with the revised strategy COM(2007)19.

The operational objectives include:

- Designing a legislative proposal that efficiently implements the fleet average emissions target for new LCVs and prevents any regulatory gap which could undermine the effectiveness of the regulation on $CO_2$ and cars;
- Making the legislation compatible with the regulation on $CO_2$ and cars for reasons of simplification; and
- Providing a regulatory framework that avoids any unjustified distortion of competition between automobile manufacturers.

### 3.2. Consistency with horizontal objectives of the European Union

Consistency of the legislative proposal on $CO_2$ and passenger cars with horizontal objectives of European Union was extensively documented in that impact assessment. As this proposal is similar, most of the same considerations apply. These are summarised in the following sections.

#### *3.2.1. Lisbon Strategy*

The policy objectives of the revised strategy, which includes both, passenger cars and light commercial vehicles, are in line with the three pillars of the European Union's Lisbon strategy, namely "*making Europe a more attractive place to invest and work*", "*knowledge and innovation for growth*" and "*creating more and better jobs*".

- The policy objectives promote innovation and technological development, because tighter requirements on $CO_2$ emissions and fuel efficiency for light duty vehicles will encourage the development and application of new vehicle technologies;

- In the longer term, it is expected to lead to increased competitiveness in the automotive sector. Technological innovation that is required to achieve the objectives is one of the main prerequisite for long-term competitiveness.

- It will increase a demand for highly qualified jobs in Europe. Development of the technologies needed to achieve emission reductions requires high skilled human resources to generate high value added solutions.
- The policy objectives are also consistent with the approach taken in the European Economic Recovery Programme to support the industry by encouraging it towards 'tomorrow's markets'.

#### *3.2.2. Sustainable Development Strategy*

The overall objective of the Renewed Sustainable Development Strategy (RSDS) of the European Union[24], regarding sustainable transport is "*to ensure that our transport systems meet society's economic, social and environmental needs whilst minimising their undesirable impacts on the economy, society and the environment*". The related operational objective is to achieve sustainable levels of transport energy use and reduce transport greenhouse gas emissions.

- The policy objectives of the proposed regulation on light commercial vehicles are in line with the RSDS. The requirements of the proposed regulation will contribute to more sustainable mobility. Cleaner light commercial vehicles will bring economic, social and environmental benefits through reduced $CO_2$ emissions and fuel consumption.

- The proposed regulation is consistent with the operational objective of the Strategy: 'promoting sustainable consumption and production by addressing social and economic development within the carrying capacity of ecosystems and decoupling

---

[24] European Council, June 2006

economic growth from environmental degradation'. Improving the fuel efficiency of vehicles will support the decoupling of economic growth from environmental degradation through reduced greenhouse gas emissions.

#### *3.2.3. EU commitments to reduce GHG emissions*

In December 2008 the Council and the Parliament reached an agreement on the climate and energy package of legislation to implement the EU's climate change commitments to be met by 2020, namely to reduce greenhouse gas emissions by at least 20%, to ensure that 20% of final energy consumption is met with renewable sources, and to raise energy efficiency by 20%. The package also contains a clear offer to go further and commit to a 30% cut in the event of a satisfactory international agreement.

- The proposed Regulation to reduce $CO_2$ emissions from light commercial vehicles will make an important contribution to the reduction of GHG emissions in the non-ETS sector of the economy which includes transport, buildings, agriculture and waste, representing some 60% of total GHG emissions in the EU. By 2020, emissions from these areas are to be reduced by an average of 10% compared to 2005, shared out between Member States. Section 5.4.1 inter alia concludes that reductions of emissions resulting from the proposed regulation on $CO_2$ emissions from light commercial vehicles will by year 2020 correspond roughly to 5% of the total EU reduction effort.

## 4. POLICY OPTIONS

### 4.1. Introduction

An extensive discussion on the appropriate policy instruments that should be used to improve fuel efficiency and performance in terms of $CO_2$ emissions in light duty vehicles took place in the context of the Commission's Communications and the proposal for a Regulation $CO_2$ and cars. The conclusion of this discussion was that voluntary agreements with industry did not bring the expected outcome and that a regulatory approach was the best solution to tackle the problem of rising $CO_2$ emissions from light-duty vehicles.

In view of growing demand for LCVs (see section 2.7) and the EU target to reduce $CO_2$ emissions by 2020 by 20% (or by 30% if a comprehensive international agreement is reached), it is clear that all sectors have to contribute to the reduction effort. Emissions from LCVs represent around 1.5% of EU total $CO_2$ emissions and it is imperative that growing emissions from LCVs do not undermine the efforts to reduce emissions in other transport modes and sectors of the EU economy. Moreover, there is a strong rationale for regulating other sectors of road transport in order to avoid creating a regulatory gap which could undermine the effectiveness of the regulation on $CO_2$ and cars by enabling larger and highly emitting passenger cars to avoid the target (see section 2.4.3). For these reasons, the business as usual option has been discarded from further analysis.

The intention of the proposed regulation on $CO_2$ from light commercial vehicles is to ensure that all light duty vehicles are covered by similar legislation to that agreed in December 2008 for passenger cars. There are no obvious reasons for a significantly different policy mechanism for LCVs than that agreed upon for cars. Therefore, there is a strong degree of guidance for many of the design parameters and policy options to be discussed in this impact assessment.

The legislation for LCVs needs to take into account the differences between the markets for passenger cars and for light-commercial vehicles and some stakeholders argue that a different approach is therefore needed. Although a substantial part of LCV sector is very similar to cars and uses the same technology (car-derived vans, mostly found in mass class I and II), heavier LCVs are less like cars and the heaviest vehicles are more akin to lighter heavy-duty vehicles. Further the market in passenger cars is highly heterogeneous. However, despite these differences, the legislation on the emission of air pollutants from road vehicles deals with LCVs of all mass classes in the same manner as cars.[25] Indeed, the concept of mass classes I, II and III is laid down in that legislation and only used there. It is necessary to find a balance between consistency with existing legislation and adaptation to the specificities of the sector. The approach chosen for the current proposal is to design the legislation on LCVs to be as similar as possible to the one on cars except where there are justifications for taking a different approach for LCVs (such as limit value and slope of the utility curve).

## 4.2. Design parameters

The main design aspects to be discussed in this section are effort sharing between manufacturers, possible flexibility mechanisms and the compliance mechanism.

### *4.2.1. Scope of the legislation*

In order to ensure that the objectives of the current proposal are met, it is important that the scope of the legislation does not create any additional regulatory gaps. Therefore, it is important that vehicles which directly compete with N1 but are not covered by other $CO_2$ emissions standards are also included into the scope of the regulation. This is the case of lighter N2 and M2 vehicles which are derived from N1 category but due to certain features, i.e. higher mass or higher number of seats are categorised as N2 or M2 vehicles. In the absence of $CO_2$ standards for lighter N2 and M2 there is a risk of creating perverse incentives for manufacturers to further increase mass of heavier N1 and type-approve them as N2 to avoid $CO_2$ standards. In one specific example of a widely used van, the N2 version of the vehicle is only 190 kg heavier than its N1 counterpart.

The scope of Regulation (EC) 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information includes vehicles of the N2 and M2 categories with a reference mass not exceeding 2610 kg or to which type-approval has been extended in accordance with Art. 2(2) of the above Regulation (with a mass up to 2840 kg). It would seem advisable to make use of the same scope for the purposes of regulating the $CO_2$ emissions of LCVs.

This would ensure that vehicles of similar physical characteristics that compete directly in the same markets are covered by the same legislation, while leaving the heavier vehicles in the M2 and N2 classes out of the scope (N2 vehicles can reach a maximum mass of up to 12 tonnes).

---

[25] Regulation(EC) 715/2007

*4.2.2. Effort sharing between manufacturers*

The key approaches to share regulatory effort between manufacturers are as follows:

- Utility based targets: in this approach, the $CO_2$ obligation is defined as a function of a so-called "utility" parameter reflecting the utility of vehicles perceived by customers.

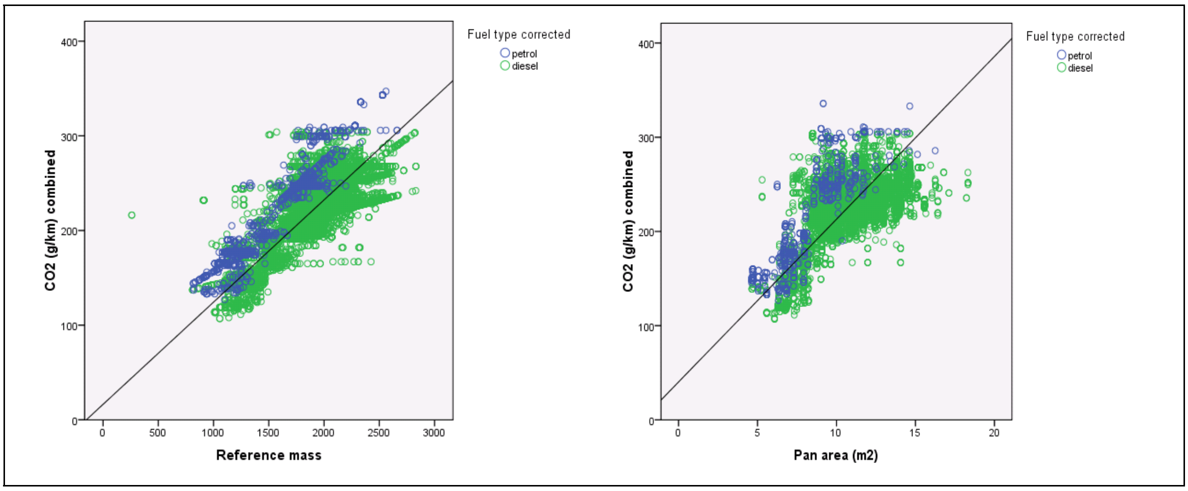
- Percentage reduction based targets: in this approach, the $CO_2$ obligation is defined as a function of a percentage emission reduction compared to earlier emissions performance.

Under the utility based target option approach, a utility curve would be developed to reflect the fact that different vehicles have different utilities and emit different levels of $CO_2$. The average reduction target would be distributed between vehicles of different sizes according to their utility (i.e. recognising that a large van capable of carrying a large load emits more than a small van with a much lower load carrying capability). As regards developing the utility function, a linear approach could be used in distributing the target amongst different vehicles and manufacturers.

In earlier studies on light commercial vehicles, a range of utility parameters was discussed including maximum payload, gross vehicle mass, loading volume, footprint and pan area. The supporting study concluded that in view of the available data and for reasons of practicality, only functions based on vehicle **mass** and on vehicle **pan area** could be analysed.

Figure 6 presents distribution of $CO_2$ emissions in relation to mass and pan area. A sales weighted regression line also demonstrates that either of these parameters is suitable as they show a reasonable correlation to $CO_2$ emissions. There are a number of outlying models on both graphs. However, the scatter for pan area is wider meaning that more models are further from the limit value curve.

Figure 6 **Sales-weighted correlation (least squares) between $CO_2$ emissions and two principal utility parameters for petrol and diesel models- 2007 LCV database** (source: supporting study on LCVs)




The option of a percentage based $CO_2$ reduction will also be considered as an alternative option to the utility based target. The percentage based reduction target would mean that a proportionate emissions reduction would be required relative to the existing base level. This would be an alternative way to distribute the burden among manufacturers. In practical terms it means that producers of vehicles emitting higher amount of $CO_2$ would have to deliver higher absolute reduction of emissions. However, it does not recognise the efforts of those manufacturers who have already taken early action to reduce emissions of their products.

### *4.2.3. Target level*

The supporting study on light commercial vehicles analysed the target levels set in the revised Strategy on $CO_2$ emissions from light duty vehicles, that is: 175 g/km target in 2012 and 160 g/km target in 2015. Since the revised Strategy was published in January 2007, there have been major developments such as the improvement of the available dataset and the agreement of the Regulation on $CO_2$ and cars which create a need for reconsideration of the target dates.

- The target of 175 $gCO_2$/km by 2012 set in the revised strategy is found in the supporting study to be demanding given the proximity of the target date of 2012. It appears desirable to also consider an option to postpone the introduction of this target to a later date (2013-15). In further analysis the level of 175 $gCO_2$/km will be tested with different utility parameters and slopes.

- The target of 160 g/km in 2015 set in the revised strategy does not appear to be realistic in this timeline according to the supporting study. Therefore, it is discarded from further analysis. However, a second step is considered as part of the discussion of the long term target (section 4.2.9).

### *4.2.4. Target year*

The revised Strategy on $CO_2$ from light-duty vehicles set the $CO_2$ emission target for passenger cars of 130g/km and set the $CO_2$ emission target for light-commercial vehicles of 175 g/km for 2012. This is the date for which targets will begin to apply for passenger cars (phased-in with full implementation in 2015). Given the time needed for the agreement of the legislation in the co-decision procedure, to allow sufficient lead-in time for the industry and to take into consideration the current economic situation (in particular more difficult access to finance (see section 2.6) additional target years from the range 2013 – 2015 will be considered.

The timeframe for LCVs should be consistent with that for cars where the limit value becomes binding in the year 2012. The proposal for a Regulation on passenger cars was made in December 2007, it was agreed in co-decision in December 2008 and formally adopted in June 2009. A similar timetable would indicate entry into force of the standard for light commercial vehicles by mid-2013.

### *4.2.5. Utility curve slope*

The choice of the slope of the utility curve and utility parameter determine the distribution of reduction effort between vehicles and as a consequence between manufacturers. The impact assessment on cars included an analysis of a wide range of utility curve slopes[26], starting from 0% slope to 120% slope. For passenger cars a 60% slope was selected. In order to rationalise the impact assessment on vans and minibuses a number of options short-listed for further thorough analysis is reduced.

Utility curves with lower slopes i.e. 0% to 40% seem less suitable for LCVs than for passenger cars where perverse incentives of increasing mass in order to gain a less stringent target are of greater concern. Light commercial vehicles are used to transport goods therefore there are fewer incentives to make them heavier. A mass increase is done at the expense of payload or performance which then needs to be compensated by increased engine power leading to higher vehicle cost. Also market shifts on the LCV market are usually not driven by such incentives as luxury or increased comfort, which could also increase the mass of a vehicle, but rather are driven by business needs (with the exceptions of LCVs also being used for private purposes). The supporting study on LCVs explains different gaming options in chapter 7 and considers that the likelihood of mass increase being used by manufacturers as a means to reduce required $CO_2$ reduction effort is considered less significant for LCVs than for passenger cars. Thus, only the upper range of utility curve slopes: **60%, 80%, 100% and 120%** will be analysed in detail in this impact assessment. However, reduction effort for lower slopes will still be presented for completeness.

### *4.2.6. Choice of average utility value in the definition of the limit value curve*

The formula for a limit value based on a utility parameter, M, can be written as follows (for the case of a target value of 175g/km, and assuming mass as the utility parameter):

$$CO_2 \text{ level} = 175\text{g/km} + a \times (M - M_0),$$

where $a$ is the slope of the limit value curve and $M_0$ is the average mass of the fleet. This formula only delivers the desired $CO_2$ fleet average if the real, physical average mass of the fleet coincides with the value $M_0$ assumed in the formula. If the figure $M_0$ is too low, the limit value curve will be too far to the left and the fleet average delivered by the legislation will be higher than desired. Conversely, if the figure $M_0$ is too high, the limit value curve will be too far to the right and the fleet average delivered by the legislation will be lower than expected. In practice, the real average vehicle mass is not known in advance. It has been observed to rise over time both for cars and for LCVs. This phenomenon is known as "Autonomous Mass Increase" (AMI) and has been discussed at length in the context of the Impact Assessment for passenger cars and its underlying study.

Further to the analysis conducted in the impact assessment on $CO_2$ from passenger cars, an account of possible future developments of the market for light-commercial vehicles is taken. An autonomous mass increase can happen as a result of additional applications to improve safety, comfort or performance within a vehicle class, or due to the overall average mass increase resulting from increasing sales of vehicles from higher classes. In general this phenomenon is less true for LCVs as explained above. In addition, a shift towards larger vehicles may also mean that $CO_2$ performance in terms of emissions per tonne kilometre may be improved.

26 See Glossary in Annex I

The analysis conducted by the consultant was done on the basis of different autonomous mass increase (AMI) scenarios: 0%, 0,82% and 1,5%. Contrary to the study for cars, an extreme scenario of AMI equal to 2,5% was excluded as an unlikely trend for LCVs. Further analysis will focus on two options 0% and 1,5%. The effects on costs and the distributional impacts for AMI=0,82% will not be presented explicitly in chapter 5 however, the expected results would be roughly halfway between the two remaining scenarios.

Two approaches can be used to handle AMI in practice. First, a plausible value of AMI can be used to make a projection into the future and thus to determine an expected value of $M_0$ in advance. Second, an ex-post adjustment of $M_0$ can be done every few years, thus enhancing planning certainty for the industry while ensuring that the actual value of the average mass is never too far away from the chosen value of $M_0$. This second approach is applied in the Regulation on $CO_2$ from cars and it appears sensible to take the same approach in the case of LCVs.

### 4.2.7. *Flexibility mechanisms*

To increase a level of flexibility for manufacturers to comply with the regulation, it is important that appropriate mechanisms are introduced. Mechanisms to be considered include options of fleet averaging, pooling, and derogations for small volume independent manufacturers:

- Fleet averaging: manufacturers could average their $CO_2$ emissions over their fleet (rather than having to respect a target for each car they sell). The model assumes that manufacturers would choose to deliver the cheapest reductions first. This approach is consistent with the one in the $CO_2$/cars legislation.

- Pooling between manufacturers: manufacturers could do the same fleet averaging amongst companies belonging to the same group; similarly different manufacturers could be allowed to create a pool on their own initiative and trade the credits they need, should this help to optimise the cost of delivering $CO_2$ reductions needed. This solution is also permitted in the $CO_2$/cars regulation.

- Pooling of the targets for cars (M1) and LCVs would mean that manufacturers can compensate underachievement in terms of $CO_2$ g/km in one category by an equivalent overachievement in the other category. This flexibility would allow manufacturers to minimise their abatement cost by choosing to reduce more in a category where it is cheaper. According to the supporting study this would be the case for the majority of manufacturers producing both passenger cars and LCVs. Pooling between cars and LCVs would lead to a net cost reduction compared to the situation in which both targets have to be met separately but would introduce competitive advantage for manufacturers producing both cars and vans.

- Specialist derogation for small volume independent manufacturers: some specialised independent manufacturers who make small numbers of vehicles may not be able to take advantage of the types of flexibility identified above (e.g. through a lack of pooling partners) and therefore may need additional flexibility. A limited number of derogations are included in the $CO_2$/cars legislation.

### 4.2.8. *Compliance mechanism*

Following the approach taken in the impact assessment for regulation on $CO_2$ and cars the excess emissions premium has been identified as being the most suitable way of enforcing the regulation. The level of premium is of crucial importance for the effectiveness of the scheme as well as competitiveness of the automotive industry. Under the regulation on $CO_2$ and cars, the premium is calculated at the manufacturer level after fleet averaging (which would allow low emitting vehicles to offset vehicles above the limit). The premium is calculated as the product of the distance to target (in grams per kilometre) multiplied by the premium level (€ per gram per kilometre) and by the number of vehicles registered for which the manufacturer under consideration is responsible.

The impact of selected levels of excess emissions premium (EEP) is evaluated in terms of deterrent effect against non-compliance and competitiveness.

The premium must be set at a level which deters non-compliance whilst taking into account the effect on global competitiveness and the automotive value chain's ability to continue contributing to the Growth and Jobs agenda. The level of the EEP under the Regulation on $CO_2$ and cars was set by reference to the marginal $CO_2$ abatement cost through vehicle technology. This rationale also applies to the setting of the EEP for light-commercial vehicles. Together with the competitiveness dimension, it should also be taken into account that manufacturers do not have full control over the average of their sales in a given year and the target is defined as the average of all the vehicles placed on the market. This creates a margin for error. Manufacturers can reduce the risk through putting in place continuous sales monitoring or through introducing a safety margin for uncertainties. The Regulation on $CO_2$ and cars addresses this situation by allowing a lower premium level for the first few grams per kilometre above the target (the so-called corridor approach). This corridor of reduced premium levels extends until the year 2018 and subsequently ceases to apply. It can be assumed that by that time the manufacturers have gained sufficient experience with the regulatory system and the response of the market so the corridor is no longer needed. The corridor is therefore a risk management tool that reduces the financial exposure of a manufacturer in case of accidental, unintended non-compliance during an introductory period. A similar approach could be taken in the case of light commercial vehicles. In addition, in the longer term it would be desirable to consider linking the excess emissions premium to the consumer price index in order to avoid that its level, once chosen, erodes over time and thereby diminishes the intended deterrent function.

### 4.2.9. *Long-term target*

The regulation on $CO_2$ and cars includes a long-term target of 95 g/km in 2020 which was introduced by the European Parliament and the Council during the co-decision. This long-term vision allows for more planning certainty for the industry and counter balances the effects of less stringent design parameters (i.e. phase-in of full compliance and fines as well as additional derogations).

The revised Strategy introduced a two step approach to $CO_2$ emissions reductions from light-commercial vehicles (in 2012 and 2015). In order to be consistent with the approach in the Regulation on $CO_2$ and cars, there is a case for replacing the 2015 target for LCVs referred to in the revised Strategy with a long-term target for 2020 and new information gathered in the meantime. However, in view of a longer than originally proposed break between the two, the target for 2020 should be more ambitious than 160 g/km. The stringency of the 2020 target for passenger cars may provide guidance in this respect.

Further to the analysis in the supporting study, the following emissions levels have been identified as potential targets for year 2020, i.e. 160, 150 g/km, 140 g/km, 135 g/km and 125 g/km. According to the supporting study the average level of 125 g/km is the maximum technically feasible option according to current knowledge, and thus the most expensive effort. The methodology applied in this assessment was based on the learning curve theory. This approach takes into account that costs of a product generally decrease over time as a function of economies of scale, learning effects and innovations in product and production methods. Learning curve theory summarises the effects of these in a learning curve that specifies the development of costs as function of the cumulative production. The consultant identified two variants with similar reduction potential but different costs: **full hybridisation** and **extra strong downsizing** (of the engine). Following the methodology described above within these two variants three possible scenarios were explored:

1. No learning (each grade in the reduction potential is achieved using new technology replacing the previous one);

2. Learning and slow penetration (technologies once introduced and having attained its maximum penetration remains in full production, the rate of penetration is low and takes about 10 years);

3. Learning and fast penetration (as above but it takes about 3 years to fully penetrate the market).

It is important to note that these calculations were done at level of total sales, without assessment of efforts by individual manufacturers and the costs do not depend on the utility parameter and limit function slope that is assumed. Costs and impacts of the identified options for the long-term target are further analysed in section 5.2.6. In addition several scenarios linking short-term and long-term targets were selected for further analysis of the economic, social and environmental impacts of the proposed legislation.

### *4.2.10. Multi-stage vehicles*

Multi-stage vehicles are LCVs 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. Sales of these vehicles are estimated to represent 8% of the market. It is expected that many multi-stage vehicles in the 2007 database will not have information on $CO_2$ emissions. Directive 2004/3/EC extended the measurement of $CO_2$ emissions to N1 vehicles and established a timetable for the reporting of these emissions which stretches from 1 January 2006 for complete vehicles of class I to 1 January 2009 for incomplete vehicles of classes II and III. Thus, the regulatory mechanism to provide the $CO_2$ levels for completed multi-stage vehicles is in principle in place. Any provisions specific to multi-stage vehicles in the Regulation on $CO_2$ from LCV would therefore have the character of transitional measures until the provisions of Directive 2004/3/EC are fully operational.

For the time being it appears feasible to adopt a pragmatic approach based on the observation that the superstructures built by third-party vehicle body manufacturers are unlikely to perform better in terms of air resistance and mass than those provided by the original equipment manufacturer (OEM). The range of variants and versions of complete vehicles of the same type offered by a manufacturer can be considered as an indication of the variety that is present in this segment of the market for light commercial vehicles.

One possibility is to use, for incomplete vehicles of each manufacturer and vehicle type, the emission level of the variant and version of the same type of vehicle marketed in that year with the second--highest specific emissions of $CO_2$ (this approach would be similar to the choice of tyres at the type approval test).

Alternatively, a conservative approach would be to consider, for each manufacturer and vehicle type, the average $CO_2$ emission level of all complete vehicles registered in the EU in that year, and to use that value as representative for the incomplete vehicles, recognising that an OEM has no control over the air resistance and mass of a vehicle that is being completed by a third party. In this case the true emissions of the vehicles as they finally enter the market are very likely to be underestimated. This approach would require safeguards such as ensuring that multi-stage vehicles that are completed by an enterprise that is connected to a manufacturer are not given unduly advantageous treatment, as well as monitoring the share of vehicles that are registered as multi-stage vehicles and adapting the legislation in case the provision is being abused.

## 4.3. Policy options considered in the further assessment

The key policy options short-listed for further assessment are summarised in Table 3 below. These options are used for the purpose of distributional analysis and do not yet include the long-term target. Further analysis of the long-term target is conducted at a later stage (section 5.2.6). The options differ according to target year and utility parameter. In options 2, 4, and 5 the target year is set beyond 2012 and is defined as a range of possible dates up to 2015 considered for the first step of the emissions standards. Within each option there are variants with different slopes of the utility curves and two variants of the autonomous mass increase (AMI).

Table 3 **Policy options**

| Target | Slope | Year | Parameter | AMI |
|---|---|---|---|---|
| **Option 1** | | | | |
| 175 g/km | 60% | 2012 | mass | 0%<br>1.5% |
| | 80% | | mass | |
| | 100% | | mass | |
| | 120% | | mass | |
| **Option 2** | | | | |
| 175 g/km | 60% | 2013-2015 | mass | 0%<br>1.5% |
| | 80% | | mass | |
| | 100% | | mass | |
| | 120% | | mass | |
| **Option 3** | | | | |
| 175 g/km | 60% | 2012 | pan area | 0% |

| | | | | |
|---|---|---|---|---|
| | 80%; | | pan area | 1.5% |
| | 100%; | | pan area | |
| | 120% | | pan area | |
| **Option 4** | | | | |
| 175 g/km | 60% | 2013-2015 | pan area | 0% |
| | 80%; | | pan area | 1.5% |
| | 100%; | | pan area | |
| | 120% | | pan area | |
| **Option 5** | | | | |
| % reduction | | 2012/ | mass/pan area | 0%<br>1.5% |
| | | 2013-2015 | mass/pan area | |

In addition to the main policy options setting the main orientation of the approach of this legislation, the design parameters such as flexibility and compliance mechanisms will be assessed and chosen independently from these options because this choice is not affected by the conclusions on main policy options. This is also true for the long-term target because at this stage the detailed modalities of reaching this target are not being defined. The recommended policy option will thus be accompanied by chosen design parameters.

## 5. ANALYSIS OF IMPACTS

The impacts of the short-listed policy options will be analysed according to the criteria set in the Communication from the Commission on the revised strategy on $CO_2$ emissions from light duty vehicles, namely neutrality to competitiveness, social equity, and sustainability. More specifically, the economic, social and environmental impacts of selected options will be analysed.

### 5.1. Description of the methodology

The methodology followed in the analysis of the impacts of identified policy options is based on the impact assessment on cars and a supporting study on light commercial vehicles. In addition, the contributions provided during the stakeholder consultation will be taken into account. To reflect the overall socio-economic impacts, the modelling time horizon is 2020 and 2030. For further details refer to Annex V.

### 5.2. Economic impacts

#### *5.2.1. Distributional effect on manufacturers*

The impacts on manufacturers (i.e. cost of compliance with the targets) of different options selected for further analysis are analysed in terms of estimated changes in retail prices and relative emissions reduction required by each manufacturer.[27]

[27] The analysis is based on the assumption of full cost pass-through from manufacturers to buyers.

5.2.1.1. Distributional impacts of mass-based limit function (2012 to 2015)

Figure 7 - Figure 12 (all figures provided in the Annex) present the distributional impacts of options 1 and 2 for the achievement of the 175 g/km target with mass-based utility parameter, as well as option 5, expressed in terms of absolute and relative price increase.

This analysis shows clearly that the costs per manufacturer are more sensitive to the slope of the limit function than was the case for passenger cars. This is also true for the difference in levels of costs across the manufacturers. In general, it can be concluded that the higher the slope of the mass-based limit function the more even is the distribution of costs between the manufacturers. Lower slopes (below 60%) increase the difficulty of meeting the targets on the limit value curve for manufacturers of larger LCVs.

If AMI is set at the level of 0% the average costs of meeting the target are independent of the target year and therefore are presented in the same figure (Figure 7 and Figure 8). On average the costs would be lower the higher the slope, with the best result for option 5 (percentage reduction target). An assumption of AMI = 1.5% and target date of 2012 (Figure 9 and Figure 10) leads to higher costs of meeting the target than in case of zero autonomous mass increase. When these are compared to the results for a later target date (Figure 11 and Figure 12) one can see that the costs of meeting the target go up when the target year is shifted. This is due to higher mass increase between 2007 and the target year leading to proportional higher $CO_2$ emissions. This mass increase needs to be compensated with additional more expensive measures from the upper end of the cost curve. This leads to an overall cost increase of meeting the target.

5.2.1.2. Distributional impacts of pan area-based limit function (2012 to 2015)

Figure 13 and Figure 14 (all figures provided in the Annex) represent absolute and relative price increase of reaching the target of 175 g/km in 2012, when pan area is selected as utility parameter (option 3) and AMI = 0%. Following the previous section, the results for option 5 are also included for comparison.

The average costs of **option 3** and **4** (if AMI is set at the level of 0% the average costs of meeting the target are independent of the target year) are quite similar to the average costs for the mass-based limit functions (option 1 and 2 with AMI=0%). However, the distributional impact is much more diverse and uneven for pan-area and therefore more manufacturers would have difficulty to meet their specific targets and one is reaching the maximum of its reduction potential (i.e. price increase is the same for different slopes of utility curves). Similarly to the results for mass-based parameter the average costs are lower with higher slopes of the curve and are the lowest for percentage reduction (option 5). This becomes even more visible if AMI of 1,5% is applied (Figure 15 and Figure 16) with the average relative costs being closer to 10%.

Shifting the introduction of the target beyond 2012 (Figure 17 and Figure 18) results in the average costs rising above 10% for most of the options. Only the manufacturer reaching the maximum of its reduction potential in 2012 benefits from slight decrease in the cost of reaching the target.

5.2.1.3. Summary of distributional analysis

Comparing the different slopes for the limit functions of all options shows that the sales-weighted average retail price increase per vehicle is lower when the slope is higher, although these variations are not very significant. The retail price increases for a mass-based curve by 5.8% (sales-weighted average) at 60% slope and by 5.4% at 100% slope for **option 1**. For **option 3** these values amount to 6.3% to 6% respectively. The differences are similarly small for options with AMI = 1.5%, equalling to 9.9% to 9.5% for mass-based limit functions and 10.5% to 10.2% for pan area-based limit functions respectively. For **option 2** and **4** with AMI = 1.5% the differences of cost increase are also less than 0.5%.

While the average cost is not subject to significant variations, the differences at the level of single manufacturers are much more important, especially with a lower slope of the curve. The most even distribution of retail price increase is observed between 100% and 120% slopes. However, even though the risk of perverse incentives of increasing the mass of vehicles to receive less stringent targets in LCVs is expected to be lower than in the case of passenger cars, the slope of 120% is more likely to provoke these adjustments than the 100% slope. Therefore, it seems that a slope of 100% would be most appropriate.

Delaying the introductory date of the 175 g/km target from 2012 to a later date (with AMI = 0%) is of advantage for the industry due to the later introduction of the target allowing for more time to implement the necessary technological measures to comply with the legislation. A certain delay beyond 2012 appears to be a necessity on practical grounds to take into account the time needed for the co-decision procedure.

The autonomous mass increase set at the level greater than 0% increases the cost of meeting the average target in the case of a mass-based limit function, and makes compliance more difficult for certain manufacturers which may find themselves at the maximum of their cost curves. As explained in section 4.2.5, the risk of perverse incentives to make LCVs heavier appears less pronounced than for cars because their size is mostly determined by the task for which they are designed, and mass increases would reduce available payload. In order to ensure that perverse incentives to increase the mass of vehicles in order to benefit from a less stringent target are avoided, an ex-post adjustment of the average mass would have to be embedded in the legislation, following the approach in the agreed Regulation on $CO_2$ and cars. Setting a zero autonomous mass increase may therefore be considered suitable for the proposed legislation on LCVs.

The choice of utility parameter (mass or pan area) has more important impacts on the average retail price increase and the distribution of burden among manufacturers. The main tendency is that the estimated retail price increase is slightly higher when pan area is used as a utility parameter (with AMI = 0%). A serious drawback of this parameter is that the distributional impacts are more unevenly spread than in case of a mass-based utility parameter. The individual targets for some manufacturers become more stringent for pan area as compared to mass.

**Option 5** (percentage reduction) is the most attractive in terms of the average costs of compliance which are lower than in other options. The average increase of retail price in this option for 2012/15 scenario equals 5.1%, rising to 7.8% with AMI=1.5% in 2012 and

9.3% with AMI=1.5% and the target date in 2015. The distribution of costs among manufacturers is also the most equal. However the drawback of this option is that past efforts to reduce $CO_2$ emissions are penalised. In addition, it would be difficult to define the targets for new market entrants. Finally, the legislation would be defined on the basis of the current market situation, and not on the basis of an objective criterion.

Following the results of the distributional analysis, options 3 and 4 (pan area-based utility parameter) and option 5 have been discarded from further considerations. Also lower slopes of the curve (below 60%) as well as the slope of 120% will not be analysed further.

5.2.1.4. Impact on small and medium enterprises (SMEs)

LCVs are mostly produced by large manufacturers. Where SMEs are currently present on the market they evidently compete in today's circumstances. As long as the legislation does not introduce distortions that impact disproportionately on the vehicles produced by SMEs, distortions at the expense of these SMEs should be avoidable.

SMEs play a rather bigger role as customers of LCVs. For them, as for all buyers and users of these vehicles, the key impact is the change in the total cost of ownership. As demonstrated in section 5.2.4, this change is expected to be a negative cost and thus beneficial. Hence SMEs, along with all other users of LCVs, stand to gain from the proposal. While upfront financing may be an issue, by the time the legislation enters into force, the effects of the economic crisis on credit availability should have abated.

*5.2.2. Innovation and competitiveness*

The impact of the regulation on $CO_2$ and cars on research and development was analysed in the impact assessment on cars and the following conclusions were drawn:

- the 130 $gCO_2$/km target for passenger cars will promote further technological advance in fuel efficiency measures and accelerate the market penetration of advanced combustion and powertrain technologies ;

- the legislation will to some extent limit possible vehicle upsizing;

- it is expected that the diesel penetration rate will continue increasing in the short term.

It is likely that the legal proposal on light commercial vehicles will have similar impacts on research and development. The proposed 175 g/km will require a significant increase in the efficiency of light commercial vehicles. To a significant extent, manufacturers of light commercial vehicles are expected to take an advantage of learning effects obtained from reducing the $CO_2$ emissions of passenger cars, especially for car-derived smaller vans.

Further dieselisation of the fleet is not expected in view of significant domination of diesel LCVs already.

The impact assessment on cars, suggested that the above mentioned trends should have positive impacts on the competitiveness of European manufacturers[28]:

*'In the global perspective, research and innovation are seen as strengths of the European market and it is not likely that the above trends will have a damaging effect on the competitive position of EU manufacturers. As regards mature non-EU markets where EU manufacturers are already present (e.g. US, Canada) there is a general trend towards the reinforcement of fuel efficiency/greenhouse gas emission standards. Because requirements on these markets are so far less ambitious than those in the EU, the proposed EU legislation will allow European carmakers to provide vehicles that are competitive and meet the reinforced standards to come into force in the coming years. '*

This conclusion can also be applied to light commercial vehicles. First of all, vehicles that meet strict $CO_2$ emissions requirements in the EU will be globally competitive and compliant with the climate change policies being implemented in third countries (especially where fuel economy standards exist and are about to be tightened, notably Japan, China, and USA, as well as India which is likely to follow). The reduction of $CO_2$ emissions is now a global phenomenon and involves all means of transport.

Currently European LCV manufacturers are amongst the most technologically advanced in the world. Vans, trucks and buses produced in Europe are highly valued on the non-EU markets. Moreover, more fuel efficient vehicles will be attractive to vehicle users allowing to lower costs of running a vehicle which is especially important for business users. New vehicles equipped with even more advanced fuel saving technologies should remain competitive, especially with oil prices expected to rise. This is also true for countries with lower fuel taxation which tend to be more sensitive to price fluctuations of oil.

To assess the impact of the proposed regulation on light commercial vehicles on trade, current trade patterns need to be understood. According to the impact assessment on cars, the automotive industry contributes nearly €60 billion to the European trade balance, so is one of the most important sectors. The share of light commercial vehicles in imports and exports of the EU automobile sector is presented in Table 4.

Table 4 **EU25 automobile trade (in million EUR)** Source: **www.acea.be**

| | **2004** | | | **2005** | | |
|---|---|---|---|---|---|---|
| **Vehicle category** | **Imports** | **Exports** | **Trade Balance** | **Imports** | **Exports** | **Trade Balance** |
| Passenger cars | 24972 | 56315 | 31342 | 25208 | 60820 | 35612 |
| Light commercial vehicles | 3005 | 1836 | -1169 | 3257 | 2155 | -1102 |

The data suggests that trade flows of light commercial vehicles are significantly lower than passenger car imports and trade balance is negative. The analysis of the

28 SEC(2007)1724

distributional impacts of the policy on manufacturers (section 5.2.1), suggests that to the extent that importing manufacturers produce vehicles with higher emissions and therefore will need to make more effort to reach the target than domestic manufacturers, the proposal could have a positive impact on the EU's trade balance.

In terms of impacts on competitiveness, the proposal will apply to all manufacturers[29], irrespective of where they are located (i.e. EU or third countries). It will therefore affect all manufacturers in a relatively consistent manner. The legislation will be most beneficial to those manufacturers with access to the most advanced technology as compliance will require lower carbon powertrain technology to be introduced. However, much advanced technology is developed by the automotive component suppliers and should be available to all manufacturers willing to purchase it.

### *5.2.3. Sensitivity analysis*

Sensitivity to fuel prices- in order to assess the impact of fuel prices (experiencing high volatility over the past year) an additional analysis including oil prices was carried out. The fuel prices used to perform these runs (TREMOVE) model are country specific and for all countries are expressed in Euro in the year 2000. Three price levels were investigated: base case, as well as half and double of the fuel price which is a common approach in econometric modelling of scenarios with high uncertainty.

Restrictions on reduction potential- the supporting study on light commercial vehicles assumes that due to much lower share of petrol vans on the market, a large part of technical measures will be introduced in diesel vehicles. To avoid unrealistic high costs for petrol vehicles in the model (due to their small share and much flatter cost curves than for diesels) a cap on the available reduction potential for petrol vehicles was introduced. This is modelled as a percentage of the maximum achievable reduction according to the cost curves. The following alternative situations with 50% cap were modelled: 175 g/km – 2012 – 60% and 175 g/km – 2012 – 100%.

Fuel price sensitivity runs (Table 12 in the Annex) show that if the fuel prices decrease (as happened currently, see section 2.6), the GHG abatement costs will be positive as the higher purchase costs will not be fully offset by the fuel savings. However, they are within the range of the EU ETS price and also in the levels comparable to the abatement costs under the Regulation on $CO_2$ and cars as presented in the $CO_2$ and cars impact assessment. Note that the fuel price is assumed constant over the modelling period in each fuel price scenario considered. It can be thus concluded that based on the results of the TREMOVE model the contribution of the transport sector is either cost benefiting for the society as whole or of a comparable cost effort to other sectors with Community-wide measures.[30]

---

29 The manufacturer is defined in the legislation as the entity responsible for the type-approval of vehicle.

30 Sensitivity runs were not performed for the long-term options because of the favourable results of analysis for the short-term targets which show a net benefit or in – the worst case – a rather limited cost. The introduction of the long-term target is expected to provide clear benefits to the society and lower compliance costs.

### 5.2.4. *Impact on society and cost effectiveness*

As mentioned at the beginning of section 5, the economic impacts of the proposal on light commercial vehicles have been analysed in terms of distributional effects among manufacturers and of overall cost-effectiveness. The results of the cost effectiveness analysis are provided in this section and the figures and tables are presented in the Annex.

The associated $CO_2$ abatement costs reflect costs to society per unit of achieved $CO_2$ emission reduction. In the supportive study on light commercial vehicles, $CO_2$ abatement costs were estimated for mass-based utility curve slopes 60% and 100%, the autonomous mass increase was assumed to be zero. The $CO_2$ abatement costs decrease with the increase of fuel prices due to higher savings from increased fuel efficiency. Abatement costs for a 60% slope are depicted in Figure 21 and for a 100% slope are depicted in Figure 22. For the autonomous mass increase of 0%, a $CO_2$ emissions reduction target of 175 g/km for light commercial vehicles is cost effective to society (because the abatement costs are negative or equal to zero) at both, 60% and 100% slope in case of oil price above 54 €/bbl and 50 €/bbl respectively.

The economic impact on society of options 1 and 2 (mass-based utility parameter, AMI=0%) was also assessed in TREMOVE model (see Table 17 in the Annex). The abatement costs to society are expressed by the net present value of purchase and fuel costs incurred to the consumers over the period 2010-2020 as compared to the base case. The difference between the options 1 and 2 is negligible in terms of costs to society and $CO_2$ abatement costs, because the target is actually the same and the same technology improvement measures have to be implemented in both options. The overall amount of $CO_2$ saved is slightly lower in the options with a later start date because of the delay in implementing the target.

The combined scenarios (options 1 or 2 combined with different levels of the long-term targets) offer negative cumulative GHG abatement costs in the range of - €38.9 to - €32.6 up to 2020, and - €20.6 to - €34.9 up to 2030 (see Table 17).

#### 5.2.4.1. Impact on vehicle buyers and users

From the end-user perspective the proposed regulation is cost beneficial according to TREMOVE simulations (Table 10 and Table 11 in the Annex). Additional costs are calculated as a difference between end-user purchase, repair and insurance costs inclusive of all taxes and end-user fuel costs inclusive of all taxes. Negative costs mean savings for end users. It should be noted that TREMOVE assumes repair and insurance costs increasing according to the increase in vehicle prices, which might not be fully in line with the actual observed technological and market development. Thus as a consequence, costs shown in the table might be overestimated which consequently would mean higher savings.

Simulations in TREMOVE model indicate, in line with the initial expectation, that the effect of the legislation on vehicle sales should be very small (see Table 9 in the Annex). In fact, the decrease in vehicle sales in N1 segment for some of the options has an effect only on lowering the expected growth of this market. The expected growth in sales (+18.7% by 2020 and +19.2% by 2030) is reduced by approximately 1%. This effect is also very small for different combinations of the short-term and long-term targets and ranges from 0.38% decrease to 0.7% increase in 2020 and approximately from 2.7% to 0.4% decrease in 2030.[31]

Further impacts on end-users are listed in section 5.2.6.

### *5.2.5. Impact on energy consumption*

In 2006, 564 Mt of crude oil was imported into the European Union and final oil consumption was 496 Mtoe. Based on the results of TREMOVE simulations, the proposed $CO_2$ in LCVs regulation (combined scenarios, 50% cap) will deliver fuel savings in the range of 3.18-4.54 Mt by 2020 depending on the case, which means decrease of fuel consumption of road transport by 1.57-2.52% (Table 7). The decrease of total fuel consumption by this range represents a sizeable cut in fuel used by light commercial vehicles, which account for 12% share in the LDV fleet and use 6-7% off all road fuel, and means a comparable reduction effort to the one required from passenger cars. The LDV fleet (passenger cars and LCVs) is in total responsible for two thirds of all road emissions, and thus fuel use. This means LCVs thereby make an adequate contribution to energy security and reducing oil import dependence.

Delay of the start date for the first step of reduction (175 g/km) to after 2012 will deliver slightly lower savings. However, an additional stricter long-term target from the range of 125 to 160 g $CO_2$/km in 2020 will more than compensate for this (see section 5.2.6.).

### *5.2.6. Impacts of the long-term target*

Figure 19 and Table 5 present relative retail price increases for both variants of the long-term target: full hybridisation and extra strong downsizing, as well as three scenarios within each option (no learning, learning with slow penetration and learning with fast penetration). The technology options of extra strong downsizing and of strong hybridisation are considered as mutually exclusive for technical reasons. It is clear that the option of hybridisation is much more expensive than extra downsizing however the differences between costs of scenarios within each variant do not differ significantly. Therefore, a preferred option for further analysis is a more cost effective scenario of **extra strong downsizing** with variant of **learning and slow penetration** which also seems to be the most realistic option.

According to the analysis performed by the contractor the level of 125 g/km is the maximum feasible reduction in the timescale and the costs of reaching this target are high, amounting to €4193 for the shortlisted variant (see Figure 19) in addition to the effort that needs to be born for the first step of emission reductions. The effort that would be required from LCVs in 2020 would in this case be more than asked from passenger cars. According to the supporting study, the 2020 target of 95 g/km for passenger cars is expected to result in 15 to 22% retail price increase from 2006, whereas the target of 125 g/km for LCVs would result in a 20% retail price increase as compared to 2007 baseline.

---

[31] The TREMOVE model has not been designed to describe the effects of situations such as the current economic crisis. This analysis therefore concerns the impact of the vehicle purchase price on the demand in the absence of other considerations like access to financing, economic situation etc.

A target of 135g/km would be consistent with the stringency of the 2020 target for cars leading to a 15 to 26% retail price increase.

Further analysis in TREMOVE uses 150 g/km as a potential target level for 2020 as well as 125 g/km which represents maximum feasibility. In addition, target levels of 160, 140 and 135 g/km are analysed in a simplified way based on the modelling results for 150 and 125g/km. A long-term target set within the range of 160-125 g $CO_2$/km is expected to deliver:

- net benefit for the vehicle owner at all investigated levels of the 2020 target in the cheaper of the two approaches (extra strong downsizing) and at a discount rate of 4% as usually employed from a public policy perspective (see in Annex IV). A target of 150g/km, for example, would on average lead to savings between €2 110 and €2 331, a target of 140 g/km would on average lead to savings of €2 028 to €2 297, and a target of 135 g/km would lead to savings of €1 987 to €2 279. Even choosing a discount rate as high as 10% – which is closer to a commercial perspective – would still lead to a net benefit for most of the options in the approach of extra strong downsizing apart from the target of 125 g/km which would impose a net cost of €88 in the 'no learning' scenario and allow for net savings ranging from €121 to €252 for other scenarios.

- net benefits to end-users in all combined scenarios (different short-term and long-term targets) as depicted in Table 10. The scenario with a 2013 start date and 135 g/km target for 2020 offers the highest savings of €4 831 and results in savings of €1.45 per €1 invested. Less challenging scenarios, e.g. 2015 as a start date and 160 as a long-term target, offer lower savings of €4 097, but require lower investment due to later introductory date and less ambitious 2020 target and thus yield higher return (€1.55 per euro invested). All scenarios offer savings also in the period up to 2030 (Table 11).

- negative cumulative GHG abatement costs as presented in section 5.2.4 and Table 17.

- benefits from savings due to reduction in the consumption of fuel of €11.6 - €15.6 billion by 2020, and €42.4 – €60.7 billion by 2030 (see Table 8 in the Annex).

### 5.2.7. *Impacts of pooling*

Flexibility mechanisms provide manufacturers with a broader range of options to meet their emission targets and therefore facilitate the achievement of targets.

The impact assessment on cars argued that applying the target to manufacturers' fleet average rather than individual vehicles would allow manufacturers to decide for themselves how and in which segments to reduce their emissions. Reduction of average emissions may be achieved by reducing the emissions of the models where such reductions cost the least. The approximate difference in cost increase for cars for fleet average/individual car was found to be 2% lower when the target applied to the manufacturer fleet average. In case of LCVs some manufacturers may find it difficult to meet the individual target if the vehicle-based emission limit is introduced therefore there is an even stronger case to apply the average target to the producer's fleet.

The positive effect of pooling between two or several manufacturers was emphasised in the impact assessment on cars. It is very likely that pooling of manufacturers producing vans and minibuses will have similar effect. A summary of the arguments are provided below:

- Pooling between manufacturers has similar effects to fleet averaging. As different vehicles are subject to different abatement costs, different manufacturers are also faced with varying costs of abatement. By allowing pooling, the abatement costs of different manufacturers could theoretically move towards average costs, which would result in increased cost-effectiveness.

- Pooling would allow for niche producers to combine their portfolios with mainstream producers hence helping to address the problem of outliers within the overall system.

- The precise impact of pooling on cost-effectiveness will depend on the extent to which manufacturers use this possibility and the nature of the agreements they reach between one another, it is likely that it will take place in practice and has been supported by representatives of the automotive industry during the consultation process.

Pooling between cars and LCVs. Bringing both categories of vehicles under the same limit function is not a realistic option, as concluded in the supporting study on LCVs, because it would require a majority of vans and minibuses manufacturers to apply 100% of their technically feasible emissions reduction potential.[32] Allowing pooling of the efforts under separate targets (resulting from different limit functions) for LCVs and passenger cars however is a possible option. Pooling of the targets for passenger cars and light commercial vehicles would mean that manufacturers can compensate underachievement in one category (expressed in average g/km above target times total sales in that category) by an equivalent overachievement in the other category (expressed in average g/km below target times total sales in that category).

According to the supporting study on light commercial vehicles, for the majority of manufacturers the marginal costs for meeting their manufacturer-specific target values (resulting from the overall targets and slope) are expected to be somewhat higher for LCVs than the marginal costs for meeting the proposed passenger car target. This means that, when pooling of targets is allowed, the manufacturers for which the difference is more important may limit their $CO_2$ reduction efforts in LCV category and to compensate this by applying more $CO_2$ reduction measures in the $M_1$ category of vehicles (see Table 13 in the Annex).

A manufacturer that produces only light commercial vehicles could still have a possibility to pool with another manufacturer of cars and/or vans[33]. However, this could potentially put such a company at a certain disadvantage compared to a manufacturer or a group of connected manufacturers that produce both types of vehicles.

### *5.2.8. Compatibility with the revised strategy on LDVs*

As explained in section 1.1, the proposal for a regulation on LCVs is a continuation of the Commission's regulatory process to address the climate change impacts of road vehicles resulting from the revised strategy on $CO_2$ from light-duty vehicles. The strategy

---

32 See section 5.3 of the supporting study on LCVs.

33 Similarly to pooling allowed under article 7 of the $CO_2$/cars regulation

announced that $CO_2$ reduction from LCVs should be a part of the measures of the integrated approach to deliver reduction of additional 10 g $CO_2$/km complementing the target of 130 g/km set for passenger cars, which in total would result in an average of 120 g/km from light-duty vehicles by 2012. However, during the co-decision process to adopt the regulation on $CO_2$ emissions standards for passenger cars, the time schedule of the strategy and the overall ambition have been amended by the European Parliament and the Council by introducing the long-term perspective of 2020 target. In addition, a phase-in period of full compliance with the target for cars introduced to the scheme changed the timeframe of the short-term reductions. It is therefore difficult to directly compare the level of $CO_2$ reductions anticipated in the impact assessment accompanying the strategy (aiming at 2012 as a target date) with the estimates of this proposal which takes into account the new framework. Likewise, a more precise estimate of the long-term target will be possible only when the modalities of reaching it are defined at the review in 2013.

The impact assessment of the revised strategy (SEC(2007)60) estimated the $CO_2$ reduction due to mandatory reduction requirements from LCVs as 44.5 Mt of GHG (expressed as well-to-wheel $CO_2$ equivalent) over the period 2010-2020. As specified in Table 16 the anticipated reduction level of the analysed option 1 and 2 (assuming AMI=0%) in the period 2010-20 should amount to at least 60 Mt of GHG in $CO_2$ equivalent with a start date from the range 2013 to 2015[34]. This amount of $CO_2$ reduction which is higher than anticipated in the strategy is the result of the more extensive data collection and investigation for this individual proposal compared to a necessarily less accurate approach for the overall strategy.[35] It was announced in the strategy that *"in 2010, the Commission will review the status of implementation and the potential for further measures to move beyond the stated EU objective."* This will be an occasion for taking stock of all EU measures undertaken to implement $CO_2$ reduction from light-duty vehicles as part of the integrated approach, and for potentially revising the strategy in view of the findings made.

## 5.3. Social impacts

### *5.3.1. Employment aspect*

The industries that manufacture cars and light commercial vehicles are very similar – indeed almost all manufacturers of LCVs also make passenger cars. Therefore, many of the key aspects in this section are rather similar in the two sectors and the discussion in the impact assessment[36] of the proposal for the regulation on $CO_2$ and cars largely applies in the present case as well, bearing in mind that the size of the market under consideration here is about 1/10 of that for passenger cars.

---

[34] The value would be 63Mt for a 100% slope of the limit value curve in 2015, based on a simplified calculation on the basis of results from TREMOVE

[35] The impact assessment of the Strategy SEC(2007)60 used the baseline of 200.9 g/km in 2002 and assumed that the baseline value (without policy aimed at efficiency improvement in N1s) for 2012 would be around 190 g/km based on autonomous efficiency improvements stemming in part at least from technology improvements diffusing into light vans from equivalent passenger cars. However, the most recent analysis shows that the average emissions in 2007 amounted to 203 g/km which explains higher savings resulting from the proposal than initially expected in the Strategy.

[36] SEC(2007)1723, section 5.3. See http://ec.europa.eu/environment/air/transport/co2/pdf/sec_2007_1723.pdf

The impact assessment on cars discussed the balance of two opposing tendencies linked to more ambitious environmental performance of vehicles. On the one hand, the higher added value on the vehicle is likely to lead to more employment along the value chain; on the other hand adverse impacts on the sales of new vehicles have the opposite effect. The impact assessment on cars concludes that the direct impact on employment through decreased sales levels caused by the legislation seems likely to be relatively marginal, while the upstream (suppliers) and downstream (servicing) impacts as well as the requirements for higher added value at the manufacturers themselves holds out positive prospects for employment.

In the case of LCVs, an assessment of the alternative options shows that the retail price increase per vehicle may range from 5.4% to 5.8% at the first stage of the legislation, depending on the slope of the utility curve and assuming full cost pass-through, and 7.1-20.9% for the long-term target (range of 160 – 125 g/km level; extra strong downsizing option). This relative price increase for light commercial vehicles is similar to the estimated 6% retail price increase for passenger cars for the short-term target, whereas the 2020 target is estimated to result in 15-20% increase.

In addition, the TREMOVE model forecasts only insignificant decreases of light duty vehicles sales (0.31 – 0.42% in 2020) due to lower price elasticity of demand for LCVs as compared to demand for passenger cars. Thus, it is expected that a marginal decrease of LCV sales (see Table 9 in the Annex) resulting from the regulation should not have important implications on employment in the vehicle manufacturing sector.

## 5.4. Environmental Impacts

### *5.4.1. Overall impacts in terms of emissions*

The overall $CO_2$ abatement in two alternatives is presented in Table 15 and Table 16 (in the Annex). The estimated emission reduction for the 2010-2020 in **option 1** amounts to 67-77 million tonnes (100% slope). However, the variation in savings between the different slopes is not very large, it may occur because of slight shift in vehicle sales.

The $CO_2$ abatement in **option 2** is at least 60 million tonnes. The difference between the options is caused by the fact that the target of 175 g/km will be achieved at the most 3 years later that in **option 1**.

According to TREMOVE modelling[37]:

- The reduction in the GHG emissions in period from 2010 to 2020 (Table 15 in the Annex) corresponds roughly to 10% of the reductions calculated in the impact assessment for $CO_2$ in cars, which is in line with the proportion of the vehicle fleet sizes of the vehicle fleet in the covered categories (the number of newly registered LCVs in 2005 was 12% of the number of passenger cars).

[37] Note: "Abatement costs" are calculated for year 2009 with the recommended discount factor 4% and expressed in Euros of year 2000 – which is the base year in the TREMOVE model. "WtW" (Well-to-Wheel) GHG abatement also includes GHG emissions reduced by fuel producers.

- The reduction in the GHG emissions from LDVs in year 2020 for targets from 2012 to 2015 targets corresponds roughly to 5% of the total reduction effort (Table 15 in the Annex) under the decisions of European Parliament and of the Council on the effort of Member States to reduce of their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 (Decision 2009/406/EC). This can be partly offset by the increase in the road transport emissions due to increase of transport activity. However, the contribution of $CO_2$ reductions from LDVs to the total effort does not take into account the offset of additional growth of GHG emissions from 2005 level.

- The introduction of the long-term target is estimated to result in the cumulative GHG savings ($CO_2$ equivalent) of 61.7 to 81.6 Mt by 2020 (Table 16). These levels of $CO_2$ abatement will help achieve 4.7 to 6.0% of the reduction effort of the non-ETS contribution to 20% reduction in EU GHG emissions by 2020 (see Table 15 and section 3.2.3). The cumulative GHG savings resulting from the combined scenarios increase to 267 to 342 Mt in 2030 (see Table 16).

- The impact of the legal proposal on $CO_2$ emissions from light commercial vehicles in principle has an insignificant impact on the overall emissions of other pollutants, as indicated in Table 18 (in the Annex). LCVs sold in the EU will be subject to pollutant emissions standards (Euro 5 and Euro 6) in any event and the proposal for $CO_2$ standards will not impact on these limit values. The share of diesel vehicles is already near 100% and no shift in the petrol/diesel share is expected.

- The production of more efficient vehicles under the present legislation is not expected to generate substantially more $CO_2$ emissions than current processes. Moreover, production is to a certain extent already covered by the EU Emissions Trading Scheme (cost of electricity as well as parts of the production of raw materials and components). At present the $CO_2$ emissions resulting from the production of vehicles are estimated to be responsible for about 15% of their lifecycle $CO_2$ emissions.

#### *5.4.2. Impact of the compliance mechanism*

In order to ensure that manufacturers have incentives to comply with the legislation, the excess emissions premium should be set at the level of the marginal cost of compliance. On the basis of the purely technical cost of compliance as obtained from the supporting study, compliance with the target of 175 g/km in the timeframe 2012-2015 with mass-based parameter and zero AMI, and within a margin of 0,1g/km, would require a premium level of around €120 per gram per kilometre (Figure 23). This is higher than the level of €95 per gram agreed for passenger cars and results from higher marginal cost of $CO_2$ abatement for light commercial vehicles.

Setting the same premium levels for the two types of vehicle would be important if pooling between passenger cars and LCVs is permitted to avoid gaming.

### 5.5. Additional costs to businesses and Member States

The proposal for a regulation to reduce $CO_2$ emissions from LCVs will not put any additional reporting burden on manufacturers. Car producers are obliged to report the data necessary to check compliance with this legislation already now at the type approval and in the certificate of conformity of each vehicles. This also includes any parameters needed for a future review of the utility parameter. This is required from both, passenger cars and LCVs (the latter as of 2007 pursuant Directive 2004/3).

The regulation will however require that producers put more effort in monitoring and forecasting of progress of sales in order to manage the compliance of their fleet with the target, and handle the monitoring reports prepared by the Commission each year. This will be already required by the regulation on $CO_2$ and cars which enters into force in 2012 and therefore a large majority of manufacturers will have these procedures in place in any case.

The Member States are obliged to monitor and report the data provided by manufacturers for passenger cars already now (Decision 1753/2000/EC). Further to the adoption of the regulation on $CO_2$ and cars regulation, the national authorities will have to adapt the monitoring schemes to the requirements of the Regulation (i.e. gather data on the footprint). The Commission is also working with the Member States to improve national monitoring schemes which also includes monitoring of the registration of passenger cars as LCVs and the opposite.

Inclusion of the obligation to monitor data concerning LCVs will put only negligible additional costs on national authorities. The monitoring scheme required for this purpose will be the same as used for passenger cars and the only difference will relate to the obligation to process more data. The share of LCVs in the whole light-duty fleet is only around 12% of the light-duty vehicles fleet and this additional effort is estimated to be very limited.

### 5.6. Comparison of options

As a starting point, five alternative policy options were identified. However, the analysis of distributional impacts of options discarded pan area-based utility (options 3 and 4) and percentage reduction (option 5) from further analysis (see section 5.2.1.3). Pan area was discarded because the distribution of reduction efforts was more uneven between different manufacturers than in case of a mass-based utility parameter. This means that the individual targets for some manufacturers were more stringent for pan area as compared to mass. The general tendency was that the estimated retail price increases were also higher for pan area.

The short-listed options 1 and 2 were further analysed in terms of social equity, competitive neutrality, cost-effectiveness and the environmental outcome. Within these options low slopes of the utility curve (below 60%) were discarded and the slope of 120% was rejected on the basis of a risk of perverse incentives to increase mass. In option 2 the target year was defined as a range of possible dates (beyond 2012 up to 2015) considered for the first step of emissions reductions.

In principle the two options are alike in terms of costs, if assumed autonomous mass increase is set to zero. If the autonomous mass of vehicles increases over 3 years, the manufacturers will be in less favourable position in 2015, because they will be required to introduce more reduction measures needed to compensate the increased $CO_2$ emissions. However, AMI of 1.5% is unlikely for light commercial vehicles because of their use in transporting goods. The additional mass would come at the expense of the payload and performance.

The most even distribution of retail price increases between manufacturers is observed between 100% and 120% slopes. In addition, even though the risk of perverse incentives of increasing the mass of vehicles to receive less stringent targets in LCVs is expected to be lower than in the case of passenger cars, the slope of 120% is more likely to provoke these adjustments than the 100% slope. Therefore, the latter seems the most suitable.

<table>
<tr><th></th><th>Option 1<br>Mass-based utility<br>Target year – 2012<br>Slope: 60% - 100%</th><th>Option 2<br>Mass-based utility<br>Target year – 2013-2015<br>Slope: 60% - 100%</th></tr>
<tr><td>Environmental impacts (i.e. $CO_2$ reductions)</td><td>☺<br>67 to 77 Mt $CO_2$ eq. until 2020</td><td>😐<br>At least around 60 Mt $CO_2$ until 2020</td></tr>
<tr><td rowspan="2">Average compliance costs (expressed as relative retail price increase for 60%-100% slope)</td><td colspan="2">5.4%- 5.8% price increase per vehicle<br>The cost of meeting this target for both start dates is similar if zero AMI increase is assumed</td></tr>
<tr><td>7.9% - 8.3% price increase per vehicle<br>Higher cost results from the need to compensate for the autonomous mass increase of 1.5% (AMI=1.5%)</td><td>9.5% - 9.9% price increase per vehicle<br>Higher cost results from the need to compensate for the autonomous mass increase of 1.5% (AMI=1.5%)</td></tr>
<tr><td>Cost-effectiveness to society (cumulative GHG abatement cost 2012-2020)</td><td>☺<br>-13.5 to -10.2 €/ton $CO_2$ eq.</td><td>☺<br>Around -13.5 €/ton $CO_2$ eq.</td></tr>
<tr><td>Other economic impacts (incl. competitive neutrality)</td><td>😐<br>The slope of 60% makes it very challenging for some manufacturers producing larger vehicles (class III) to meet their respective targets. The slope of 100% gives a more even distribution of costs over different manufacturers and on average a lower cost of compliance for the industry.<br>The start date of 2012 is very challenging and does not leave enough lead time for manufacturers to adjust their production cycles.</td><td>😐/☺<br>Concerning slope and costs this option has similar characteristics as option 1. However, it provides manufacturers with more time to respond to the requirements of the legislation (i.e. longer lead time).</td></tr>
<tr><td>Other economic impacts - impact on businesses including SMEs</td><td>☺<br>Light Commercial Vehicles are mostly used by commercial enterprises including SMEs. At both slopes there are net benefits to the vehicle operator.</td><td>☺<br>At both slopes there are net benefits to the vehicle operator. Option 2 also offers net benefits per vehicle to the vehicle operator in the same order as option 1.</td></tr>
</table>

| | **Option 1<br>Mass-based utility<br>Target year – 2012<br>Slope: 60% - 100%** | **Option 2<br>Mass-based utility<br>Target year – 2013-2015<br>Slope: 60% - 100%** |
|---|---|---|
| **Social impacts (employment)** | ☺<br>The higher added value on the vehicle is likely to lead to more employment along the value chain (similarly to effects of $CO_2$/cars regulation).<br>The adverse impacts on the sales of new vehicles are estimated to be very small: -0.69% to – 1.33% | ☺<br>The higher added value on the vehicle is likely to lead to more employment along the value chain (similarly to effects of $CO_2$/cars regulation).<br>The adverse impacts on the sales of new vehicles are estimated to be very small, around -1%. |

### *5.6.1. Long-term target[38]*

| **2020 target** | | **160 g/km** | **150 g/km** | **140 g/km** | **135 g/km** | **125 g/km** |
|---|---|---|---|---|---|---|
| Environmental impacts [cum. GHG savings in Mt] | 2020 | 59.1 | 61.7 | 71.7-64.3 | 65.6-81.6 | 68.2 |
| | 2030 | 237 | 267 | 297-311 | 312-342 | 342 |
| Fuel savings [in Mt] | 2020 | 3.18 | 3.49 | 3.80-4.07 | 4.21 | 4.51 |
| | 2030 | 5.99 | 7.02 | 8.06-8.19 | 8.57-8.85 | 9.60 |
| Fuel savings at 4% discount rate [€/vehicle] | | 3477 | 4286 | 5094 | 5499 | 6307 |
| Retail price increase [€/vehicle] (extra strong downsizing; slow penetration scenario) | | 1499 | 2049 | 2907 | 3335 | 4193 |
| Cost-effectiveness to society [€/t$CO_2$] | 2020 | -38.9 | -36.9 | -34.7 to -35.1 | -33.4 to -34.2 | -32.6 |
| | 2030 | -34.9 | -29.6 | -25.4 to -25.5 | -23.7 to -23.9 | -20.6 |

# 6. MONITORING AND EVALUATION

## 6.1. Core indicators of progress towards meeting the objectives

The core indicators of progress are linked to the evolution of the average new fleet of light commercial vehicles over the years, and they cover data relating to:

38 Only for combined scenarios with 50% cap

- 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 or footprint), to provide an analysis of the evolution of the EU LCV 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 maximum payload or maximum load volume have been proposed by stakeholders and could become part of a mandatory monitoring regime in order to assess the appropriateness of such parameters at a future review.

### 6.2. Monitoring arrangements

The necessary data have to be provided by manufacturers of light commercial vehicles already now at type approval (Directive 2004/3). The arrangements on monitoring of compliance with the legislation will be similar to the ones for passenger cars. Further to the adoption of the regulation on $CO_2$ and cars, the national authorities already now need to adopt the monitoring schemes to new requirements, e.g. by gathering data on footprint. The Commission is currently working with the Member States to improve national monitoring schemes which also includes monitoring of the registration of passenger cars as LCVs and the opposite. The revised monitoring arrangements will allow using the similar scheme for both categories of vehicles, cars and vans.

## 7. REFERENCE DOCUMENTS


**SUPPORTING STUDY**

1. AEA 2008

Assessment of policy options for the regulation on $CO_2$ emission reduction for light-commercial vehicles carried out by ASPEN, TNO, CE DELFT, OKO INSTITUT, Framework contract No. ENV/C.5/FRA/2006/0071, December 2008

2. AEA 2009

Assessment with respect to long term $CO_2$ emission targets for passenger cars and vans carried out by ASPEN, TNO, CE DELFT, OKO INSTITUT, Framework contract No. ENV/C.5/FRA/2006/0071, July 2009

**FLEETS 2008**

European Database of Vehicle Stock for the Calculation and Forecast of Pollutant and Greenhouse Gases Emissions with TREMOVE and COPERT, Contract No 070501/2006/451259/MAR/C5, Final report, 2008

**TNO 2004**

Service Contract on the Policies for reducing $CO_2$ emissions from light commercial vehicles, carried out by TNO, IEEP and LAT on behalf of the European Commission (DG Environment) in 2003-2004

**TNO 2006**

Review and analysis of the reduction potential and costs of technological and other measures to reduce $CO_2$-emissions from passenger cars, study for DG Enterprise carried out by TNO, IEEP and LAT/AUTh, Contract nr. SI2.408212, October2006

## ANNEX I: GLOSSARY

**Light-duty vehicles (LDVs)** - passenger cars and light commercial vehicles

**Light Commercial vehicles (LCVs) –** the definition applied for the purpose of this document aligns the scope of LCVs with that of the Euro 5/6 legislation and covers N1, N2 and M2 vehicles with a reference mass not exceeding 2610 kg. This is further extended to those vehicles with reference mass up to 2840 kg to which type-approval is extended in accordance with Article 2(2) of Regulation (EC) No 715/2007.

**N1 vehicles** - definitions of N1 vehicles and N1 vehicle classes are given in Directive 2007/46 Annex II; these are motor vehicles with at least four wheels designed and constructed for the carriage of goods and having a maximum mass not exceeding 3.5 tonnes. Classes of N1 vehicles are defined on the basis of reference mass: class I (≤ 1305kg), class II (1305 kg < reference mass ≤ 1760 kg), class III (> 1760 kg).

**N2 vehicles** – according to Directive 2007/46 Annex II N2 vehicles are designed and constructed for the carriage of goods and having a maximum mass exceeding 3,5 tonnes but not exceeding 12 tonnes.

**M2 vehicles -** according to Directive 2007/46 Annex II M2 vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass not exceeding 5 tonnes.

**Autonomous mass increase (AMI)** – is an indicator of an average increase of mass of the fleet resulting from such factors as additional safety measures.

**Limit value curve** - in the utility based approach the obligation of $CO_2$ reduction is defined as a linear function of a so-called "utility" parameter reflecting the utility of vehicles. The line is such that the average new LCV fleet respects the average target (e.g. 175 g/km). A 100% curve is based on the observed trend in a base year, scaled down to reach the desired limit value. Furthermore, one can rotate the curve 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.

**Utility parameter** – a parameter meant to distinguish vehicles by their utility as perceived by buyers or users. The utility parameter can for example be chosen to be vehicle's mass, pan area or footprint, or its carrying capacity.

## ANNEX II: SUMMARY OF STAKEHOLDER CONSULTATION 02 SEPTEMBER 2008

**Stakeholder meeting on the Proposal to reduce $CO_2$ emissions from light commercial vehicles, 02.09.2008**

Chairman: Philip Good, DG Environment

The chair from the Clean Air and Transport unit in DG Environment opened the meeting and outlined the context for the stakeholder consultation. The revised strategy on $CO_2$ emissions from light duty vehicles announced that the Commission would propose legislation to reduce $CO_2$ emissions from light commercial vehicles. The aim of this workshop was to give industry and NGO stakeholders to express their views on the proposed legislation and in particular the issue paper circulated by the Commission.

### Introduction

The chair gave an introductory presentation, highlighting the main aspects of the proposed regulation on light commercial vehicles. These included following:

- Proposed regulation on $CO_2$ from light commercial vehicles should follow in general the structure of the proposal on passenger cars;
- To be consistent with the scope of Euro 5 and Euro 6 standards (Regulation (EC) No. 715/2007) the proposed regulation should cover vehicles of categories $N_1$, $N_2$ and $M_2$;
- The Communication from the Commission sets two targets for light commercial vehicles: 175 g/km target in 2012 and 160 g/km target in 2015. The proposed legislation should include these targets;
- With regard to long term targets it is possible to proceed in two ways, i.e. to set separate targets for passenger cars and light commercial vehicles, or to set a single long term target;
- It is considered appropriate to apply a utility curve based target in the proposed regulation. Utility parameters under consideration are vehicle pan area and vehicle mass;
- For manufacturers producing both M and N type of vehicles it is possible to allow pooling between cars and vans targets. Possibility for pooling between manufacturers is also being considered;
- It is considered to have a similar compliance mechanism to that for cars;
- The possibility of including a derogation for small scale manufacturers will be considered.

The Commission aims to make a proposal before the end of 2008. The full consultation paper is available at:

http://ec.europa.eu/environment/air/transport/co2/co2_cars_regulation.htm.

**ACEA Presentation**

Mr. Rolf Stromberger from ACEA provided their opinion on some of the key questions in the issue paper. He highlighted that:

- LCVs have a wide range of different designs and are more varied in terms of vehicle configuration and body styles than passenger cars. Functionality is one of the key purchase considerations for LCVs.

- ACEA considered that $CO_2$ savings potential for LCVs were limited, as the vast majority of the light commercial vehicles fleet is already equipped with diesel engines.

- ACEA considered that there was a lack of $CO_2$ emissions data for light commercial vehicles, making it difficult to set targets.

With regard to the specific questions posed by the Commission he noted that:

- They do not consider that an immediate merger of the proposals on $CO_2$ emissions from passenger cars and that for light commercial vehicles is appropriate.

- They do not support a common target for passenger cars and light commercial vehicles.

- They agree that an increase in fuel price makes technologies more cost-effective.

- They consider that retail price increase would require the first owner to keep the vehicle longer to get the investment back. Small and medium enterprises may postpone investments in new vehicles.

- ACEA supports a utility based approach, but it raised a question whether a single utility parameter is sufficient to cover the range of segments of vehicles. They emphasised that bigger vans carry significantly more load that smaller vans and that this should be taken into consideration.

- ACEA is supportive to the pooling between manufacturers,

- They did not support pooling within a manufacturer between the targets for cars and vans due to competition concerns.

- They support the possibility to grant derogations to small scale producers.

- They stated that the level of excess emissions premium should be similar those in the EU Emissions trading scheme.

**Summary of discussion**

ACEA was asked to clarify the statement that retail price increase will cause a slowdown of fleet renewal. It was quite possible that any increase in price of the vehicle would be offset by the reduced fuel cost, so it could have little or no overall effect. ACEA thought that in order to get back the extra purchase cost, users will drive the same vehicle for longer.

ACEA proposed to exclude vehicles of category $M_2$ from the scope of legislation, arguing that this segment of vehicles is specialised, and that increased retail price of the vehicle may cause the increase in costs of transportation of passengers so was not socially desirable. Other stakeholders thought that the rationale for this exclusion was not at all clear as these vehicles are based on $N_1$, and that it would not be correct to exclude one particular segment of vehicles.

Industry representatives were concerned about a long product cycle of 10 years, due to which manufacturers will have difficulties in reaching the target in 2012. They also stressed that all new technologies being developed now have to undergo long testing procedures before implementing them in the vehicles. The assertion that it was not possible improve vehicle fuel efficiency in a shorter time period was disputed, as for example emissions requirements tended to change every 4- 5 years.

Industry representatives stated that it may not be enough to apply a single utility parameter, due to the large segmentation of light commercial vehicles. However, no preference was expressed for a specific utility parameter at this stage.

The issue of multi-stage vehicles was also raised. It was noted that these vehicles are sold incomplete, so there is an issue of who should be responsible for emissions from these vehicles. ACEA was asked to provide information on what is the share of sales of these vehicles and the type approval arrangements for vehicles which have been completed by a coachbuilder.

There were questions as to why ACEA opposed pooling between the cars target and the vans target. Their opposition was because of competition concerns between different manufacturers. JAMA and KAMA did not have a common position regarding the pooling yet.

Other questions and comments:

- A comment was made that a maximum mass limit can cause loopholes and perverse incentive to produce heavier vehicles that will be outside of the scope of this regulation.

- A question was asked about the strategy if there will be a fleet wide non-compliance with the target due to shift to heavier vehicles.

- A comment was made that all derogations in the legislation should not be permanent and need to be regularly reviewed.

- A comment was made that different policies between $M_1$ and $N_1$ classes could cause a distortion in the $M_1$ and $N_1$ markets.

At the end of the meeting stakeholders were informed that the presentations of DG Environment and ACEA will be circulated via e-mail. Stakeholders were asked to provide their additional comments by 30 September 2008.

In addition DG Environment received some written responses to the consultation which can be accessed on:
http://ec.europa.eu/environment/air/transport/co2/co2_cars_regulation.htm

## ANNEX III: SUMMARY OF SECOND STAKEHOLDER CONSULTATION 09 MARCH 2009

Chairman: Stefan Moser, Günter Hörmandinger, DG Environment

The chair from the Clean Air and Transport unit in DG Environment opened the meeting and outlined the context for the stakeholder consultation. The aim of this meeting was to inform all interested parties about the progress with regard to the development of the legislative proposal on light commercial vehicles and to provide an opportunity to share views on the proposal.

### Introduction

Representative of the contractor[39] Richard Smokers gave an introductory presentation on the main elements and findings of the report on the Assessment of options for the legislation of $CO_2$ emissions from light commercial vehicles. The main conclusions of the report were:

- 175 g/km target can be reached in 2012/15
  - at around 10% retail price increase
- 160 g/km target not feasible for 2015
  - based on static cost curves for 2012-15 period with conservative safety margin for assessing total reduction potential for combined measures
  - assessment of a long-term target for 2020 still on-going
    - analysis will include additional technological options and cost reduction as function of cumulative production due to learning effects
- mass-based limit function with slope ≥ 80% preferred due to:
  - lowest average costs per vehicle for meeting target
  - most equal distribution of efforts among manufacturers
  - limited chance of perverse effects compared to M1
- non-zero AMI has strong impacts on costs

impacts on $CO_2$ corrected by adjusting the limit curve

[39] Consortium of AEA, CE Delft and TNO; analysis performed under the framework contract DG ENV/C.5/FRA/2006/0071

**ACEA presentation**

Mr Rolf Stromberger from ACEA (Association of European Car Manufacturers) provided joint position of association's members on some of the key issues in the proposal and the report. The main highlights are:

- it is a business-to-business market and there is a high diversity in customer needs

- there is no need for a regulation on light commercial vehicles, because:

  - 85% of road vehicles are already covered by $CO_2$ cars legislation

  - LCVs are responsible for 1,7% of man-made $CO_2$ emissions in the EU

  - LCVs are not 'emotional products' and are not driven by fashion, they need to fulfil a work function;

- ACEA considers that direct application of the same design used for $CO_2$ and cars regulation is not appropriate because of differences between passenger cars and LCVs, for instance: dedicated business needs; higher diversity of LCVs; limited $CO_2$ reduction potentials; etc.

- Impact assessment should sufficiently consider the wide range of LCVs and other aspects as lead-time. According to ACEA inadequate impact assessment may put additional burden on industry and customers and is incompatible with CARS 21 principles.

- ACEA noted that LCV's development and product cycles are longer than for passenger cars. In addition, due to cash shortage and economic situation the current development time for LCVs will be even longer. Therefore, ACEA believes that proposed $CO_2$ target in 2012 does not consider lead-time needs;

- According to ACEA, $CO_2$ saving potential for LCVs is limited as compared to cars because diesel engine penetration is above 90%; load volume determines aerodynamics and design of vehicle; some technologies for cars are not applicable or have lower $CO_2$ reduction potential (e.g. engine down-sizing). Due to this the vehicle price and $CO_2$ abatement costs will increase significantly.

- ACEA considers that the data used by the consultant is weak because it contains many assumptions;

- ACEA considers that cost increase for LCVs will not be recoverable because of the following aspects:

  - $CO_2$ fleet average is not representative

  - When proposing targets in the revised Strategy on $CO_2$/LDVs it was not considered that $CO_2$ reduction for LCVs is more costly than for passenger cars;

– For proposed Community target of 175g/km average retail price increase would be €1,650–€2,000 (excl. tax);

– Tougher long term target will require further cost increase and it is not technically feasible.

- ACEA considers that consultants study does not justify the proposed $CO_2$ target for LCVs;

- The current economic situation of the automotive industry: LCV sales dropped by 35.6% in January 2009; forecasts show that vehicles production in the world will further decrease in 2009. The goal of the industry is to get through the recession without long-term damage to competitiveness and minimisation of the closure of production sites.

- ACEA considers that proposed legislation needs a robust database and a comprehensive impact assessment and it proposes a following way forward:

– Joint work of the Commission and the industry on the vehicles database;

– Setting more realistic targets than currently proposed and allowing sufficient lead-time; and avoiding additional economic burden;

– Consideration of the cumulative costs of regulation.

**FIA European Bureau presentation**

Mr Wilfried Klanner from FIA (Fédération International d'Automobiles) European Bureau presented results of their own analysis conducted on the ADAC data to demonstrate the influence of different target line concepts on the $CO_2$ emission reduction potential based on the strategy to reduce $CO_2$ from LDVs, and on the achievability of these targets by future N1 fleet. The objective of this analysis was to find the most promising concept. The analysis looked at three policy options: utility curve based on kerb weight, utility curve based on gross mass, and similar scheme as the one used in regulation on $CO_2$ from passenger cars.

Based on this analysis of the data, FIA presented the following conclusions:

i. The constant $CO_2$ reduction target line concept, based on vehicle kerb weight respectively on vehicle reference mass, is likely to be a good compromise between $CO_2$ reduction potential and achievability.

ii. Using the M1 target line for the N1 car fleet as well is not a satisfactory solution, due to low achievability and due to the fact that, in contrast to M1 cars, heavier N1 vehicles normally also transport higher loads. Therefore heavier N1 should not be punished by more demanding thresholds, as it is the case for the M1 target line.

iii. Based on this concept the target lines to fulfil the $CO_2$ emission targets for 2012 and 2015 are developed and discussed.

iv. The outcomes of this analysis show good compliance with the findings of the AEA study.

v. FIA proposal for 2012- 175 g/km average- a constant $CO_2$ reduction target line based on vehicle kerb mass.

vi. The target line of 2012 would mean 13,79% reduction line (203 g/km to 175 g/km)- already today a lot of vehicles are meeting this target.

**Contribution by Axel Friedrich**

Axel Friedrich presented a short statement on behalf of German environmental NGOs**.** An importance of reducing $CO_2$ emissions from all sources (also small emitters) and energy security (i.e. lowering reliance on imports of oil) was stressed**.**

Mr Friedrich referred to the estimation of costs in the contractor's report saying that they are much too high. In addition, a longer lifetime of light commercial vehicles, and thus longer impact on emissions, should be taken into account in the estimations of efficiency of $CO_2$ reductions. In UBA the costs of optimised technological packages were estimated proving that these reductions can be done at much lower costs, e.g. optimisation of tyres can provide savings of 5%, engine friction 3-5% with virtually no cost, improvement of air resistance of vehicles can also contribute to fuel efficiency. Taking this into consideration when analysing data in the report leads to conclusions that the target of 175g/km can be reached with no additional costs.

In addition, Mr Friedrich claimed that nearly all light commercial vehicles in class I are derived from passenger cars which means that $CO_2$ reduction in the former could be done using the same solutions as in M1. According to the speaker half of LCVs in class II could also benefit from investments in efficiency in passenger cars (example of the retrofitting programme in Germany). The statement that some of the targets cannot be made was also opposed and benefits to society being three times higher than costs were highlighted. In addition, an example of hybrid LCVs being used in Japan and USA and offering 50-60% of reduction in fuel consumption was given.

Mr Friedrich also referred to an agreement on phasing out of cooling agent for air conditioners 134a and possible plans of manufacturers to delay coming into effect of this agreement until 2017. The speaker claimed that this should be penalised by adding 8-10g of $CO_2$ to the emissions figure of vehicles.

Finally, a mass-based utility parameter was questioned, and volume/or area based standard was proposed instead as more suitable for LCVs.

**Contribution by JAMA (Hiroki Ota)**

The representative of Association of Japanese Automobile Manufacturers (JAMA) highlighted that the recommendations of CARS 21 should be respected while preparing this proposal and that unnecessary costs for the industry should be avoided. Mr Ota called for a comprehensive impact assessment of the proposal, especially because the costs of compliance are higher than for passenger cars. A need for more precise and accurate database was reiterated and JAMA offered support to the Commission in this respect. The speaker reminded that manufacturers of LCVs need more lead time due to longer product cycles, especially the target date of 2012 is too short to achieve it.

**<u>Summary of discussion</u>**

**- Timing of the proposal**

The representative of the European Shippers Council expressed its concern on the timeline highlighting that their members will not be left with much choice if heavier vans go out of the market and that it will cause serious problems of efficiency. Timing of 2012/15 was therefore assumed to be not realistic.

The official from the Ministry of Environment of the Netherlands asked whether the long-term target (mentioned by the contractor) would also be included in the proposal.

**- Slope of the utility line and utility parameter**

The representative of the European Shippers Council questioned whether it would be fair if all categories had the same burden (100% slope). A possibility of relative targets, i.e. same relative reduction effort for large and small vans was suggested as a better option.

Jos Dings from Transport and Environment said that mass-based parameter was an unfortunate consequence of copying M1 proposal. T&E study on feasibility of footprint parameter concluded that costs are likely to be lower in this approach. The speaker said that it is possible to use this parameter because the data is available and in addition the light weighting options pay off fully. Jos Dings also reminded that the regulation on LCVs has been in place in the USA for 30 years thus, in reality the diversity of the market is not an obstacle to regulation.

Axel Friedrich highlighted that any parameter that is based on the area, i.e. pan area or footprint, is better because of the utility of LCVs (to transport goods) and because it prevents a misuse. The data on pan area is available whereas footprint, although more complicated, can be estimated based on data from manufacturers.

Wilfried Klanner referred to AEA study and comparison of the outcomes of different policies (incl. different utility parameters) and asked for keeping the same approach as in M1 regulation. Pan area does not bring many benefits because of the wider scatter.

**- Pooling**

The representative of Toyota expressed a concern that some of the manufacturers do not produce passenger cars and therefore would not have an opportunity to use the flexibility of pooling.

An official from Department for Transport (UK) also questioned the practicality of this flexibility even though it sounds reasonable from the theoretical point of view.

**- Derogations**

The representative of Jaguar Land Rover highlighted that Land Rover products would need a derogation for small volume manufacturers due to very high costs of $CO_2$ reductions and a specific use of vehicles (i.e. off-road).

The participant from the UK Society of Motor Manufacturers and Traders (SMMT) also mentioned that the diversity of the market should be preserved and the case for derogations (also based on other parameters than volume) should be made. The concern over impacts of abatement costs on small volume manufacturers was also expressed by the official from Department for Transport (UK) and a need to include these actors to the analysis was highlighted.

T&E stressed that any derogation has a tendency to grow into a regulatory gap which can be abused. In addition, a need for speed limiters for LCVs should be seriously considered. LCVs are often overloaded and raise safety concerns. This was backed strongly by a representative of German NGOs. The official from the Ministry of Environment (NL) agreed that this issue should be analysed. ACEA mentioned some concerns on the grounds of safety. The European Shippers Council highlighted that speed limiters should be able to adapt to traffic situation.

In addition, a demand for inclusion of supercredits for low emitting vehicles (similar to the ones introduced in the $CO_2$/cars regulation) was made.

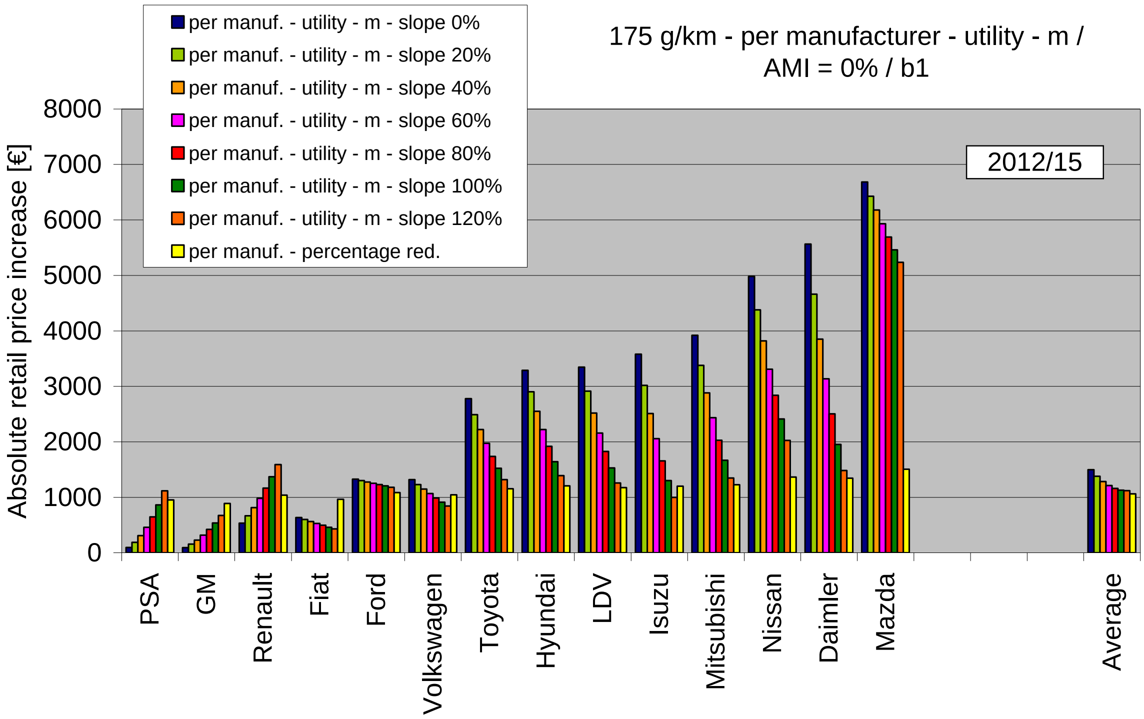
Finally, ACEA and Ford called for the current economic situation to be taken into account, especially in view of current difficulties in getting financing. It was highlighted that in order to meet the targets in 2012/15 investment should take place now. In addition, ACEA representative proposed to contribute to improvement of the database used in the analysis.

The Chairman concluded the meeting and invited participants to send their written contributions in the coming weeks.

## ANNEX IV: DISTRIBUTIONAL EFFECTS ON MANUFACTURERS

### Part A – Mass-based utility parameter (options 1, 2 and 5)[40]

Figure 7 **Estimate of absolute price increase for options 1, 2 and 5 with AMI = 0.0% p.a.** (Source: Supporting study on light commercial vehicles)




---

40 Mazda (and to a lesser extent Hyundai for pan area) appears to be an outlier in this analysis. This is due to inclusion of pick-up SUVs with relatively high $CO_2$ emissions as N-type vehicles in the JATO database. These vehicles are also included in the sales figures of other, mainly Japanese and Korean, manufacturers.

Figure 8 **Estimate of relative price increase for options 1, 2 and 5 with AMI = 0.0% p.a.** (Source: Supporting study on light commercial vehicles)

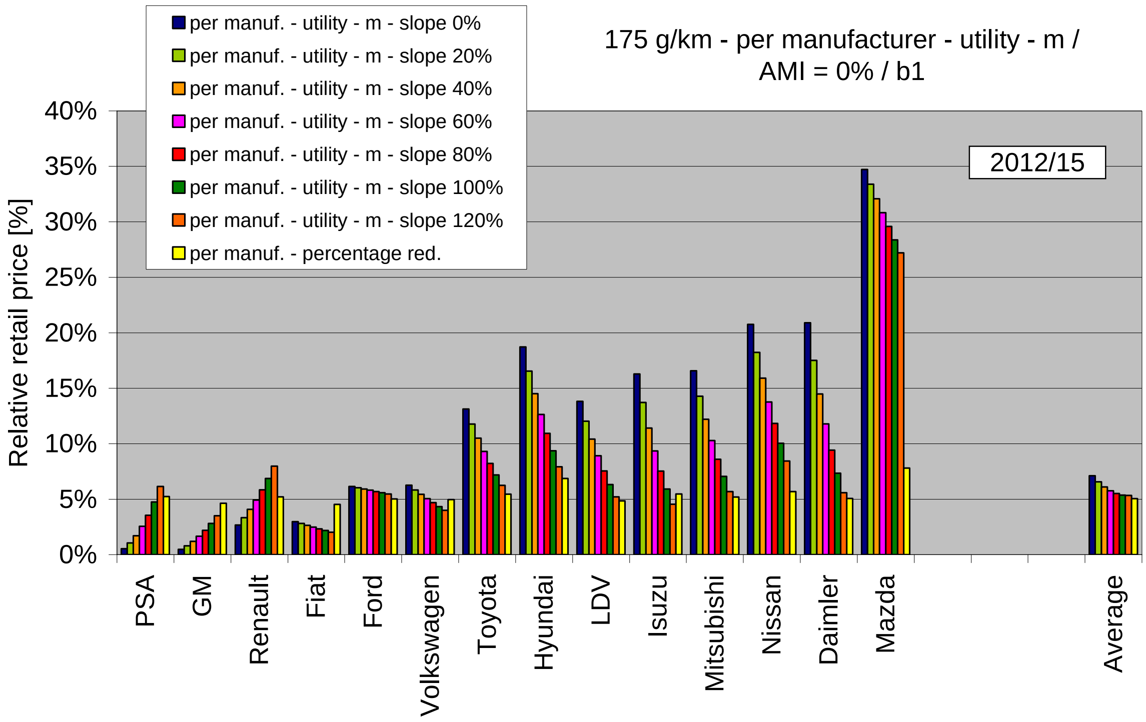



Figure 9 **Estimate of absolute price increase for options 1 and 5 with AMI = 1,5% p.a**. (Source: Supporting study on light commercial vehicles)

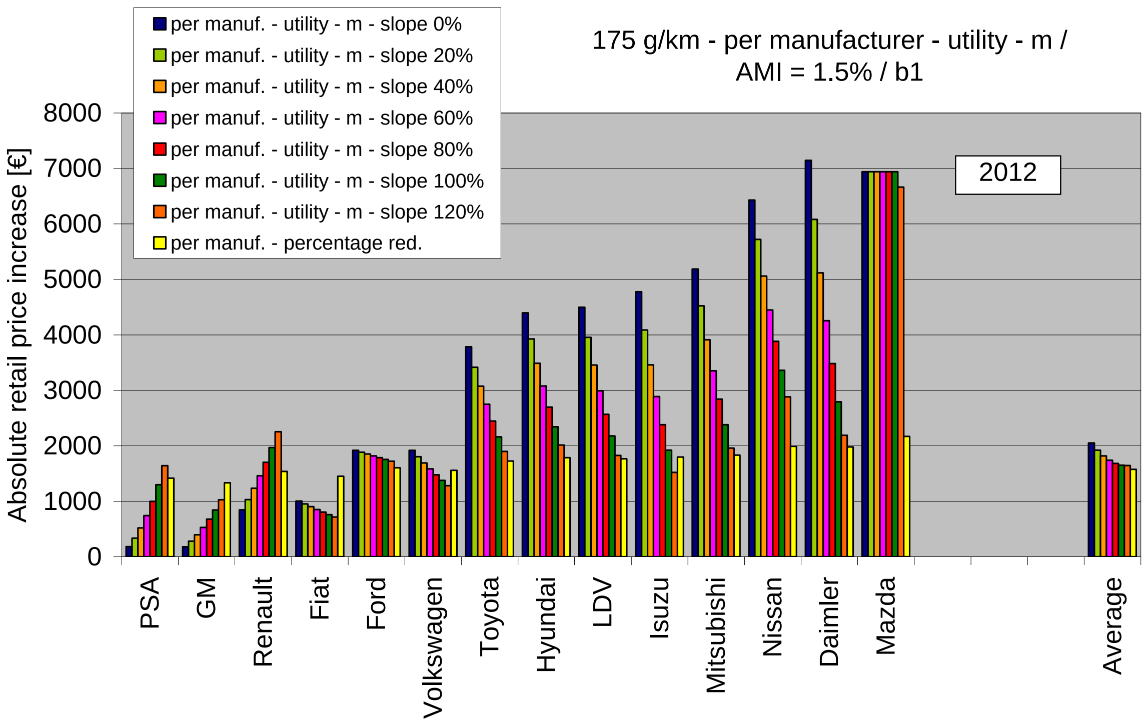


Figure 10 Estimate **of relative price increase for options 1 and 5 with AMI = 1,5% p.a.** (Source: Supporting study on light commercial vehicles)

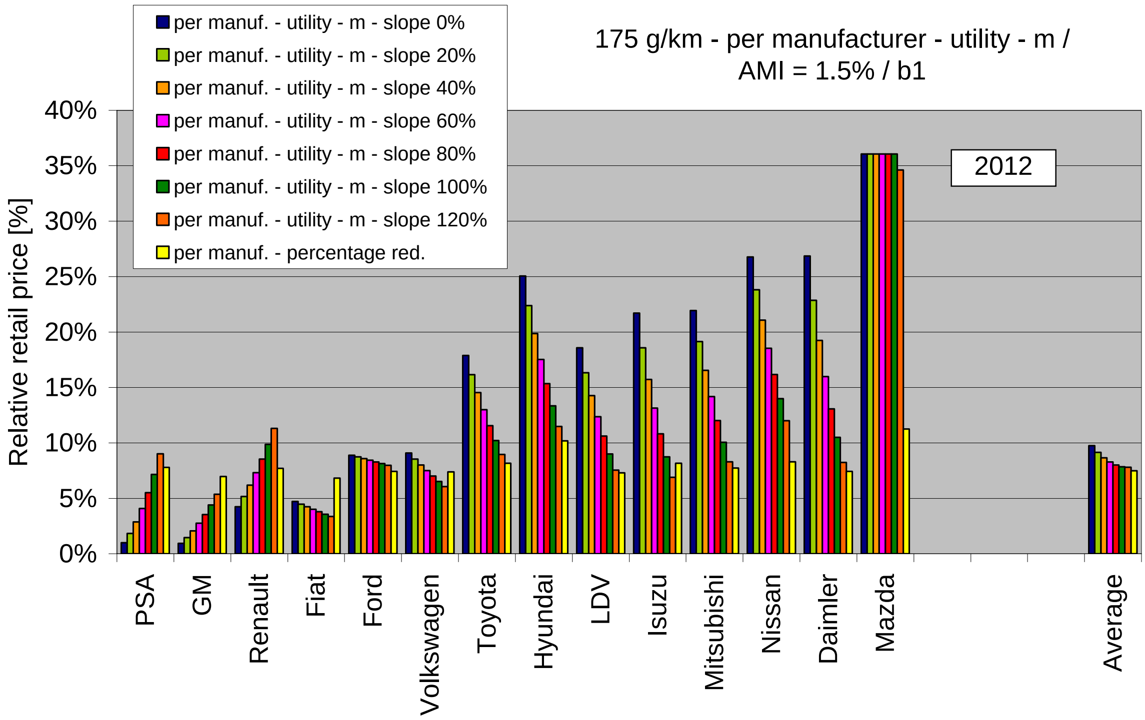



Figure 11 **Estimate of absolute price increase for option 2 with AMI = 1,5% p.a**. (Source: Supporting study on light commercial vehicles)

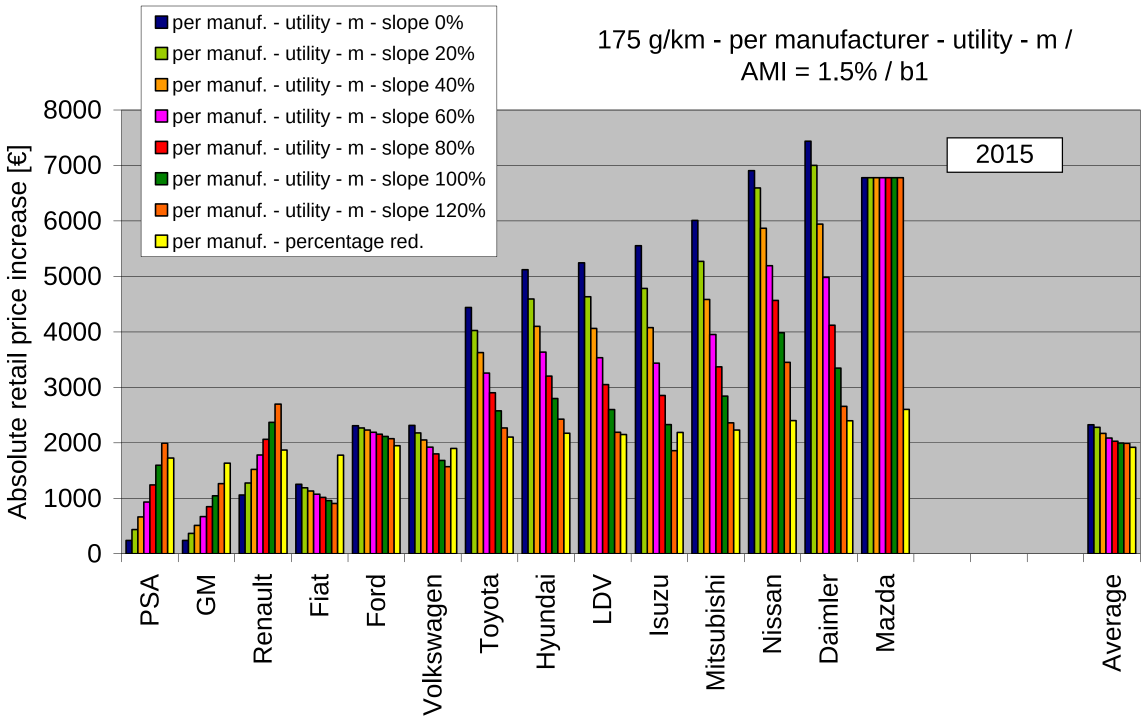
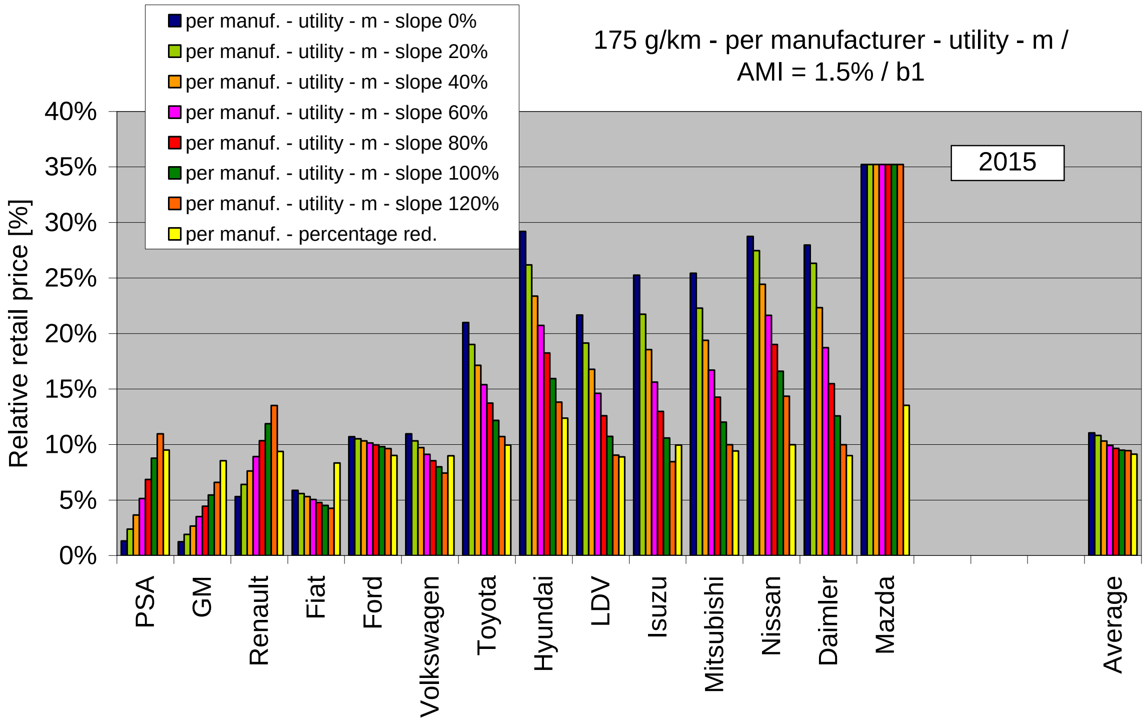


Figure 12 **Estimate of relative price increase for option 2 with AMI = 1,5% p.a.** (Source: Supporting study on light commercial vehicles)




**Part B- pan area-based utility parameter (options 3, 4 and 5)**

Figure 13 **Estimate of absolute price increase for option 3 with AMI = 0.0% p.a.** (Source: Supporting study on light commercial vehicles)

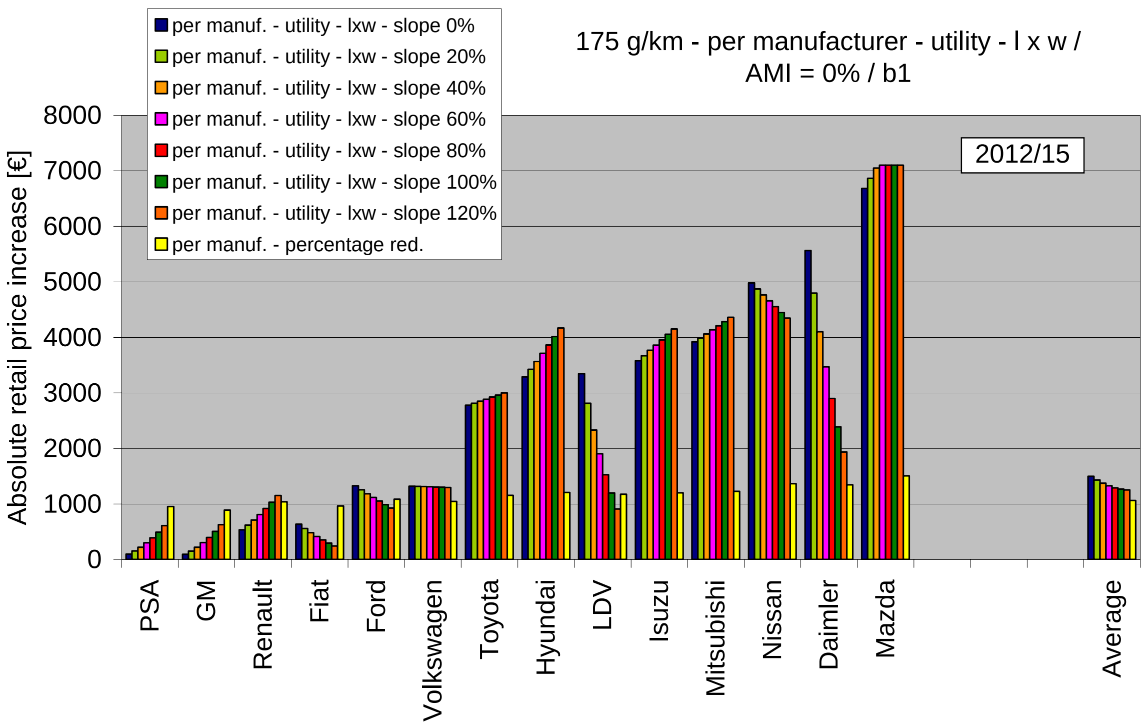


Figure 14 **Estimate of relative price increase for option 3 with AMI = 0.0% p.a.** (Source: Supporting study on light commercial vehicles)

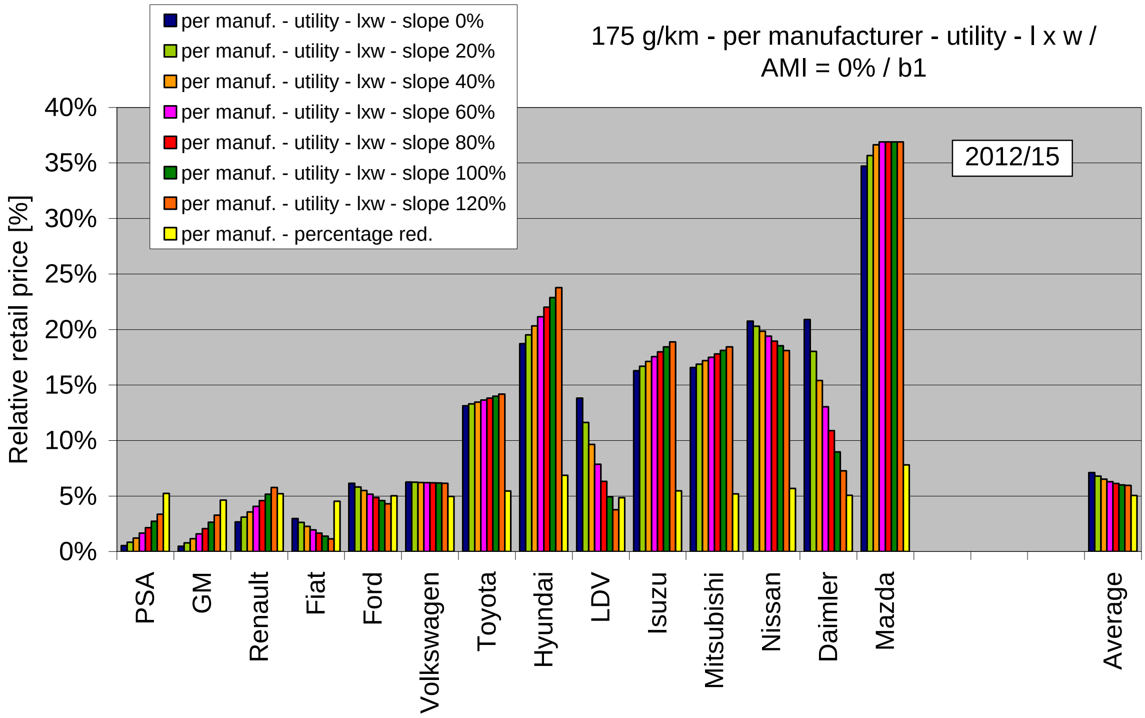



Figure 15 **Estimate of absolute price increase for option 3 with AMI = 1,5% (Source:** Supporting study on light commercial vehicles)

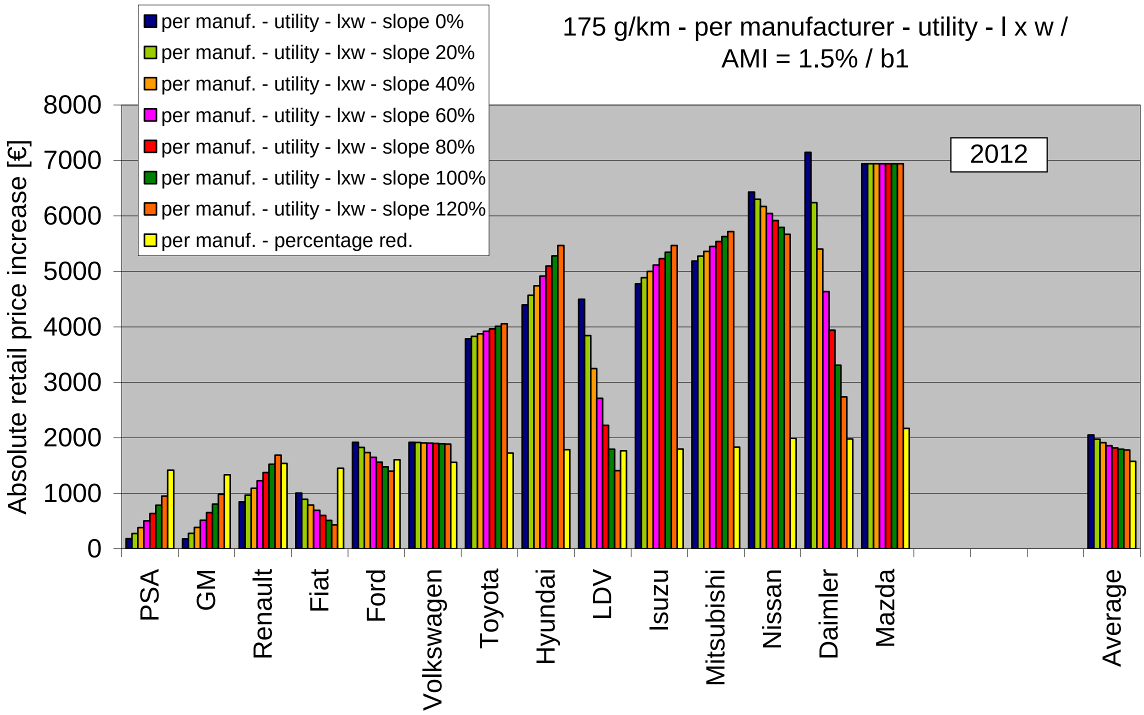


Figure 16 **Estimate of relative price increase for option 3 with AMI = 1,5% p.a.** (Source: Supporting study on light commercial vehicles)

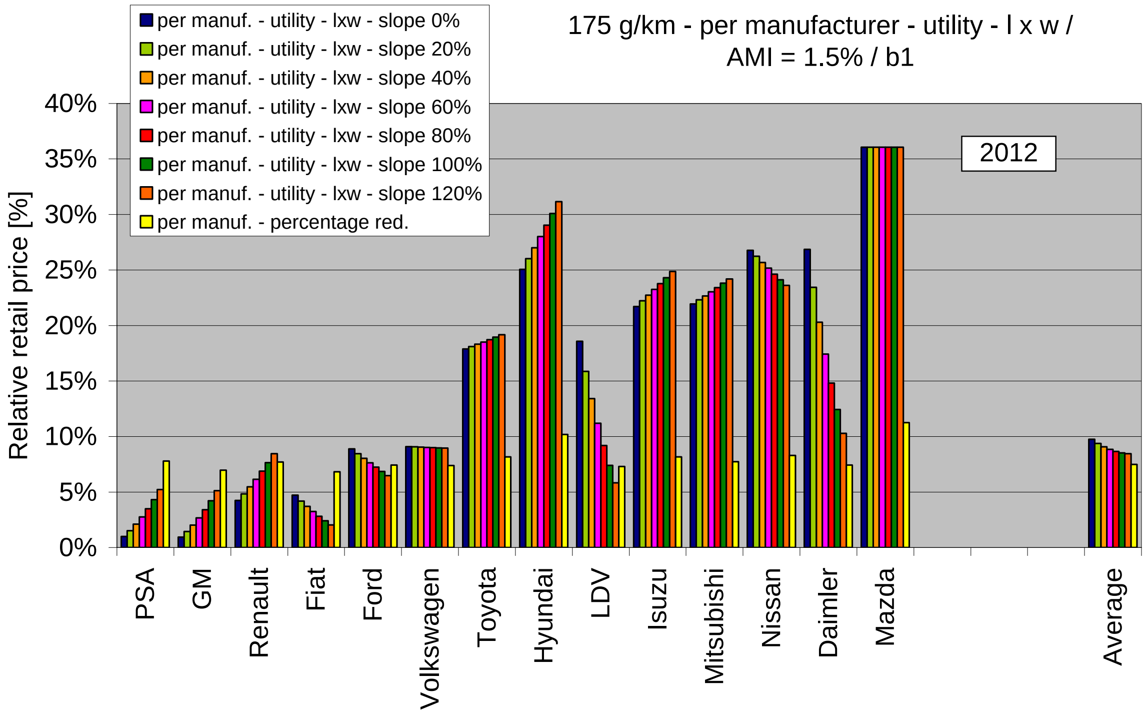



Figure 17 **Estimate of absolute price increase for option 4 with AMI = 1,5% p.a.** (Source: Supporting study on light commercial vehicles)

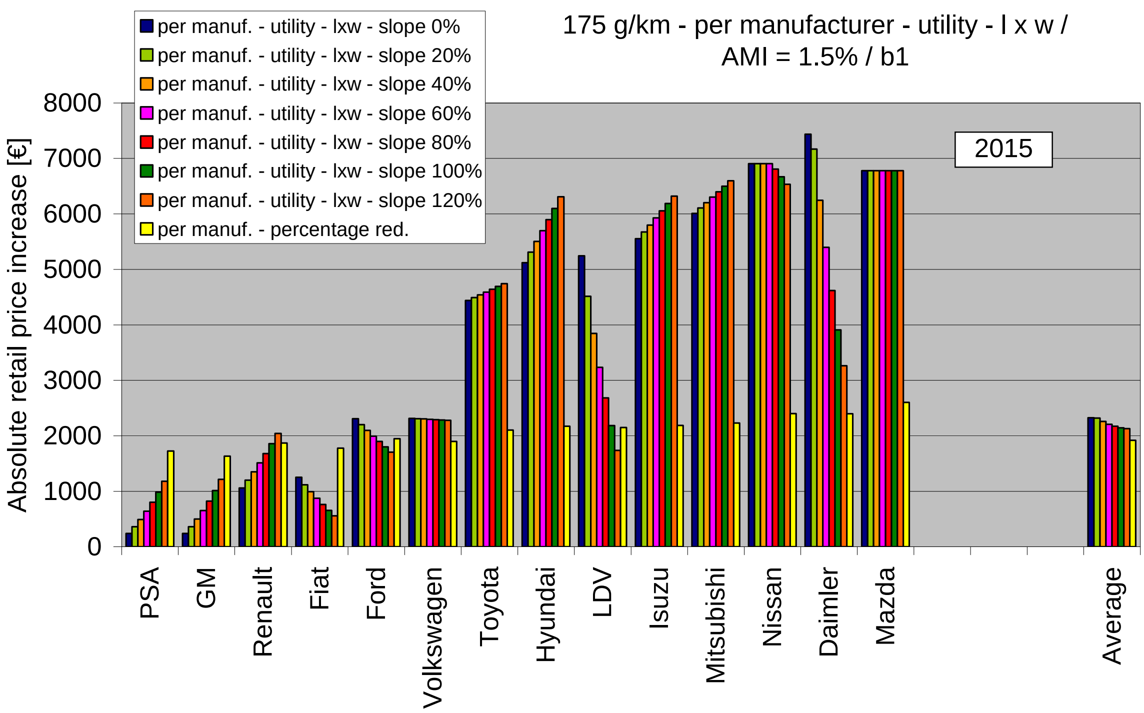


Figure 18 **Estimate of relative price increase for option 4 with AMI = 1,5% p.a**. (Source: Supporting study on light commercial vehicles)

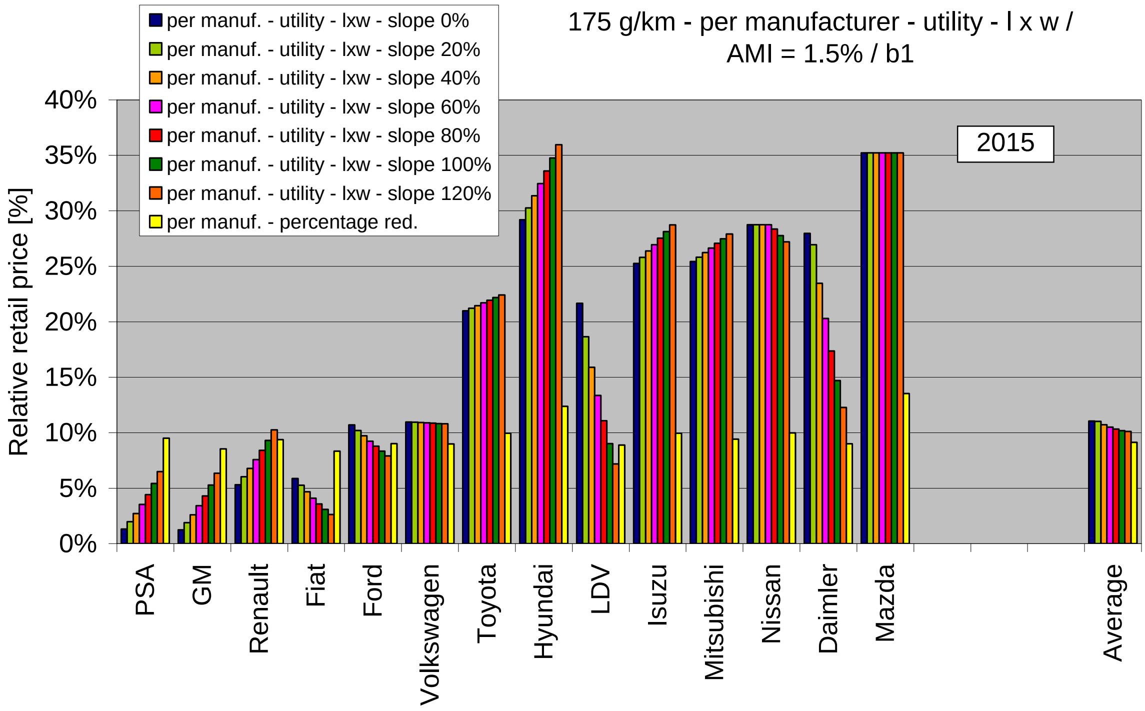


Figure 19 **Relative retail price increase – scenarios for the long-term target** (Source: Supporting study on light commercial vehicles)

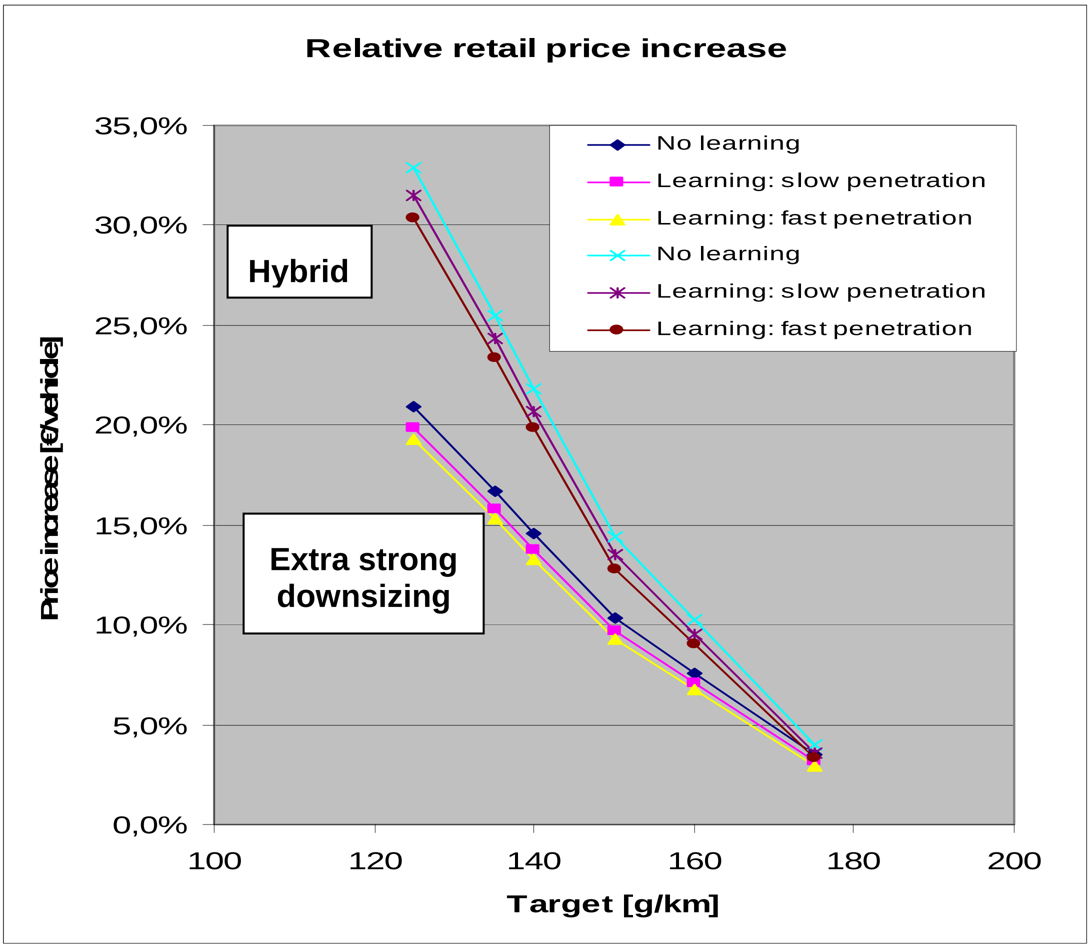


Table 5 **Summary of the average costs for reaching the different 2020 target levels in the 6 different scenario variants - all relative to 2007** (Source: calculations based on supporting study)

| | Absolute retail price increase relative to 2007 [€/vehicle] | | | | | |
|---|---|---|---|---|---|---|
| | Extra strong downsizing | | | Hybrid options | | |
| Target | No learning | Learning: slow penetration | Learning: fast penetration | No learning | Learning: slow penetration | Learning: fast penetration |
| 160[(a)] | 1599 | 1499 | 1420 | 2155 | 2004 | 1899 |
| 150 | 2175 | 2049 | 1954 | 3030 | 2840 | 2703 |
| 140[(a)] | 3066 | 2907 | 2797 | 4584 | 4354 | 4179 |
| 135[(a)] | 3512 | 3335 | 3219 | 5360 | 5111 | 4917 |
| 125 | 4403 | 4193 | 4062 | 6914 | 6625 | 6393 |

| | Relative retail price increase relative to 2007 [€/vehicle] | | | | | |
|---|---|---|---|---|---|---|
| | Extra strong downsizing | | | Hybrid options | | |
| Target | No learning | Learning: slow penetration | Learning: fast penetration | No learning | Learning: slow penetration | Learning: fast penetration |
| 160[(a)] | 7,6% | 7,1% | 6,8% | 10,2% | 9,5% | 9,0% |
| 150 | 10.3% | 9.7% | 9.3% | 14.4% | 13.5% | 12.8% |
| 140[(a)] | 14,5% | 13,8% | 13,3% | 21,8% | 20,7% | 19,8% |
| 135[(a)] | 16,7% | 15,8% | 15,3% | 25,5% | 24,3% | 23,4% |
| 125 | 20.9% | 19.9% | 19.3% | 32.9% | 31.5% | 30.4% |

[(a)] Values are obtained by linear interpolation which causes a certain overestimate.

Table 6 **(1) Summary of fuel savings and net costs/benefits for the different 2020 target levels**[b] **at 4% discount rate** (Source: calculations based on supporting study)

| | | Total user costs and benefits (discount rate of 4%) [€/vehicle] | | | | | |
|---|---|---|---|---|---|---|---|
| | | Extra strong downsizing | | | Hybrid options | | |
| Target | Discounted fuel saving | No learning | Learning: slow penetration | Learning: fast penetration | No learning | Learning: slow penetration | Learning: fast penetration |
| 160[a] | 3477 | -1878 | -1978 | -2057 | -1322 | -1473 | -1578 |
| 150 | 4286 | -2110 | -2237 | -2331 | -1256 | -1445 | -1583 |
| 140[a] | 5094 | -2028 | -2188 | -2297 | -511 | -740 | -915 |
| 135[a] | 5499 | -1987 | -2163 | -2279 | -138 | -387 | -582 |
| 125 | 6307 | -1904 | -2114 | -2245 | 607 | 318 | 86 |

[b] Taking into account purchase price increase and fuel savings; assuming a fuel price of €1 per litre including taxes and a mileage of 300 000km over a 15 year lifetime. Negative numbers are savings.

**(2) Summary of fuel savings and net costs/benefits for the different 2020 target levels**[b] **at 10% discount rate** (Source: calculations based on supporting study)

| | | Total user costs and benefits (discount rate of 12%) [€/vehicle] | | | | | |
|---|---|---|---|---|---|---|---|
| | | Extra strong downsizing | | | Hybrid options | | |
| Target | Discounted fuel saving | No learning | Learning: slow penetration | Learning: fast penetration | No learning | Learning: slow penetration | Learning: fast penetration |
| 160[a] | 2379 | -779 | -880 | -958 | -224 | -375 | -479 |
| 150 | 2932 | -757 | -883 | -977 | 98 | -92 | -229 |
| 140[a] | 3485 | -419 | -578 | -687 | 1099 | 869 | 694 |
| 135[a] | 3762 | -250 | -426 | -542 | 1599 | 1350 | 1155 |
| 125 | 4315 | 88 | -121 | -252 | 2599 | 2311 | 2079 |

[b] Taking into account purchase price increase and fuel savings; assuming a fuel price of €1 per litre including taxes and a mileage of 300 000km over a 15 year lifetime. Negative numbers are savings.

## ANNEX V DESCRIPTION OF THE METHODOLOGY

- Estimates of costs and distributional impacts for vehicle manufacturers

An ex-ante model developed by consultants analysed the distributional effects and costs among manufacturers. The cost model used in this supporting study was based on cost curves representing different combinations of powertrain technologies. The methodology for defining cost curves was based on information collected from the industry on the relative $CO_2$ reduction potential (% reduction) and additional costs (€) for a large number of technological $CO_2$ reduction options[41] that can be applied to baseline N1 vehicles. For each vehicle segment (defined by vehicle class and fuel) a number of technology packages was assembled, containing a combination of various technology options for which overall reduction potential and costs were estimated. The overall relative $CO_2$ reductions were then applied to the average $CO_2$ emission per segment of the 2002 baseline vehicles. This methodology was also used in the supporting study on LCVs however, the cost curves were updated to mirror more recent reference data.[42]

The starting point for the determination of cost curves were the 2002_reference vehicles, however the database used in the supportive study on LCVs provided information for 2007 only. To obtain 2002 reference data that would be consistent with the 2007 averages determined from the database, assumptions on the development of $CO_2$ emissions in LCVs between 2002 and 2007 were made. Previous studies (see Annex I) have suggested that in the period from 2002 to 2006 manufacturers have applied $CO_2$ reduction technologies to vehicles. In addition manufacturers have applied some efficiency improvements to $M_1$ vehicles in the context of the voluntary agreements covering these vehicles. As these agreements do not apply to LCVs it has been assumed that the amount of $CO_2$ reduction measures applied in LCVs is smaller than in cars. The total reduction was set at 3.5% for petrol vehicles and 2.5% for diesel vehicles over the complete 2002-2007 period.

In order to properly determine the maximum reduction potential available in the various LCV segments, the number of technology packages used to construct the cost curves has been extended from 4 to 5, as compared with the previous analysis. The updated cost curves are provided in the figure 1.

It is important to note that the analysis for the range of dates considered for the first step of emission reductions is based on the static cost curves. Possible effects of developments in technology, learning effects and costs are ignored for this short term horizon. The only dynamic element in this short-term analysis is the autonomous mass increase (AMI).

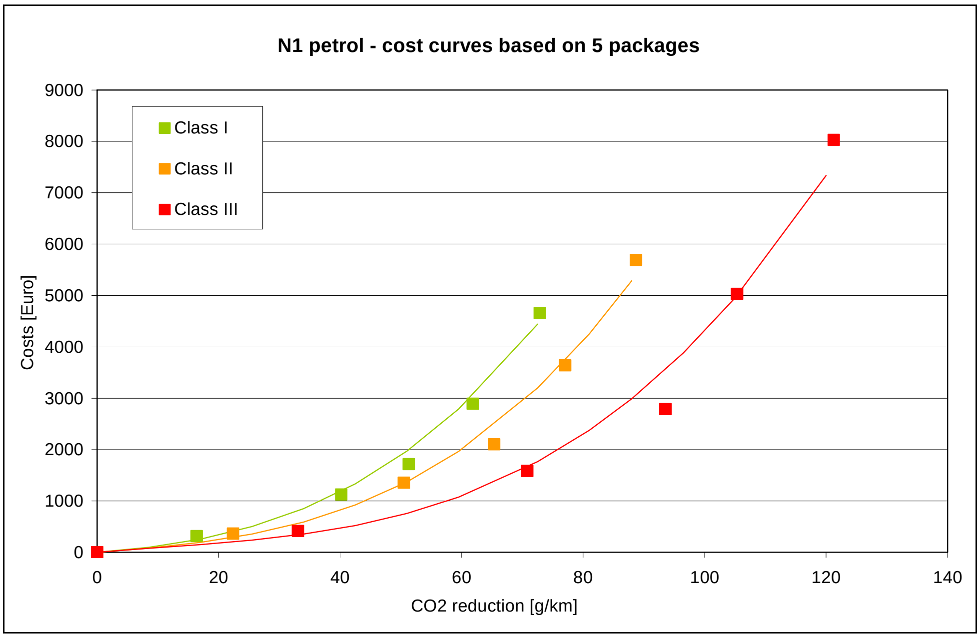
- For certain scenarios for the long-term target a linear approximation was performed. This is methodologically justified because the targets for which the intra/extrapolation was done are sufficiently close to the basis points (i.e. the target of 140 g/km in 2020

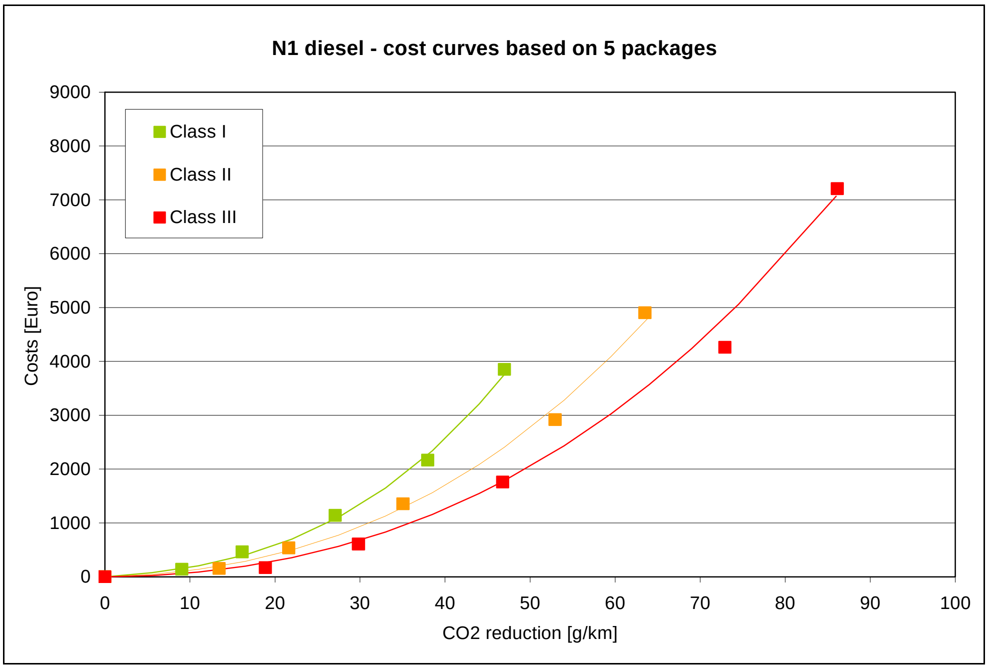
41 The methodology was developed in the Supportive study carried out in 2006 [TNO 2006] Technological $CO_2$ reduction options were presented in the Tables 8.2 and 8.3 of this study.

42 For more information see the study: Assessment of options for $CO_2$ legislation for LCVs, Chapter 4

was estimated on the basis of modelled scenarios for targets of 150 g/km and 125 g/km, whereas 160 g/km on the basis of 175 g/km and 150 g/km). In addition, 13 scenario runs in total were performed for short and long-term targets which allowed for a sufficient understanding of characteristics of the model.

Figure 20 **Estimated cost curves for emissions reductions from light commercial vehicles** (Source: Supporting study on light commercial vehicles)




In the ex-ante assessment, no significant variation to overall segmentation of the car market is expected.

- Dynamic modelling of economic and environmental impacts

In addition to the modelling of cost impacts at manufacturer and consumer level, TREMOVE runs have been carried out. TREMOVE is a transport and emissions simulation model developed for the European Commission. It is designed to study the effects of different transport and environment policies on the emissions of the transport sector. The model estimates the changes in transport demand, modal split, vehicle fleets, welfare level and emissions of air pollutants of different policy scenarios. The scenarios for the present IA report have been modelled using the latest version of the model TREMOVE 2.7, which covers all EU-27 Member States over the period 1995-2030 with yearly intervals.

The details on the model structure and the baseline can be found in the final report of the service contract for the development of the model on the website http://www.tremove.org/. For the present report a variant of the 2.7 baseline scenario has been used. New fuel prices for the EU countries, as they are known in 2008 were incorporated in this case. Also fuel taxes were updated according to the situation in 2008. This mainly involved updating values for non Euro-zone countries as their exchange rate to Euro have changed and thus TREMOVE values which are in Euros of year 2000 had to be updated.

# ANNEX VI: ECONOMIC IMPACTS

Figure 21 **$CO_2$ abatement costs for N-type vehicles (for AMI = 0.0% p.a.) as function of the target level and the oil price for a mass-based limit function with slope 60%** (Source: supporting study)

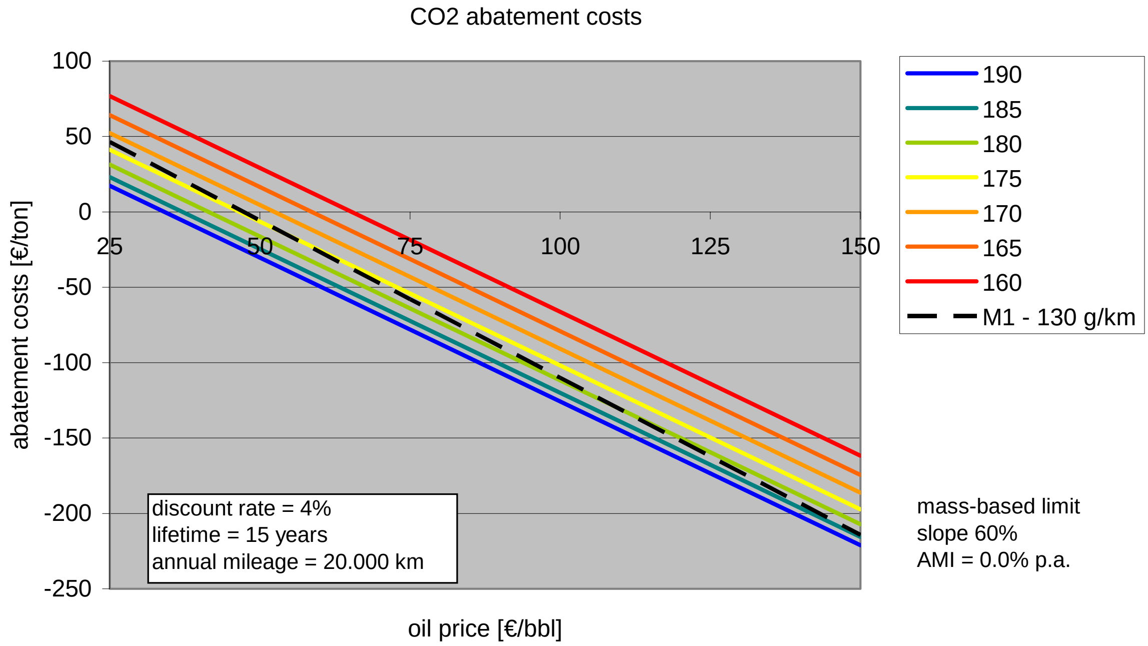



**Figure 22** $CO_2$ abatement costs for N1 vehicles (for AMI = 0.0% p.a.) as function of the target level and the oil price for a mass-based limit function with slope 100% (Source: supporting study)

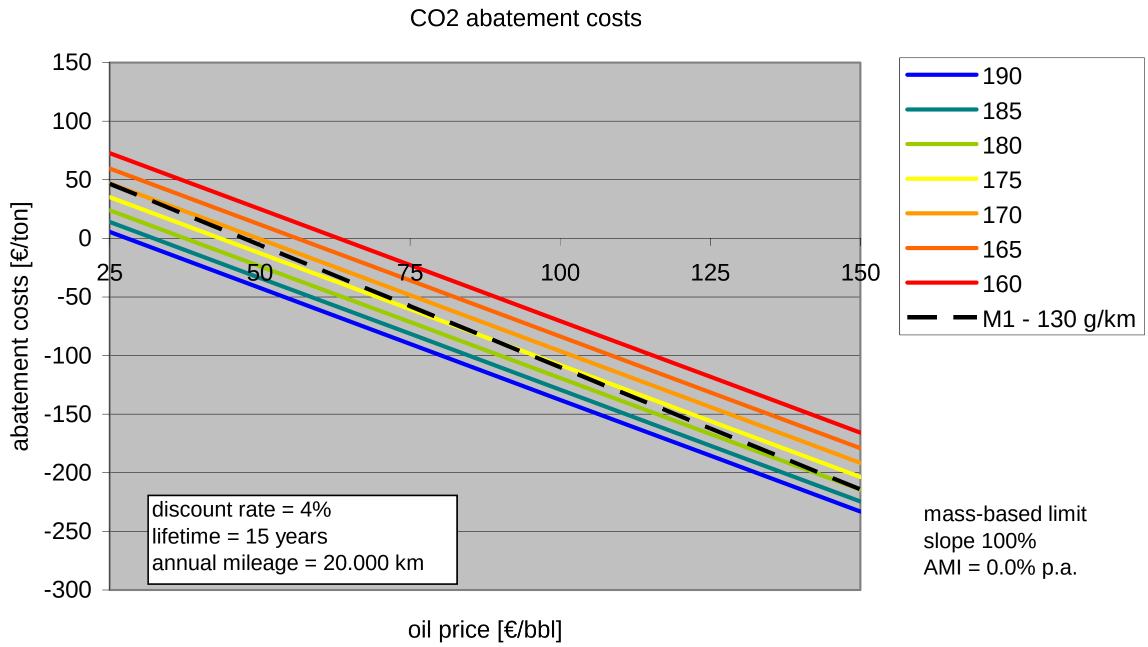


Table 7 **Fuel savings for options 1,2 and long-term targets in 2020 and 2030** (Source: TREMOVE)

| scenario | | slope | cap | fuel price[43] | Fuel savings | | Fuel savings share in total road transport fuel consumption | |
|---|---|---|---|---|---|---|---|---|
| short-term target and start date | 2020 target | | | | 2020 [Mt] | 2030 [Mt] | slope | cap |
| 175 g/km (**2012**) | n/a | 60% | no | basecase | 3.15 | 4.66 | 0.92% | 1.22% |
| | | 100% | no | basecase | 3.28 | 4.89 | 0.96% | 1.28% |
| | | 60% | 50% | basecase | 2.85 | 4.15 | 0.83% | 1.09% |
| | | 100% | 50% | basecase | 2.85 | 4.15 | 0.83% | 1.09% |
| 175 g/km (**2015**) | n/a | 60% | no | basecase | 2.86 | 4.55 | 0.84% | 1.19% |
| 175 g/km (**2012**) | n/a | 60% | no | half | 3.24 | 4.84 | 0.95% | 1.26% |
| | | 100% | no | half | 3.38 | 5.07 | 0.99% | 1.32% |
| | | 60% | no | double | 2.98 | 4.36 | 0.87% | 1.15% |
| | | 100% | no | double | 3.11 | 4.59 | 0.91% | 1.21% |
| 175g/km (**2013**) | **135**g/km | 100% | 50% | basecase | 4.54 | 8.85 | 1.33% | 2.32% |
| 175g/km (**2014**) | **140**g/km | 100% | 50% | basecase | 4.07 | 8.19 | 1.19% | 2.15% |
| 175g/km (**2015**) | **160**g/km | 100% | 50% | basecase | 3.18 | 5.99 | 0.93% | 1.57% |
| 175g/km (**2015**) | **150**g/km | 100% | 50% | basecase | 3.49 | 7.02 | 1.02% | 1.84% |
| 175g/km (**2015**) | **140**g/km | 100% | 50% | basecase | 3.80 | 8.06 | 1.11% | 2.11% |
| 175g/km (**2015**) | **135**g/km | 100% | 50% | basecase | 3.96 | 8.57 | 1.16% | 2.25% |
| 175g/km (**2015**) | **125**g/km | 100% | 50% | basecase | 4.27 | 9.60 | 1.25% | 2.52% |
| 175g/km (**2013**) | **135**g/km | 100% | no | basecase | 4.62 | 8.91 | 1.35% | 2.34% |
| 175g/km (**2014**) | **140**g/km | 100% | no | basecase | 4.15 | 8.23 | 1.22% | 2.16% |
| 175g/km (**2015**) | **160**g/km | 100% | no | basecase | 3.26 | 6.02 | 0.95% | 1.58% |
| 175g/km (**2015**) | **150**g/km | 100% | no | basecase | 3.57 | 7.05 | 1.04% | 1.85% |
| 175g/km (**2015**) | **140**g/km | 100% | no | basecase | 3.88 | 8.09 | 1.14% | 2.12% |
| 175g/km (**2015**) | **135**g/km | 100% | no | basecase | 4.04 | 8.61 | 1.18% | 2.26% |
| 175g/km (**2015**) | **125**g/km | 100% | no | basecase | 4.35 | 9.64 | 1.27% | 2.53% |

Note: Shaded scenarios are estimated using linear interpolation/extrapolation.

[43] Fuel prices used in TREMOVE model are country specific and for all countries are expressed in Euro of year 2000. As an example of a baseline, in Germany the assumed fuel price increases between 2000 and 2020 are as follows: pure biodiesel +27%, diesel +26%, ethanol +16%, gasoline +12%, CNG +4% and LPG +17%.

Table 8 **Savings on fuel spending by end-users (incl. all taxes) in 2010-2020 and 2010-2030** (Source: TREMOVE)

| scenario | | slope | cap | fuel price[44] | savings in M€$_{2000}$ | |
|---|---|---|---|---|---|---|
| short-term target | 2020 target | | | | 2010 to 2020 | 2010 to 2030 |
| 175 g/km (**2012**) | n/a | 60% | no | basecase | -15 677 | -41 952 |
| | | 100% | no | basecase | -16 436 | -44 071 |
| | | 60% | 50% | basecase | -14 122 | -37 535 |
| | | 100% | 50% | basecase | -14 155 | -37 611 |
| 175 g/km (**2015**) | n/a | 60% | no | basecase | -12 243 | -37 228 |
| 175 g/km (**2012**) | n/a | 60% | no | half | -13 337 | -33 419 |
| | | 100% | no | half | -14 014 | -35 265 |
| | | 60% | no | double | -20 086 | -58 020 |
| | | 100% | no | double | -21 005 | -60 673 |
| 175g/km (**2013**) | **135**g/km | 100% | 50% | basecase | -15 656 | -60 721 |
| 175g/km (**2014**) | **140**g/km | 100% | 50% | basecase | -13 891 | -55 294 |
| 175g/km (**2015**) | **160**g/km | 100% | 50% | basecase | -11 613 | -42 452 |
| 175g/km (**2015**) | **150**g/km | 100% | 50% | basecase | -11 953 | -47 392 |
| 175g/km (**2015**) | **140**g/km | 100% | 50% | basecase | -12 294 | -52 331 |
| 175g/km (**2015**) | **135**g/km | 100% | 50% | basecase | -12 464 | -54 801 |
| 175g/km (**2015**) | **125**g/km | 100% | 50% | basecase | -12 804 | -59 741 |
| 175g/km(**2013**) | **135**g/km | 100% | no | basecase | -16 250 | -61 748 |
| 175g/km (**2014)** | **140**g/km | 100% | no | basecase | -14 459 | -56 286 |
| 175g/km (**2015**) | **160**g/km | 100% | no | basecase | -12 155 | -43 395 |
| 175g/km (**2015**) | **150**g/km | 100% | no | basecase | -12 496 | -48 345 |
| 175g/km (**2015**) | **140**g/km | 100% | no | basecase | -12 837 | -53 295 |
| 175g/km (**2015**) | **135**g/km | 100% | no | basecase | -13 007 | -55 770 |
| 175g/km (**2015**) | **125**g/km | 100% | no | basecase | -13 349 | -60 721 |

**Note:** Negative number denotes savings, positive additional costs. Saving (costs) in this table are discounted (4% rate) and are expressed in Euros of year 2000.

Table 9 **Effect on new LCV sales in 2020 and 2030** for options 1, 2 and long-term targets (Source: TREMOVE)

| scenario | | slope | cap | fuel price[44] | Total N1 market change [%] from 2005 levels | | Change in vehicle sales | |
|---|---|---|---|---|---|---|---|---|
| short-term target | 2020 target | | | | in 2020 | in 2030 | in 2020 | in 2030 |
| baseline scenario | | | | | +18.7% | +19.2% | | |
| 175g/km (**2012**) | n/a | 60% | no | basecase | +17.4% | +17.6% | -1.16% | -1.34% |
| | | 100% | no | basecase | +17.2% | +17.3% | -1.33% | -1.59% |
| | | 60% | 50% | basecase | +17.8% | +18.1% | -0.83% | -0.87% |
| | | 100% | 50% | basecase | +17.9% | +18.3% | -0.69% | -0.75% |
| 175g/km (**2015**) | n/a | 60% | no | basecase | +17.6% | +17.6% | -0.98% | -1.34% |
| 175g/km (**2013**) | **135**g/km | 100% | 50% | basecase | +18.4% | +16.9% | -0.25% | -1.88% |
| 175g/km (**2014**) | **140**g/km | 100% | 50% | basecase | +18.8% | +17.3% | +0.01% | -1.58% |
| 175g/km (**2015**) | **160**g/km | 100% | 50% | basecase | +19.6% | +18.9% | +0.71% | -0.23% |
| 175g/km (**2015**) | **150**g/km | 100% | 50% | basecase | +19.2% | +18.1% | +0.42% | -0.92% |
| 175g/km (**2015**) | **140**g/km | 100% | 50% | basecase | +18.9% | +17.2% | +0.13% | -1.62% |
| 175g/km (**2015**) | **135**g/km | 100% | 50% | basecase | +18.7% | +16.8% | -0.01% | -1.97% |
| 175g/km (**2015**) | **125**g/km | 100% | 50% | basecase | +18.4% | +16.0% | -0.31% | -2.66% |
| 175g/km (**2013)** | **135**g/km | 100% | no | basecase | +19.6% | +18.7% | +0.70% | -0.37% |
| 175g/km (**2014**) | **140**g/km | 100% | no | basecase | +19.3% | +18.2% | +0.48% | -0.78% |
| 175g/km (**2015**) | **160**g/km | 100% | no | basecase | +19.6% | +19.0% | +0.74% | -0.11% |
| 175g/km (**2015**) | **150**g/km | 100% | no | basecase | +19.2% | +18.2% | +0.42% | -0.84% |
| 175g/km (**2015**) | **140**g/km | 100% | no | basecase | +18.9% | +17.3% | +0.10% | -1.57% |
| 175g/km (**2015**) | **135**g/km | 100% | no | basecase | +18.7% | +16.9% | -0.06% | -1.93% |
| 175g/km (**2015**) | **125**g/km | 100% | no | basecase | +18.3% | +16.0% | -0.38% | -2.66% |

Note: Shaded scenarios are estimated using linear interpolation/extrapolation

Table 10 **Costs to end-users[(a)] in period 2010-2020** (Source: TREMOVE)

| scenario | | slope | cap | fuel price[44] | Additional costs [M€$_{2000}$] | Savings per 1 € invested [€$_{2000}$] |
|---|---|---|---|---|---|---|
| short-term target | 2020 target | | | | | |
| 175g/km (**2013**) | **135**g/km | 100% | 50% | basecase | -4 831 | 1.45 |
| 175g/km (**2014**) | **140**g/km | 100% | 50% | basecase | -4 438 | 1.47 |
| 175g/km (**2015**) | **160**g/km | 100% | 50% | basecase | -4 097 | 1.55 |
| 175g/km (**2015**) | **150**g/km | 100% | 50% | basecase | -4 061 | 1.51 |
| 175g/km (**2015**) | **140**g/km | 100% | 50% | basecase | -4 025 | 1.49 |
| 175g/km (**2015**) | **135**g/km | 100% | 50% | basecase | -4 007 | 1.47 |
| 175g/km (**2015**) | **125**g/km | 100% | 50% | basecase | -3 971 | 1.45 |
| 175g/km(**2013**) | **135**g/km | 100% | no | basecase | -4 658 | 1.40 |
| 175g/km (**2014)** | **140**g/km | 100% | no | basecase | -4 291 | 1.42 |
| 175g/km (**2015**) | **160**g/km | 100% | no | basecase | -3 987 | 1.49 |
| 175g/km (**2015**) | **150**g/km | 100% | no | basecase | -3 943 | 1.46 |
| 175g/km (**2015**) | **140**g/km | 100% | no | basecase | -3 900 | 1.44 |
| 175g/km (**2015**) | **135**g/km | 100% | no | basecase | -3 878 | 1.42 |
| 175g/km (**2015**) | **125**g/km | 100% | no | basecase | -3 834 | 1.40 |

(a) Costs in this table are discounted (4% rate) and are expressed in Euros of year 2000

**Note:** Negative number denotes savings, positive additional costs. Saving (costs) in this table are discounted (4% rate) and are expressed in Euros of year 2000

Table 11 **Costs to end-users[(a)] in period 2010-2030** (Source: TREMOVE)

| scenario | | slope | cap | fuel price[44] | Additional costs [M€2000] | Savings per 1 € invested [€2000] |
|---|---|---|---|---|---|---|
| short-term target | 2020 target | | | | | |
| 175g/km (**2013**) | **135**g/km | 100% | 50% | basecase | -10 442 | 1.21 |
| 175g/km (**2014**) | **140**g/km | 100% | 50% | basecase | -10 519 | 1.23 |
| 175g/km (**2015**) | **160**g/km | 100% | 50% | basecase | -12 232 | 1.40 |
| 175g/km (**2015**) | **150**g/km | 100% | 50% | basecase | -11 138 | 1.31 |
| 175g/km (**2015**) | **140**g/km | 100% | 50% | basecase | -10 044 | 1.24 |
| 175g/km (**2015**) | **135**g/km | 100% | 50% | basecase | -9 497 | 1.21 |
| 175g/km (**2015**) | **125**g/km | 100% | 50% | basecase | -8 403 | 1.16 |
| 175g/km(**2013**) | **135**g/km | 100% | no | basecase | -9 699 | 1.19 |
| 175g/km (**2014)** | **140**g/km | 100% | no | basecase | -10 037 | 1.22 |
| 175g/km (**2015**) | **160**g/km | 100% | no | basecase | -12 199 | 1.39 |
| 175g/km (**2015**) | **150**g/km | 100% | no | basecase | -10 978 | 1.29 |
| 175g/km (**2015**) | **140**g/km | 100% | no | basecase | -9 758 | 1.22 |
| 175g/km (**2015**) | **135**g/km | 100% | no | basecase | -9 148 | 1.20 |
| 175g/km (**2015**) | **125**g/km | 100% | no | basecase | -7 927 | 1.15 |

(a) Costs in this table are discounted (4% rate) and are expressed in Euros of year 2000

**Note:** Negative number denotes savings, positive additional costs. Saving (costs) in this table are discounted (4% rate) and are expressed in Euros of year 2000

Table 12 **Results of price sensitivity runs**

| **175 g$CO_2$/km** (no cap) | | | WtW GHG abatement 2010 >> 2020 [Mt $CO_2$ eq.] | Abatement costs [€/t $CO_2$ eq.] |
|---|---|---|---|---|
| 2012 | 60% slope | base case | 73 | -12.5 |
| | 100% slope | base case | 77 | -9.4 |
| | 60% slope | half | 75 | 12.9 |
| | 100% slope | half | 78 | 15.7 |
| | 60% slope | double | 71 | -62.9 |
| | 100% slope | double | 74 | -59.6 |

Table 13 **Comparison of marginal costs per manufacturer for a 175 g/km target in 2012 / 2015 with different slope values for N-type vehicles (assumed AMI = 0.0% p.a.) with the marginal costs per manufacturer for meeting the 130 g/km target based on a 60% slope in M1 category.** (Source: supporting study on LCVs)

| | N-type vehicles | | | | M1 vehicles | |
|---|---|---|---|---|---|---|
| | target | 175 | | | target | 130 |
| | slope | 60% | 80% | 100% | slope | 60% |
| | N sales | marginal costs | | | M1 sales | marginal costs |
| manufacturer | [#] | [€/g/km] | [€/g/km] | [€/g/km] | [#] | [€/g/km] |
| ACEA | | | | | | |
| Daimler | 156700 | 124 | 108 | 94 | 913774 | 93 |
| Fiat | 279541 | 47 | 45 | 44 | 1115536 | 48 |
| Ford | 235507 | 76 | 76 | 75 | 1581958 | 65 |
| GM | 128245 | 37 | 43 | 49 | 1512436 | 64 |
| PSA | 317266 | 47 | 56 | 66 | 1998004 | 47 |
| Renault | 233872 | 70 | 78 | 86 | 1308043 | 51 |
| Volkswagen | 190664 | 69 | 66 | 63 | 2913713 | 62 |
| JAMA | | | | | | |
| Isuzu | 11549 | 96 | 85 | 74 | | |
| Mazda | 6723 | 190 | 186 | 181 | 243231 | 94 |
| Mitsubishi | 34675 | 106 | 96 | 85 | 107345 | 78 |
| Nissan | 82163 | 132 | 120 | 109 | 290743 | 63 |
| Toyota | 53239 | 95 | 88 | 82 | 820904 | 53 |
| KAMA | | | | | | |
| Hyundai | 9054 | 103 | 94 | 86 | 490295 | 67 |
| LDV | 7897 | 99 | 90 | 81 | | |

## ANNEX VII: SOCIAL EQUITY AND DISTRIBUTIONAL EFFECTS WITHIN THE FLEET

Table 14 **Relative retail price increase (%) per segment for alternative policy options** (Source: Supporting study on light commercial vehicles)

| | Diesel class I | Diesel class II | Diesel class III | Sales-weighted average |
|---|---|---|---|---|
| **Options 1 & 2 : 175 target in 2012/2015; utility parameter – mass; AMI = 0** | | | | |
| Slope 60% | 3.6% | 5.0% | 6.3% | 5.8% |
| Slope 80% | 4.4% | 5.1% | 5.8% | 5.5% |
| Slope 100% | 5.2% | 5.2% | 5.4% | 5.4% |
| **Option 1: 175 target in 2012; utility parameter – mass; AMI = 1.5%** | | | | |
| Slope 60% | 5.2% | 7.4% | 8.9% | 8.3% |
| Slope 80% | 6.2% | 7.5% | 8.3% | 8.0% |
| Slope 100% | 7.3% | 7.7% | 7.9% | 7.9% |
| **Option 2: 175 target in 2015; utility parameter – mass; AMI = 1.5 %** | | | | |
| Slope 60% | 6.2% | 9.0% | 10.7% | 9.9% |
| Slope 80% | 7.3% | 9.2% | 10.0% | 9.6% |
| Slope 100% | 8.6% | 9.4% | 9.5% | 9.5% |
| **Options 3 & 4 : 175 target in 2012/2015; utility parameter – pan area; AMI = 0** | | | | |
| Slope 60% | 3.0% | 5.0% | 7.2% | 6.3% |
| Slope 80% | 3.4% | 5.0% | 6.9% | 6.1% |
| Slope 100% | 3.9% | 5.0% | 6.6% | 6.0% |
| **Option 3: 175 target in 2012; utility parameter – pan area; AMI = 1.5%** | | | | |
| Slope 60% | 4.3% | 7.3% | 9.9% | 8.8% |
| Slope 80% | 4.8% | 7.4% | 9.6% | 8.7% |
| Slope 100% | 5.5% | 7.4% | 9.3% | 8.5% |
| **Option 4: 175 target in 2015; utility parameter – pan area; AMI = 1.5 %** | | | | |
| Slope 60% | 5.1% | 8.7% | 11.8% | 10.5% |
| Slope 80% | 5.8% | 8.8% | 11.4% | 10.3% |
| Slope 100% | 6.5% | 8.9% | 11.1% | 10.2% |

## ANNEX VIII: ENVIRONMENTAL IMPACTS

Table 15 **Well-to-wheel GHG reductions in year 2020 and 2030 for options 1, 2 and long-term targets** (Source: TREMOVE)

| scenario | | slope | cap | fuel price44 | GHG abatement [Mt CO2 eq.] | Contribution to the Effort Sharing Decision | GHG abatement [Mt CO2 eq.] |
|---|---|---|---|---|---|---|---|
| short-term target and start date | 2020 target | | | | **2020** | | **2030** |
| 175 g/km (**2012**) | n/a | 60% | no | basecase | 11.4 | 4.2% | 16.9 |
| | | 100% | no | basecase | 11.9 | 4.4% | 17.7 |
| | | 60% | 50% | basecase | 10.3 | 3.8% | 15.0 |
| | | 100% | 50% | basecase | 10.3 | 3.8% | 15.0 |
| 175 g/km (**2015**) | n/a | 60% | no | basecase | 10.4 | 3.9% | 16.5 |
| 175 g/km (**2012**) | n/a | 60% | no | half | 11.7 | 4.4% | 17.5 |
| | | 100% | no | half | 12.2 | 4.6% | 18.3 |
| | | 60% | no | double | 10.8 | 4.0% | 15.8 |
| | | 100% | no | double | 11.2 | 4.2% | 16.6 |
| 175g/km (**2013**) | **135**g/km | 100% | 50% | basecase | 16.2 | 6.0% | 32.1 |
| 175g/km (**2014**) | **140**g/km | 100% | 50% | basecase | 14.7 | 5.5% | 29.6 |
| 175g/km (**2015**) | **160**g/km | 100% | 50% | basecase | 11.5 | 4.3% | 21.7 |
| 175g/km (**2015**) | **150**g/km | 100% | 50% | basecase | 12.6 | 4.7% | 25.4 |
| 175g/km (**2015**) | **140**g/km | 100% | 50% | basecase | 13.8 | 5.1% | 29.1 |
| 175g/km (**2015**) | **135**g/km | 100% | 50% | basecase | 14.3 | 5.3% | 31.0 |
| 175g/km (**2015**) | **125**g/km | 100% | 50% | basecase | 15.4 | 5.8% | 34.8 |
| 175g/km (**2013**) | **135**g/km | 100% | no | basecase | 16.5 | 6.1% | 32.2 |
| 175g/km (**2014)** | **140**g/km | 100% | no | basecase | 15.0 | 5.6% | 29.8 |
| 175g/km (**2015**) | **160**g/km | 100% | no | basecase | 11.8 | 4.4% | 21.8 |
| 175g/km (**2015**) | **150**g/km | 100% | no | basecase | 12.9 | 4.8% | 25.5 |
| 175g/km (**2015**) | **140**g/km | 100% | no | basecase | 14.1 | 5.2% | 29.3 |
| 175g/km (**2015**) | **135**g/km | 100% | no | basecase | 14.6 | 5.4% | 31.1 |
| 175g/km (**2015**) | **125**g/km | 100% | no | basecase | 15.7 | 5.9% | 34.9 |

Note: Shaded scenarios are estimated using linear interpolation/extrapolation

Table 16 **Well-to-wheel cumulative GHG reductions in the period from 2010 to 2020 and 2010 to 2030 for options 1,2 and long-term targets** (Source: TREMOVE)

| scenario | | slope | cap | fuel price44 | GHG abatement [Mt $CO_2$ eq.] | GHG abatement [Mt $CO_2$ eq.] |
|---|---|---|---|---|---|---|
| short-term target and start date | 2020 target | | | | 2010 >> 2020 | 2010 >> 2030 |
| 175 g/km (**2012**) | n/a | 60% | no | basecase | 73 | 221 |
| | | 100% | no | basecase | 77 | 231 |
| | | 60% | 50% | basecase | 67 | 199 |
| | | 100% | 50% | basecase | 67 | 199 |
| 175 g/km (**2015**) | n/a | 60% | no | basecase | 60 | 201 |
| 175 g/km (**2012**) | n/a | 60% | no | half | 75 | 228 |
| | | 100% | no | half | 78 | 238 |
| | | 60% | no | double | 71 | 209 |
| | | 100% | no | double | 74 | 219 |
| 175g/km (**2013**) | **135**g/km | 100% | 50% | basecase | 81.6 | 342 |
| 175g/km (**2014**) | **140**g/km | 100% | 50% | basecase | 71.7 | 311 |
| 175g/km (**2015**) | **160**g/km | 100% | 50% | basecase | 59.1 | 237 |
| 175g/km (**2015**) | **150**g/km | 100% | 50% | basecase | 61.7 | 267 |
| 175g/km (**2015**) | **140**g/km | 100% | 50% | basecase | 64.3 | 297 |
| 175g/km (**2015**) | **135**g/km | 100% | 50% | basecase | 65.6 | 312 |
| 175g/km (**2015**) | **125**g/km | 100% | 50% | basecase | 68.2 | 342 |
| 175g/km (**2013**) | **135**g/km | 100% | no | basecase | 84.1 | 347 |
| 175g/km (**2014**) | **140**g/km | 100% | no | basecase | 74.1 | 316 |
| 175g/km (**2015**) | **160**g/km | 100% | no | basecase | 61.4 | 241 |
| 175g/km (**2015**) | **150**g/km | 100% | no | basecase | 64.0 | 271 |
| 175g/km (**2015**) | **140**g/km | 100% | no | basecase | 66.6 | 302 |
| 175g/km (**2015**) | **135**g/km | 100% | no | basecase | 67.9 | 317 |
| 175g/km (**2015**) | **125**g/km | 100% | no | basecase | 70.5 | 347 |

Note: Shaded scenarios are estimated using linear interpolation/extrapolation

Table 17 **Cumulative GHG abatement costs in 2010 to 2020 and 2010 to 2030 for options 1, 2 and long-term targets** (Source: TREMOVE)

| scenario | | slope | cap | fuel price44 | GHG abatement costs €/$tCO_2$ in €[2000] | |
|---|---|---|---|---|---|---|
| short-term target and start date | 2020 target | | | | 2010 >> 2020 | 2010 >> 2030 |
| 175 g/km(**2012**) | n/a | 60% | no | basecase | -13.5 | -9.3 |
| | | 100% | no | basecase | -10.2 | -5.4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 60% | 50% | basecase | -20.2 | -17.2 |
| | | 100% | 50% | basecase | -23.2 | -19.9 |
| 175 g/km(**2015**) | n/a | 60% | no | basecase | -13.5 | -9.8 |
| 175 g/km(**2012**) | n/a | 60% | no | half | 13.9 | 24.2 |
| | | 100% | no | half | 17.0 | 27.8 |
| | | 60% | no | double | -68.1 | -78.1 |
| | | 100% | no | double | -64.4 | -73.2 |
| 175g/km (**2013**) | **135**g/km | 100% | 50% | basecase | -33.4 | -23.9 |
| 175g/km (**2014**) | **140**g/km | 100% | 50% | basecase | -34.7 | -25.5 |
| 175g/km (**2015**) | **160**g/km | 100% | 50% | basecase | -38.9 | -34.9 |
| 175g/km (**2015**) | **150**g/km | 100% | 50% | basecase | -36.9 | -29.6 |
| 175g/km (**2015**) | **140**g/km | 100% | 50% | basecase | -35.1 | -25.4 |
| 175g/km (**2015**) | **135**g/km | 100% | 50% | basecase | -34.2 | -23.7 |
| 175g/km (**2015**) | **125**g/km | 100% | 50% | basecase | -32.6 | -20.6 |
| 175g/km (**2013**) | **135**g/km | 100% | no | basecase | -31.3 | -22.4 |
| 175g/km (**2014)** | **140**g/km | 100% | no | basecase | -32.4 | -24.4 |
| 175g/km (**2015**) | **160**g/km | 100% | no | basecase | -36.3 | -34.2 |
| 175g/km (**2015**) | **150**g/km | 100% | no | basecase | -34.4 | -28.9 |
| 175g/km (**2015**) | **140**g/km | 100% | no | basecase | -32.7 | -24.6 |
| 175g/km (**2015**) | **135**g/km | 100% | no | basecase | -31.9 | -22.8 |
| 175g/km (**2015**) | **125**g/km | 100% | no | basecase | -30.4 | -19.6 |

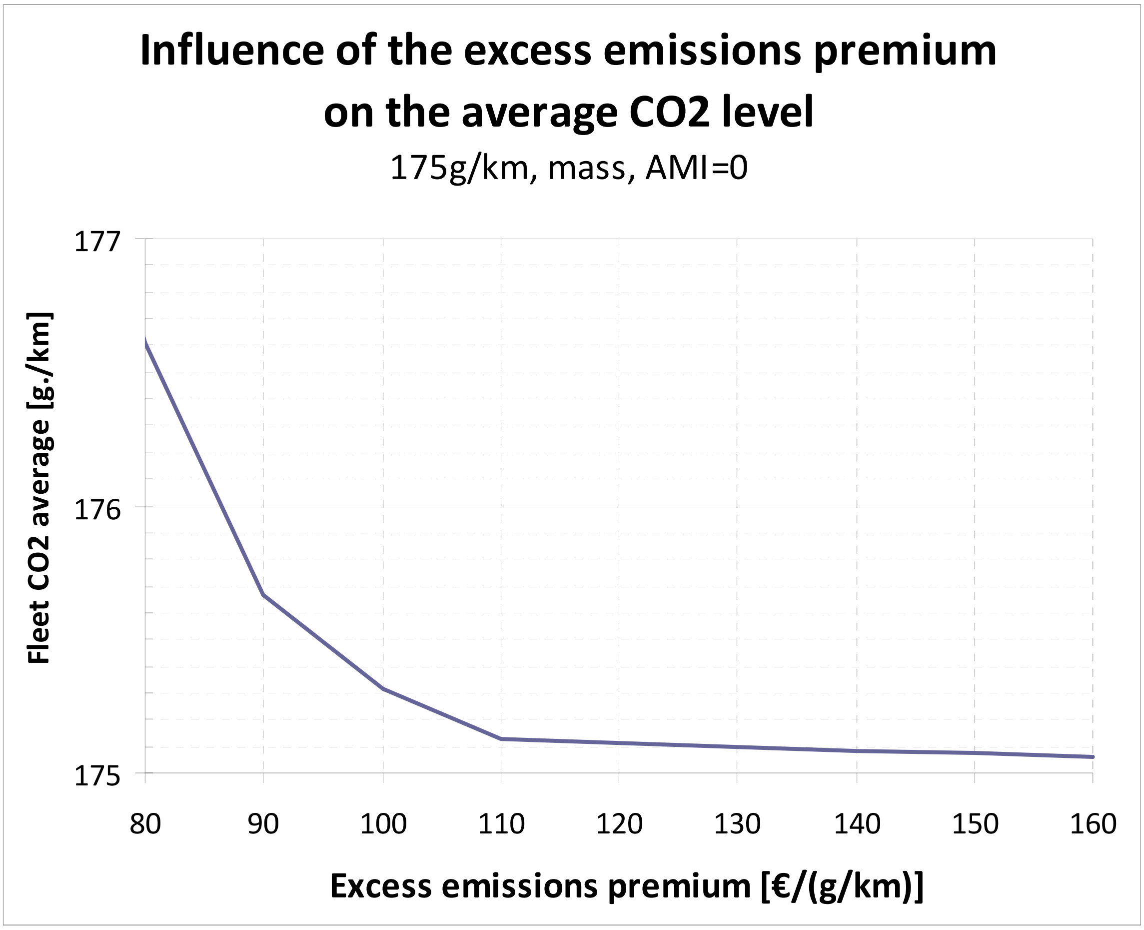
Note: Shaded scenarios are estimated using linear interpolation/extrapolation.

Table 18 **Reduction of emissions of other pollutants for modelled scenarios** (Source TREMOVE)

| scenario | | slope | cap | fuel price44 | well-to-wheel changes from the baseline scenario in year **2020** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| short-term target and start date | 2020 target | | | | PM | $SO_2$ | VOC | $NO_X$ | TOFP |
| 175g (**2014**) | **140**g/km | 100 % | 50% | basecase | -0.63% | -1.13% | -0.47% | -0.36% | -0.35% |
| 175g (**2015**) | **150**g/km | 100 % | 50% | basecase | -0.54% | -0.97% | -0.41% | -0.31% | -0.30% |
| 175g (**2015**) | **125**g/km | 100 % | 50% | basecase | -0.66% | -1.19% | -0.50% | -0.38% | -0.37% |
| 175g (**2014**) | **140**g/km | 100 % | no | basecase | -0.65% | -1.16% | -0.49% | -0.37% | -0.36% |
| 175g (**2015**) | **150**g/km | 100 % | no | basecase | -0.56% | -1.00% | -0.42% | -0.31% | -0.31% |
| 175g (**2015**) | **125**g/km | 100 % | no | basecase | -0.68% | -1.22% | -0.51% | -0.38% | -0.37% |

| scenario | | slope | cap | fuel price44 | well-to-wheel changes from the baseline scenario in year **2030** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| short-term target and start date | 2020 target | | | | PM | $SO_2$ | VOC | $NO_X$ | TOFP |
| 175g (**2014**) | **140**g/km | 100 % | 50% | basecase | -1.33% | -2.07% | -1.16% | -0.82% | -0.83% |
| 175g (**2015**) | **150**g/km | 100 % | 50% | basecase | -1.13% | -1.78% | -0.99% | -0.70% | -0.70% |
| 175g (**2015**) | **125**g/km | 100 % | 50% | basecase | -1.57% | -2.43% | -1.38% | -0.97% | -0.98% |
| 175g (**2014**) | **140**g/km | 100 % | no | basecase | -1.34% | -2.09% | -1.17% | -0.82% | -0.83% |
| 175g (**2015**) | **150**g/km | 100 % | no | basecase | -1.14% | -1.80% | -1.00% | -0.70% | -0.71% |
| 175g (**2015**) | **125**g/km | 100 % | no | basecase | -1.57% | -2.44% | -1.38% | -0.97% | -0.99% |

Figure 23 **Influence of the excess emissions premium on the average $CO_2$ from LCVs** (Source: technical compliance costs from supporting study; own calculations assuming that emission improvement stops when the marginal abatement cost is equal to the premium)


Influence of the excess emissions premium
on the average CO2 level
175g/km, mass, AMI=0
Fleet CO2 average [g./km]
177
176
175
80
90
100
110
120
130
140
150
160
Excess emissions premium [€/(g/km)]