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Annex to the

Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on the approximation of the laws of the Member States with respect to emissions from on-road heavy duty vehicles and on access to vehicle repair information,

Impact Assessment

{COM(2007) 851 final}
{SEC(2007) 1720}

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EXECUTIVE SUMMARY

Air quality has improved over the past decade but there are still significant air quality problems throughout the European Union, especially in urban areas and in densely populated regions.

By 2020 the EU will still be a long way from achieving the objectives of the 6th Environmental Action Programme. Significant negative health and environmental impacts will continue to persist even with effective implementation of current legislation.

In order to solve these problems, further measures have been considered, and in doing so the following options have been assessed:

- No policy change
- Regulatory approach at the European level
- Regulation in Member States
- Fiscal incentives by Member States
- Non-regulatory approach

The impact assessment has demonstrated that further reduction of emission limits for heavy duty vehicles (Euro VI) is necessary to improve air quality while at the same time retaining the functioning of the internal market.

Particulate matter (PM) pollution is of increasing scientific concern and harmonised emission limits at European Union level are necessary to prevent barriers to the distribution and circulation of heavy duty vehicles and to achieve substantial reductions in particulate emissions from those vehicles across the EU. A 66% reduction in the limit value for particulate matter is proposed with an emission limit of 0.01 g/kWh, which, given current technology, will require particulate filters to be fitted to all diesel vehicles.

Additional action on nitrogen oxide (NO_x) and hydrocarbon (HC)[1] emissions is also justified, given the fact that many Member States will otherwise be unable to fulfil the requirements of the National Emissions Ceilings Directive (2001/81/EC) and the proposal for revision of the air quality directives (COM(2005) 447)[2]. An 80% reduction in NO_x to an emission limit of 0.4 g/kWh is proposed. Increased use of engine technology and after-treatment technology shall be needed to fulfil the required NO_x emission limits.

A series of amendments to the existing legislation are discussed in this impact assessment. The general effect of these is to further tighten emission limits from vehicles, in that they reduce the risk of vehicles producing unnecessary levels of pollution by providing more robust and comprehensive regulatory requirements without imposing excessive costs. In addition, they ensure standardised access to vehicle repair information.

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1 Hydrocarbons (HC) and Volatile Organic Compounds (VOC) are used in this document interchangeably.

2 This proposal for an Ambient Air Quality Directive would amend existing air quality legislation, i.e. Directives 96/62/EC ("Framework Directive"), OJ L 296, 21.11.1996, p.55, and three "daughter directives" 1999/30/EC, 2000/69/EC 2002/3/EC and Council Decision 97/101/EC.

The impact assessment concludes that it is appropriate to align our future emission values with those of the US. Most stakeholders – including industry – support the alignment with the US limit values, and our impact assessment shows that it is cost-efficient.

The result will be a considerable improvement in air quality while, at the same time reducing the cost of engine development and testing. In fact, the proposal will enable manufacturers to produce highly environmentally friendly engines for both the US and the European markets.

It will also enable Member States to fulfil the requirements of the Air Quality Directive.

1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

1.1. Organisation and timing

A proposal relating to the pollutant emissions from heavy duty vehicles has been included in the 2007 Commission Legislative and Work Programme. The proposal has been identified as a Priority Initiative under the Roadmap reference number 2007/ENTR/009. The latter has been published as part of the Work Programme.

1.2. Consultation and expertise

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

- A questionnaire was sent to stakeholders in 2004 on possible scenarios of new Euro VI emission limit values for heavy-duty vehicles. The questionnaire aimed at gathering views of stakeholders as to the required technology and associated costs of meeting various limit value scenarios. The Commission services consulted a wide spectrum of interested organisations through the questionnaire: national authorities, vehicle manufacturers, component suppliers, industry associations and non-governmental organisations.

- A panel of experts, external to the Commission, was engaged to assess stakeholder responses to the questionnaire sent out by the Commission on new Euro VI emission limit values for heavy-duty vehicles. The panel was composed of three independent professionals, whose task was to assess and validate the stakeholder responses on various emission reduction scenarios and on costs of necessary technology. The results of the work of the expert panel were reported to the Commission services[3]. The panel subsequently reported on its interpretation of the stakeholder responses in terms of the technologies required and the costs involved. This report is further referenced in the impact assessment as TNO Report.

- To understand more fully the results of the questionnaire, the expert panel organised a number of targeted stakeholder meetings to generate additional data on technology performance and related costs. The panel produced a technology map and a cost range of meeting the various emission reduction scenarios.

- Modelling of environmental and economic impacts was undertaken to understand the cost-effectiveness of different emission limit scenarios using the analytical tools developed under the CAFE Programme in order to model the impacts of different emission limit levels. This work was reported by an external consultant contracted by the Commission in a study that is referenced as LAT study throughout this Impact Assessment[4]. LAT performed additional calculations to assess the impacts of the

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[3] TNO: Panel Report on Euro VI technologies and costs – The expert panel's summary of stakeholder responses; 06.OR.PT.034.2/NG; September 12 2006 http://ec.europa.eu/enterprise/automotive/pagesbackground/pollutant_emission/tno_report_euro_vi.pdf

[4] LAT - TREMOVE model scenario runs related to the impact assessment of EURO VI emission limit values for Heavy Duty Vehicles – Draft final report – February 2007 [link will be introduced once final report is published]

emission limit value scenarios in 2030 which was carried out with version 2.52 of the TREMOVE model. This work was also reported in a study that is referenced as LAT study No. 2 throughout this Impact Assessment[5]

- A number of scenarios for Euro VI (see section 6.2.1) were put to public consultation in July-September 2007. The Commission services aimed to gather the views of all interested parties on future limit values and to take into consideration all relevant comments of stakeholders in its proposal. The opinion of the stakeholders on whether the introduction of the Euro VI should be introduced in a single step or in two steps, was also requested in the public consultation. Comments and issues raised by stakeholders are summarised in Annex 1.

The Commission's standards for consultation of interested parties[6] were met throughout the consultation procedure.

1.3. Impact Assessment Board

The Board has examined a draft of this Impact Assessment and has made a number of recommendations. These concern on the one hand the presentation of the options. This aspect has been taken into account throughout the report. On substance, the Board suggested that the choice of the scenarios should be better justified. This has been done in section 6.1. The Board has also asked for a better evaluation of the accompanying measures. This has been done in section 6.3. Finally, the Board has asked for clarification why sub-option A has been chosen despite the fact that this does not seem to be the most cost-efficient option. This aspect has been dealt with in section 6.4.1.

2. PROBLEM DEFINITION

2.1. Nature of the issue or problem that requires action

The proper functioning of the single market in the European Union requires common standards limiting the emission of atmospheric pollutants from motor vehicles. Action at Community level prevents varying product standards emerging across Member States which results in fragmentation of the internal market and imposition of unnecessary barriers to intra-Community trade. Also through harmonised standards it is possible to reap the economies of scale as production series can be made for the whole European market.

Harmonized vehicle emission standards have long been a feature of EU policy. Given developments in automotive technology, increased demand for road transport and continuing air quality problems, there has been a need to keep standards under review.

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[5] LAT - TREMOVE model scenario runs related to the impact assessment of EURO VI emission limit values for Heavy Duty Vehicles – Draft final report – October 2007 [link will be introduced once final report is published]

[6] COM(2002) 704 final, 11.12.2002

2.2. Underlying drivers of the problem

All Member States and their citizens are concerned about the significant risk to human health and environment that results from air pollution. Although air quality has improved over the past decade, there are still significant air quality problems throughout the European Union, especially in urban areas and in densely populated regions.

The 6th Environmental Action Programme (EAP)[7] establishes the objective of achieving levels of air quality that do not give rise to significant negative impacts on and risks to human health and the environment. Following its communication on the Clean Air For Europe programme (CAFE)[8], the Commission has examined whether current legislation is sufficient to achieve the 6th EAP objectives by 2020.

The Commission's Communication on the Thematic Strategy on Air Pollution[9] has identified that by 2020 the EU will still be a long way from achieving the objectives of the 6th Environmental Action Programme. Significant negative health and environmental impacts will continue to persist even with effective implementation of current legislation. Thus, the strategy established objectives for air pollution in the EU and proposed appropriate measures to achieve them. To that end, it has been identified that a further review of the emission limits for heavy duty vehicles beyond the current Euro standards (Euro IV and V) is needed to meet the air quality targets for 2020[10]. Furthermore, the Council Conclusions on the Thematic Strategy emphasised "that achievement of ambitious objectives depends on the timely adoption and implementation of further Community measures, therefore urged the Commission to come forward as soon as possible with appropriate proposals inter alia on emissions from engines in heavy-duty vehicles (EURO VI)"[11]

The Thematic Strategy on Air Pollution has identified that the pollutants from road transport of most concern for human health are airborne particulates and ozone. Ozone is formed by reaction between HC and NO_X, both of which are emitted by road transport. The road transport sector is a significant source of pollution; it was responsible for 41% of total NO_X emission and 22% of total non-methane volatile organic compounds (NMVOCs) emissions in 2004.[12] The transport sector (including road transport, shipping, aviation and rail) accounted for 29% of total $PM_{2.5}$ emissions in the year 2000.[13] Road transport contributed 15 % to the total emissions (i.e. from all sectors) of acidifying substances in 2001 for EEA-31 (25 EU Members States, Bulgaria, Romania, Turkey, Iceland, Lichtenstein and Norway). Road transport is the dominant source of ozone

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7 Decision 1600/2002/EC - OJ L242, 10.9.2002

8 COM(2001) 245 final, 04.05.2001

9 Thematic Strategy on Air Pollution, COM(2005)446 final, 21.09.2005.

10 Impact Assessment of the Thematic Strategy on Air Pollution, SEC(2005)1133, 21.09.2005, p. 22

11 Council of the European Union: Thematic Strategy on Air Pollution − Council conclusions 7329/06 http://ec.europa.eu/environment/air/cafe/pdf/council_concl_them_strategy.pdf

12 Source: Eurostat – Environment and energy statistical data: http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136239,0_45571447&_dad=portal&_schema=PORTAL.

13 Impact Assessment of the Thematic Strategy on Air Pollution, SEC(2005)1133, 21.09.2005, p. 9, 26, 31.

precursors and contributed 36 % of total ozone precursor emissions in 2001 in EEA-31[14]. These pollutants are associated with damage to health and have detrimental impacts on ecosystems through: ozone formation; particulate matter formation; acidification and eutrophication. Since the emissions of these pollutants from motor vehicles are harmonised at EU level, the Community needs to address these issues, as it carries responsibilities for the internal market for vehicles, public health and the environment.

[14] EEA factsheet of air pollutants from transport: http://themes.eea.eu.int/Sectors_and_activities/transport/indicators/consequences/TERM03%2C2003.09/TERM2003_03_EEA31_Transport_emissions_of_air_pollutants_by_mode_final.pdf

2.3. Stakeholders affected

A wide range of different groups are affected by the problem:

- The population of the European Union is affected by poor air quality through the impacts on health and welfare of society. In the year 2000, exposure to particulate matter was estimated to reduce average statistical life expectancy by approximately eight months in the EU-25. This equates to approximately 3.6 million life years lost or 348,000 premature mortalities per annum. In addition, it has been estimated that there were some 21,000 cases of hastened death due to ozone[15].

- Consumers of motor vehicles are affected by changes in the price of new vehicles, which may alter as a result of stricter vehicle emission limits.

- Stricter emission limits affect vehicle manufacturers by requiring improvements to new vehicles through the development and introduction of better technologies.

- Component suppliers will be affected by increasing demand for advanced engine and exhaust gas after-treatment technologies.

2.4. Consequences of no change in policy

With no change in the policy of reducing emission levels for motor vehicles, there is a high risk that the functioning of the internal market would be impaired. Poor air quality will remain an issue in the European Union as atmospheric pollution will continue to have a detrimental impact on human health.

With no additional action on motor vehicle pollution, it is likely that Member States would question whether EU legislation still provides a high level of environmental protection in the sense of Article 95 (3) of the Treaty. It is foreseeable that they would try to promote vehicles that fulfil stricter emission limit values. There is a risk that this would result in disruption to the single market if varying standards for vehicles emerge from different Member States. If air quality remains a problem, the use of other measures, such as bans on certain types of vehicle entering cities or creation of low emission zones would also become even more widespread, restricting the free movement of goods and people.

The Thematic Strategy on Air Pollution has forecast the likely levels of air pollution given present policies for the period 2000-2020. Despite the improvements in pollutant emissions, health impacts from air pollution across the EU are still projected to be considerable in 2020[16] .

- For particulate matter, the average loss in statistical life expectancy will be five months in 2020. Correspondingly, in 2020 it is estimated that some 2.5 million life years will be lost in the EU-25. This is equivalent to about 272,000 premature deaths.

- No significant decrease is estimated in the health impacts of ozone with 20,000 cases of hastened death in the year 2020.

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[15] Thematic Strategy on Air Pollution, COM(2005) 446 final, 21.09.2005, p. 3

[16] Impact Assessment of the Thematic Strategy on Air Pollution, SEC(2005)1133, 21.09.2005, p. 11, 37, 39

The total annual damage costs to human health associated with particulate matter and ozone pollution in 2020 are estimated at between €189 billion and €609 billion. This excludes an estimate of damage on ecosystems and cultural heritage which are difficult to value.

It has to be noted however that the baseline of the Thematic Strategy on Air Pollution included only the policy measures existing in 2000 and estimated the impacts of these in the year 2020. Therefore, the baseline of the Thematic Strategy on Air Pollution did not include the measures adopted since then, such as the Euro 5 and 6 emission limits for light-duty vehicles that significantly contribute to the reduction of the above health impacts. However, the Impact Assessment on the Thematic Strategy on Air Pollution assesses that, when considering the level of stringency in the three air quality scenarios foreseen for 2020, it had been assumed that lower emission limit values would be applied from October 2005 (Euro IV) and from October 2008 (Euro V) for heavy duty vehicles. Furthermore, it is stated that "for new heavy duty vehicles, the assumption was that tightened emission limit values would take effect from 2013 in all Member States"[17]

2.5. Treaty base and subsidiarity principle

Since the objective of the Euro VI proposal is to lay down harmonised rules on the construction of motor vehicles with regard to their emissions with a view to ensuring the functioning of the internal market, the proposed Regulation is based on Article 95 of the EC Treaty.

Atmospheric modelling shows that the pollution emitted in one Member State contributes to pollution in other Member States so, in order to solve the problem of air pollution, concerted action at the EU scale is required.

The subsidiarity principle is respected, since the policy objectives cannot be sufficiently achieved by actions of the Member States and can be better achieved at Community level. European Union action is necessary because of the need to avoid the emergence of barriers to the single market and because of the trans-boundary implications of air pollution.

[17] Impact Assessment of the Thematic Strategy on Air Pollution, SEC(2005)1133, 21.09.2005, p. 67

3. OBJECTIVES

3.1. Policy objectives

The proposal pursues the following general policy objectives:

- Ensuring proper functioning of the internal market; and
- Providing for a high level of environmental protection in the European Union.

The specific objectives cover:

- Setting harmonised rules on the construction of motor vehicles; and
- Improving air quality by reducing pollutants emitted by the road transport sector.

3.2. Consistency with horizontal objectives of the European Union

3.2.1. Lisbon strategy

The policy objectives of Euro VI are in line with the aims of the European Union's Lisbon strategy, which has three pillars, namely:

- Making Europe a more attractive place to invest and work

The objectives of Euro VI are supporting the integrity of the single market, providing for uniform standards for new vehicles sold throughout the European Union. It means that the automotive industry in Europe is required to meet uniform regulations throughout the Internal Market of the EU. This will ensure that the European heavy duty vehicle industry remains competitive and an attractive industry to invest in. The proposal will also contribute to enhancing its competitiveness on world export markets.

The CAFE Programme has shown that air pollution has significant effects on productivity.[18] For example, the CAFE Cost-Benefit Analysis[19] assessed the effects of air pollution on activities of the population, namely by estimating the Restricted Activity Days (RADs) and the Work Loss Days (WLDs) for each Member State that are attributable to air pollution. By seeking to reduce air pollution, the policy objectives of Euro VI contribute to increasing productivity in the European Union.

- Knowledge and innovation for growth

New emission limits for vehicles encourage the development and implementation of new environmental technologies. The policy objectives therefore promote innovation and technological development, enabling the EU to keep pace with the technology development of the automotive industry in the United States and in Japan. The vast majority of heavy-duty trucks and buses are using diesel technology in which Europe is world leader. Policies which support the development of cleaner diesel open up the potential for greater export of European technology to other parts of the world.

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[18] Methodology for the Cost-Benefit analysis for CAFE, Volume 2: Health Impact Assessment, AEA Technology Environment, February 2005, p. 85

[19] CAFE Cost Benefit Analysis: Baseline Analysis 2000 to 2020, AEA Technology Environment, April 2005, p.18, p. 60

- Creating more and better jobs

In the Impact Assessment of the Thematic Strategy on Air Pollution (SEC (2005) 1133) it was demonstrated that reducing air pollution in the EU would have a negligible impact on employment. As Euro VI would be one of the measures considered in the Thematic Strategy, the overall employment impact of this proposal is also negligible. One of the main employment impacts is likely to be created by the demand for new vehicle components. Given that more advanced technology would be required, the employment impact will be a mixture between high value added research and development activities and also manufacturing opportunities.

3.2.2. Sustainable Development strategy

At the core of the European Union's Sustainable Development strategy, as communicated by the Commission to the European Council at Göteborg in 2001[20] and supported by the European Council, is that "*economic growth, social cohesion and environmental protection must go hand in hand*". The policy objectives of Euro VI are in line with the strategy by ensuring that the automotive industry grows in a more sustainable way through production of more environmentally friendly vehicles. Such vehicles bring social benefits through reducing the impacts on human health.

3.2.3. Simplification of the regulatory framework

The proposal provides for simplification of administrative procedures for public authorities (EU or national). The proposal is included in the Commission's rolling programme for up-date and simplification of the acquis communautaire and its Legislative Work Programme under the reference 2007/ENTR/009.

Simplification is introduced through the repeal of the current existing Directives in the field of emissions from heavy duty vehicles and the integration of the test requirements for measuring diesel smoke, which were previously contained in Directive 72/306/EEC[21] into this proposal. This Directive has been repealed by Euro 5 and 6 Regulation[22]. Council Directive 80/1269/EEC[23], and its amendments, relating to the engine power of motor vehicles will also be repealed and its technical requirements have been included in this proposal.

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20 COM(2001)264 final.

21 Council Directive 72/306/EEC of 2 August 1972 on the approximation of the laws of the Member States relating to the measures to be taken against the emission of pollutants from diesel engines for use in vehicles (OJ L 190, 20.8.1972, p. 1).

22 Regulation (EC) No 715/2007 of the European Parliament and of the Council on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information, amending Council Directive 70/156/EEC and Directive 2005/55/EC

23 Council Directive 80/1269/EEC of 16 December 1980 on the approximation of the laws of the Member States relating to the engine power of motor vehicles (OJ L 375, 31.12.1980, p. 46)

4. POLICY OPTIONS

4.1. Options Identified

Four policy options have been identified as possible means of meeting the policy objectives identified in the previous section. These are:

(1) **No policy change,** maintaining the Euro V emission limit values

(2) **Regulatory approach at the European level**: revising the existing Euro IV and V legislation through setting new Euro VI emission limit values at European Union level.

(3) **Regulation in Member States:** Member States develop their own emissions standards and/or impose other policy measures (e.g. temporary driving restrictions on vehicles not complying with more ambitious standards).

(4) **Fiscal incentives by Member States**: Member States introduce on a voluntary basis (or on the basis of a potential EU legislation) fiscal incentives for vehicles that fulfil stricter emission limit values than Euro V.

(5) **Non-regulatory approach**: self-regulation through negotiated commitments with the automotive industry to reduce the emissions from new vehicles.

4.2. Options discarded at an early stage

Discussions with stakeholders have shown that there is little interest in a fundamental change in the regulatory system. Moreover, the 'softer' options such as self-regulation or voluntary fiscal incentives may not deliver on the environmental side or would not be workable. For example, the option may not be feasible due to the unanimity requirement in the Council with respect to a fiscal regime, or because it creates significant distortions in the working of the internal market. Therefore, four options were discarded at an early stage, these are:

(1) **No policy change,** maintaining the Euro V emission limit values: As stated in section 2.4 with no change in the policy of reducing emission levels for motor vehicles, there is a high risk that the functioning of the internal market would be impaired. Poor air quality will remain an issue in the European Union as atmospheric pollution will continue to have a detrimental impact on human health.

(2) **Regulation in Member States:** Member States develop their own emissions standards and/or impose other policy measures (e.g. temporary driving restrictions on vehicles not complying with more ambitious standards).

This policy option was rejected because of its detrimental effects on the functioning of the internal market, for example regarding the market of commercial vehicles, but also the free movement of goods transported by these vehicles.

(3) **Fiscal incentives by Member States**: Member States introduce on a voluntary basis (or on the basis of a potential EU legislation) fiscal incentives for vehicles that fulfil stricter emission limit values than Euro V.

The policy option of using fiscal incentives as a mechanism to introduce lower emission limits was rejected for the following reasons:

- Due to the unanimity requirement at the Council it is likely that legislation on support schemes would be very difficult to ever finalise.
- At present only a small number of Member States have a history of introducing fiscal measures encouraging the introduction of cleaner vehicles in advance of new Euro standards, so uptake of the measure could be limited. This would clearly lead to a fragmented internal market, since only a limited number of Member States would introduce incentives and manufacturers would have to construct vehicles according to different specifications.

- With a purchase tax regime, a key issue is their sustainability over a period of time. They could involve significant financial commitment by Member States so there is no guarantee that they would be in place for the long term. Therefore the resultant policy could lead to considerable uncertainty for manufacturers as to the demand for cleaner vehicles. Fiscal incentives could be designed such that they are revenue neutral with charges on the sale of polluting trucks and buses subsidising the purchase of cleaner ones. Such a tax would only be revenue neutral as long as sales of polluting vehicles continue to take place. If the instrument becomes too successful and the market shifts to cleaner vehicles, the tax base will diminish. The incentive mechanism will then become a net cost to the Member State. If the incentive scheme were to finish, the market risks shifting back to cheaper, less clean vehicles.

- In order to make such an approach revenue neutral such an option could only work through differentiation of circulation taxes. For example, vehicles fulfilling a more ambitious but indicative new norm would benefit from reduced taxes (or a direct subsidy), whilst vehicles fulfilling the norms in place when the vehicles were registered for the first time would come with higher circulation taxes. The higher the penetration rate of new vehicles, the higher the tax 'penalty' for older ones would have become for revenue neutrality to continue. This could lead to undesired distortions of the market and unacceptable negative economic and social consequences for the owners of vehicles already on the market.

- If uncoordinated, different types of incentive regimes in neighbouring countries could result in unpredictable cross border effects, both in terms of vehicle purchasing patterns and air pollution impacts. The continued existence of the single market for vehicles could therefore be put in danger. A Commission Communication giving some guidance to Member States could perhaps help at an early stage. However, such a Communication would also have to develop indicative vehicle emission limit values so as to give some guidance on an adequate tax differentiation. Thus, if effective this would eventually come close to a regulatory approach without delivering the planning security for vehicle manufacturers and the greater environmental certainty that a regulation would bring about.

In conclusion, such a policy option does not ensure that the stated policy objectives are attained and could even have a negative impact on the functioning of the internal market through reducing the certainty as to the demand for specific types of vehicles. However, fiscal incentives could be used by Member States (preferably in a budget neutral way) as an accompanying measure to a European regulation so as to accelerate the penetration of new vehicles fulfilling more ambitious standards. Furthermore, the use of fiscal incentives to **accelerate** the penetration of new – more environmentally friendly –

vehicles is already a feature of applicable emissions legislation both for light and heavy duty vehicles. This approach ensures that fiscal incentives are only used for an interim period in advance of the application of the new emission standards.

(4) **Non-regulatory approach**: self-regulation through negotiated commitments with the automotive industry to reduce the emissions from new vehicles.

The policy option of self-regulation was discarded due to the following reasons:

- Self-regulation would imply a significant departure from an approach that is well established all over the world and has proven its effectiveness and proportionality in the past.
- A large number of other countries around the world base their emissions regulation on EU practice. A radical change in approach to a non-regulatory approach risks reducing the EU's leadership in this area. The use of EU regulation by other countries also offers competitiveness benefits to the EU automotive industry which could be affected by a change of approach.
- It is not clear that a self commitment provides an adequate guarantee that a specific emission level will be reached or that there will be appropriate sanctions available if the self-commitment were to be breached.
- As the issue of emission control has repercussions on the protection of the environment and public health, it is questionable whether a self-commitment can be justified.
- A self-regulation approach could take too much time to be negotiated and to deliver the hoped-for effects. Due to the problem of several Member States to meet existing air quality targets, there is a certain urgency to introduce action that has more immediate effects.

In addition, it is not apparent that the use of a voluntary approach would offer any additional benefits to the industry, governments or the general public. It is likely that a similar compliance process would be used as currently exists in the type approval system, however there would be additional transaction costs in establishing an appropriate monitoring and compliance mechanism. A regulatory approach instead would provide industry with a stable and predictable framework in which investment in better technology solutions would be stimulated.

5. ANALYSIS OF IMPACTS

5.1. Impacts of the policy options

This section analyses the impacts of the Regulatory approach (policy option 2 – introducing new Euro VI limit values) relative to the No policy change option (policy option 1 – maintaining Euro V emission limit values). The potential economic, environmental and social impacts have been examined.

5.1.1. Option 1 - No policy change

As discussed in Section 2.4 and 4.2, the option of no policy change (maintaining Euro V emission limit values) is not considered a viable way forward due to the significance of the air pollution problems that the EU faces. However for the purpose of this chapter this option provides a baseline to consider the impact of the Regulatory approach. The impacts related to the baseline have been based on the forecasts made under the CAFE Programme. Any potential limitations with the forecasts have already been considered in the development of the CAFE Programme, so it is not necessary to consider these issues in the present impact assessment.

5.1.2. Option 2 - Regulatory approach

Considerable emphasis was given to gathering data from stakeholders to understand the costs of varying emission limits. There is substantial information asymmetry as those with the best information on these costs do not necessarily have clear incentives to make it public. Another key issue with cost data relates to understanding the effect of mass production on new technology. A more detailed explanation of this process is provided in section 6.

5.1.2.1. Economic impacts

The fulfilment of stricter emission limit values would require the increased use or the development and introduction of new technologies to reduce emissions of pollutants. There are a number of economic impacts that result from the further regulation of vehicle emissions:

- Single market

Harmonised emission limit values throughout the European Union would have a positive impact on the competition in the internal market by sustaining a 'level playing field' for all automotive businesses.

- Competitiveness

This policy option may have neutral direct impacts overall on the competitiveness of the automotive industry of the European Union. The option may increase the operating costs of businesses in the automotive industry through the additional cost of additional components and also research and development expenditure. However, the competitive position of the manufacturers within the EU would not be influenced by the policy option. Moreover, costs and economic impacts could be expected to diminish over time, once a new technology becomes established and production costs fall.

The policy option would have some indirect impacts as well in terms of competitiveness. The automotive industry could become more competitive in markets outside the EU with strict environmental regulation in force, through being able to produce vehicles and engines equipped with advanced environmental technologies. Moreover, it should be noted that at present, the EU is the world leader in clean diesel technology. Encouraging the development of cleaner diesel vehicle technology will have a positive impact on the international competitiveness of EU industry through expanding the size of the global clean diesel market.

Further development of EU emissions standards ensures their continued use in other markets around the world. At present there are three main systems used around the world for setting vehicle emission limits, these are those from the EU, the United States and Japan. Currently there is widespread use of EU standards in OECD countries such as Australia and emerging markets around the world, including in China and India. As many of these markets have significant air quality problems and are experiencing high growth in the use of heavy duty vehicles, there is continued demand for better standards. Current high levels of oil prices and concerns over security of supply, is increasing the level of interest in diesel technology in a number of markets, where petrol engines are still used in heavy duty vehicles. So driving forward the development of cleaner diesel technology is an important need which could provide competitiveness benefits. Therefore further evolution of EU policy in this area, will sustain the use of the Euro system so be in the interests of both EU based manufacturers and equipment suppliers.

Finally, a policy that makes it necessary to develop and introduce new environmental technologies would benefit indirectly the component suppliers in the automotive industry, who would benefit from increasing revenues.

- Affordability of vehicles

The necessary technological developments will result in an increase in prices of new vehicles, which might to a certain extent negatively affect road hauliers and bus operators in the European Union. However, these would also benefit from the proper functioning of the internal market indirectly through greater competition between manufacturers and the reduction in barriers to cross-border vehicle purchases. At any rate, the price increase will be small compared to the cost of a new truck or bus. Moreover, road hauliers and bus operators are generally able to pass on any increased costs towards their customers so that the price increase that the end consumer of goods and services will have to bear will be minimal.

5.1.2.2. Environmental impacts

- Air quality

As explained in Section 2.2, the Thematic Strategy on Air Pollution identified that a further review of the emission limits for heavy duty vehicles beyond the current Euro standards (Euro IV and V) is needed to meet the air quality targets for 2020.[24]

This policy option would result in improvement in air quality through reducing the levels of pollution produced by road transport, in particular by heavy-duty vehicles, and would therefore be an essential part of the regulatory measures necessary to meet the air quality

[24] Impact Assessment of the Thematic Strategy on Air Pollution, SEC(2005)1133, 21.09.2005, p. 22

objectives for 2020. A decrease in the areas under threat of ozone and eutrophication would be a result of reduced air pollution from vehicles. Furthermore, cleaner air in cities would also reduce damage to buildings and cultural heritage.

- Biodiversity

The regulatory option would have reduced impact on biodiversity compared to the baseline scenario through reducing the emission of pollutants from vehicles. The threats of ozone and eutrophication on biodiversity would be reduced.

- Climate

Tighter emission limits could have both direct and indirect effects on fuel consumption and greenhouse gas emissions. The direct impact is due to some forms of engine technology and after-treatment resulting in slightly higher CO_2 emissions in comparison with the Euro V stage, therefore, the policy option might cause the emission of greenhouse gases to increase. Given the nature of emission limits being considered, and the likely technologies used to reach these limits a small direct negative impact on CO_2 could be expected.

However, there might be some positive impacts indirectly. Because of the strong competition in the transport industry and the resulting cost pressure in the sector, operators tend to choose the vehicles with the lowest fuel consumption. Therefore, greenhouse gas emissions may be decreased since vehicle manufacturers will try to diminish the fuel consumption through technological measures in order to achieve high sales volumes of their vehicles. Then fuel consumption could be maintained close to the level in Euro V in the long term.

5.1.2.3. Social impacts

- Public health

Better air quality would improve public health by decreasing morbidity rates and increasing life expectancy of the population, which in turn results in lower mortality. The impacts will grow in proportion to the penetration of newer low emission vehicles onto the market while older more polluting vehicles are retired.

- Employment

The proposal has no perceptive impact on employment (see Section 3.2.1).

5.2. Conclusion

In conclusion, in comparison with the no policy change option, the regulatory option will have the clear benefits of ensuring the proper functioning of the internal market and improving air quality. This, in turn, will improve public health and, thus, will enable Governments to generate savings.

As far as the competitiveness of industry is concerned, the indirect impacts of the regulatory option might be positive as the international competitiveness of EU industry, especially in markets with strict environmental regulation in force, might be improved.

On the other hand, the introduction of new technologies will bring additional costs and result in an increase in consumer prices of new vehicles.

It is therefore essential to ensure a right balance between higher environmental standards and the increase of vehicle cost. To this effect, in the next section different sub-options under the regulatory option are compared.

6. IDENTIFICATION OF THE BEST SUB-OPTION UNDER THE REGULATORY OPTION

In this section, different sub-options under the regulatory option are compared, where possible, based on a quantification of their impacts.

6.1. Data Collection and Modelling of the Impacts

The Euro VI proposal was developed in the context of the Commission's Thematic Strategy on Air Pollution. Stakeholders were actively engaged in the discussion of this programme.

In the preparation for a new set of limit values for heavy-duty vehicles, the Commission services sent out a questionnaire to stakeholders that requested information on the technologies needed and the associated costs for meeting a number of different scenarios for possible Euro VI limit values. Those scenarios represented a reduction of 50 to 90% in NOx and 33 to 66% in PM in relation to the already defined Euro V stage for the years 2008-2009. One of the scenarios was considered as equivalent to the one to be introduced in US in the period 2007-2010.

The questionnaire was sent in the autumn of 2004 to the stakeholders participating in the Motor Vehicle Emission Group (MVEG) and contained specific questions about technologies, cost, durability and additional requirements to fulfil 11 emission limit scenarios (6 for compression ignition engines and 5 for positive ignition engines). Official responses to the EC's request for information were submitted by the European Association of Vehicle Manufacturers (ACEA), the European Association of Control by Catalyst (AECC), the European Natural Gas Vehicle Association (ENGVA) and the German Agency for the Environment (UBA).

The responses received from the stakeholders were then provided to a panel of three independent experts for validation. Some further discussion was held between the panel and the stakeholders in order to clarify outstanding issues and to generate additional information. The results of the work of the expert panel were reported to the Commission services in the study referred to as TNO Report.

The data summarised by the panel was used as input for the modelling of the impacts of different scenarios. The analysis was carried out by using the TREMOVE model, which was developed in the context of the CAFE Programme. TREMOVE is a policy assessment model designed to study the effects of different policies on the emissions of the transport sector. More details on this model can be found in Section 6.2.5. The modelling work was reported in two reports referred to as LAT study and LAT study No. 2.

6.2. Scenarios (Sub-options) of the Regulatory approach

A number of scenarios, hereafter named as sub-options, combining different levels of particulate matter (PM), nitrogen oxides (NOx) and hydrocarbon (HC) emission limit values for compression ignition engines (CI) and positive ignition engines (PI) fuelled with natural gas (NG) and liquefied petroleum gas (LPG) have been developed for policy option 2 (Regulatory approach), including one with limit values equivalent to those to be applicable in US from 2010. Those sub-options were included in the questionnaire sent to stakeholders (see section 1.2) and are described in **Table 2**.

6.2.1. Baseline

For the purpose of the evaluation of the impacts of possible Euro VI emission limit value sub-options and to assess the costs and benefit of each sub-option, Euro V has been taken as baseline, which approach corresponds to the 'no policy change' option. In line with this approach, the baseline of TREMOVE 2.43b – which version was used for the modelling exercise – includes EURO V as final heavy-duty vehicle emission reduction step.[25]

As an example, for compression ignition engines, the Euro V limit values are included in **Table 1**.

Table 1: Euro V emission standards (Operation Cycle: ETC)
for compression ignition engines considered in the baseline sub-option

Pollutant	g/kWh (ETC)
CO	4.0
THC	0.55
NO_x	2.0
PM	0.03

Source: Directive 2005/55/EC

6.2.2. Euro VI emission limit value sub-options

The emission limit value sub-options that have been developed and considered for the Euro VI stage of heavy-duty vehicles are shown in **Table 2**.

Table 2: Euro VI emission limit value sub-options

		Sub-option							
		A		**B**		**C**		**D**	
	Engine	**CI**	**PI**	**CI**	**PI**	**CI**	**PI**	**CI**	**PI**
Emission limit values (g/kWh)	**PM**	0.01	0.01	0.02	0.02	0.015	0.02	0.015	0.01
	NOx	0.4	0.4	0.2	2.0	1.0	2.0	0.5	1.0
	THC	0.16	0.66	0.55	1.05	0.55	1.05	0.55	1.05

The percentage reductions for the various compression ignition engine Euro VI sub-options over the Euro V baseline are shown in Table 3.

[25] LAT study, p. 6

Table 3: Reductions of emission limit values of Euro VI sub-options over EURO V for compression ignition engines (%)

Pollutant	Sub-option A	Sub-option B	Sub-option C	Sub-option D
PM	66	33	50	50
NOx	80	90	50	75
THC	70	-	-	-

The limit value for CO remains unchanged compared to Euro V.

6.2.3. Evaluation of sub-options

The cost implications for the various sub-options examined as part of this proposal, taking into account the possible technology options, are set out in

Table 4. This summarises the average cost per vehicle for each sub-option, expressed in 2012 Euros. The figures are based on the replies from stakeholders to the questionnaire sent by the Commission as reported by the panel of independent experts. According to the panel report, due to the unpredictability of the precious metal price towards 2012, the price level used has been taken constant at the level of summer 2004 but, in order to take into account that the actual precious metal loading of the catalyst to achieve certain emission reduction efficiencies is likely to decrease over time (thrifting effect) a correction of 30% has been applied.[26] In addition, due to uncertain production volumes of certain components in 2012, especially NOx after-treatment systems and diesel particulate filters, the cost figures could be lower than those expressed by the stakeholders in the questionnaire. Furthermore, no reduction in costs is made to take account of mass production economies of scale. Therefore, cost data should be seen as worst case.

The highest cost sub-options relate to those with the most significant PM and NO_x reduction.

[26] TNO Report, p. 45

Table 4: Sub-optionss of Euro VI emission limit values and sales weighted average cost per heavy-duty vehicle (2012 prices)

		Sub-option							
		A		B		C		D	
	Engine	CI	PI	CI	PI	CI	PI	CI	PI
Emission limit values (g/kWh)	PM	0.01	0.01	0.02	0.02	0.015	0.02	0.015	0.01
	NOx	0.4	0.4	0.2	2.0	1.0	2.0	0.5	1.0
	THC	0.16	0.66	0.55	1.05	0.55	1.05	0.55	1.05
		Average cost per vehicle (€)							
Engine displacement	6 l	2539	--- (1)	2838	---	1027	---	1227	---
	9 l	3226	1825 (2) 4025 (3)	3575	1000 (2) 1825 (3)	1333	1000 (2) 1825 (3)	1583	1000 (2) 3825 (3)
	12 l	4009	---	4423	---	1741	---	1991	---
	Baseline	Euro V	Euro V	Euro V	Euro V	Euro V	Euro V	Euro V	Euro V

Source: TNO report

(1) For positive ignition engines (PI), the representative engine displacement is considered to be 9 litres.

(2) Stoichiometric engines; (3) Lean burn engines.

It is to be noted that directives currently applicable to the limitation of pollutant emissions from heavy duty engines and vehicles (Euro IV and V stages)[27] have introduced the concept of "Enhanced Environment-friendly vehicle" (EEV) as those vehicles propelled by an engine which complies with permissive limit values more stringent than those for Euro V. At this stage, vehicles fulfilling those requirements are provided with positive-ignition engines and, therefore, taking the EEV as the reference, the cost for a representative engine would be:

[27] Directive 2005/55/EC of the European Parliament and of the Council, of 28 September 2005, on the approximation of the laws of the Member States relating to the measures to be taken against the emission of gaseous and particulate pollutants from compression-ignition engines for use in vehicles, and the emission of gaseous pollutants from positive-ignition engines fuelled with natural gas or liquefied petroleum gas for use in vehicles. O.J. L 275, 20.10.2005, p.1, and subsequent amendments

Table 5: Sales weighted average cost per positive ignition engined vehicles with reference to EEV (€ in 2012 prices)

Engine displacement		CI	PI	CI	PI	CI	PI	CI	PI
	9 l		825 (2) 2200 (3)		0 (2) 0 (3)		0 (2) 0 (3)		0 (2) 2000 (3)
	Baseline		EEV		EEV		EEV		EEV

(2) Stoichiometric engines; (3) Lean burn engines.

The 9 litre engine is considered fully representative of the current fleet of positive ignition engines.

6.2.4. Possible emission reduction technologies for different sub-options

Taking into account that gas vehicles represent less than 1% of the whole fleet of heavy duty vehicles, this section focuses on vehicles fuelled with diesel.

To achieve the sub-option A NOx limit value, both cooled EGR and SCR might be necessary. Together with an advanced development of the combustion system, fuel injection and turbo-charging technology, it seems feasible to meet the PM limit with either an open-flow DPF or a wall-flow DPF.

Limit values in this sub-option are considered to be equivalent to the most stringent standards that will be introduced in the US from 2010. Those US standards were introduced following a public consultation and impact assessment[28]. This impact assessment has shown that the US standards will result in substantial benefits to public health and welfare and the environment through significant reductions in emissions of NOx, PM and other pollutants. It is assessed that by 2030, the total net benefit of the introduction of new standards in 2010 will result in a benefit of $70.3 billion in the US.

Nevertheless, some considerations should be taken when comparing the European and US legislative framework:

- The US legislation includes a programme on Averaging, Banking and Trading (ABT) in which manufacturers are allowed to certify their engine families with various family emission limits (FELs), provided that in each model year the average of the FELs does not exceed the emission standard when weighted by the numbers of engines produced in each family for that model year.

- Emission credits are generated by engine families that are certified below the applicable standard.

- The credits can be used to offset the production of engine families that are certified to have emissions in excess of the applicable standard.

[28] Federal Register / Vol. 66, No. 12 / Thursday, January 18, 2001 / rules and Regulations

- Manufacturers are allowed to bank these credits for later use or trade them to other manufacturers.

The system of Averaging, Banking and Trading (ABT) included in the certification procedure in the US is substantially different from the one of type-approval in Europe. The ABT means that it is sufficient that a family of vehicles reaches a limit value of 0.7 g/kWh NOx, which is substantially higher than the value proposed with sub-option A. This would mean that some vehicles would be allowed to emit more than others. This is particularly problematic if those vehicles are operated in urban areas.

This approach is not likely to bring about any benefit and would imply the set up of a costly and complicated monitoring and compliance mechanism, whereby the emission performance of a manufacturer's products are reported, verified and approved. Furthermore, an emissions trading mechanism between manufacturers would have to be set up. This can only be done with the help of an agency that would have to be created. The introduction of Euro VI would certainly be delayed by several years.

Therefore, this issue has not been considered in the impact assessment.

Due to the fact that there are no standards for CO_2 emissions and fuel consumption, the evaluation of these impacts of the various sub-options was based on a comparison to the current Euro IV stage.

In sub-option A, fuel consumption and therefore CO_2 emissions are likely to increase slightly compared to the Euro IV baseline, especially in the case of a wall-flow DPF.[29] This increase is estimated to be in the order of 2-3%, however, as explained in section 5.1.2.2, may decrease in the long term. In this context, the US legislation foresees that after some years after the introduction of measures (by 2010) the increase in fuel consumption can be regained through the optimisation of the engine and the after-treatment systems so that, at the end, no fuel economy penalty results.[30]

To achieve the sub-option B NOx limit, both cooled EGR and SCR might be necessary. At this NOx level, a wall-flow DPF will be needed to meet the PM limit value. Fuel consumption and therefore CO_2 emissions are likely to increase significantly (in the order of 5-6%) compared with the Euro IV baseline.[31]

Sub-option C could be achieved either with EGR or SCR technology. The use of EGR will imply rates over 25% with larger radiators and heat exchangers, which will tend to increase the fuel consumption. For manufacturers using SCR technology already for the Euro V stage, the engine will be kept without major changes but the urea dosing strategy will be revised. For this sub-option, a wall-flow DPF may be needed.[32]

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[29] TNO report, p. 32

[30] Federal Register / Vol. 66, No. 12 / Thursday, January 18, 2001 / rules and Regulations (pages 5061 to 5063)

[31] TNO report, p. 32, p.39

[32] TNO report, p. 32, p.39

It seems unlikely that the NOx level in sub-option D can be achieved with cooled EGR only, but if so, fuel consumption and therefore, CO_2 emission will increase due to the high level of EGR required. The alternative strategy to use SCR appears to be more feasible, although some cooled EGR will be needed to achieve the NOx target.[33] This latter solution could be considered as having neutral impact on fuel consumption and CO_2 emissions. For this sub-option, a wall-flow DPF may be needed.

6.2.5. Impacts of Euro VI emission limit value sub-options

The impacts of each of the above mentioned sub-options have been evaluated with the TREMOVE model.[34] TREMOVE is a policy assessment model designed to study the effects of different transport and environment policies on the emissions of the transport sector. It covers economic, environmental and technical aspects of transport and it is therefore usable for the evaluation of the impacts of different sub-options.

It contains, inter alia, information on the mileage travelled by vehicles in the different transport modes, the vehicle stock and its specific emissions, as well as on the cost of transport and technologies. It covers the major part of Member States of the EU, Switzerland and Norway.

It has to be noted that the impact of more stringent limit values for positive ignition engines have not been included in the TREMOVE model runs, due to the fact that gas engines in heavy duty vehicles represent less than 0.2% of the total number of those vehicles.[35] The model runs have been developed under the assumption that 70% of compression ignition Euro V vehicles are using SCR technology and 30% are using EGR technology. Therefore, the cost of urea has been included in the calculations.[36]

On the basis of the calculations performed with the TREMOVE model, it is possible to assess the monetary impacts of the identified emission limit value sub-options within the regulatory policy option. This assessment includes the estimation of the total economic cost of sub-options and the associated pollution benefits. A more detailed explanation of the concepts used in TREMOVE is provided in Box 1.

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33 TNO report, p. 32, p.39

34 www.tremove.org

35 LAT study, p. 7

36 LAT study

Box 1: TREMOVE model

The TREMOVE model is designed to analyse welfare differences between the basecase sub-option and alternative policy's sub-options. The welfare differences calculated by TREMOVE are composed of four components:

- Changes in aggregated utility level of households;
- Changes is aggregated production costs of firms;
- Welfare changes stemming from changes in government tax revenues;
- Changes in external environmental costs.

Households

A decrease in utility then can stem from an increase in consumption and/or a substitution of low utility goods by high utility goods. Both could be the results, of, amongst others, changes in price structures or changes in infrastructures.

Production

Next to the calculation of the impact of policy sub-options on aggregate household utility, TREMOVE also calculates the impacts on the overall production costs of firms and service sectors. As TREMOVE is a partial equilibrium model, it assumes that the overall production level of goods and services is not affected by the policy sub-options.

Public funds

To evaluate the welfare effect of these increases in tax revenues, an assumption has to be taken on the way in which the government will make us of the additional tax revenues from the transport sector. As the government balances its revenues and expenses, changes in revenues from the transport sector will be compensated in one or another way.

External costs

In TREMOVE, country values for external costs per ton of pollutant are derived from the cost-benefit analysis research in the Clean Air for Europe Programme.

Furthermore, it has to be noted that the results of the TREMOVE model runs involve uncertainty, given that it is based on the current knowledge regarding vehicle mileage, vehicle stock and specific emissions. Any future change in these variables can introduce some variation in the final impacts of any of the Euro VI sub-options.

TREMOVE version 2.43b covers the period up to 2020. The results of the model runs performed with this version of the model are provided in Section 6.2.5.1.

Given that in 2030 a higher proportion of heavy duty vehicles on EU roads will have been type approved according to Euro VI than in 2020, it is considered also appropriate to evaluate the cost and benefits of the different sub-options in that year. TREMOVE version 2.52 covers the period until 2030 and uses different emission factors and assumptions than version 2.43b. This version of the model became available during the

impact assessment process. The results of the model runs performed with this version of the model are provided in Section 6.2.5.2.

The main differences between the two versions are the following:

- v2.52 covers EU31, while v2.43b covers EU21. This results in a total number of vkm in v2.52 37.7% higher than v2.43b, which is directly reflected on the calculated emission reduction;

- The NOx emission factors in v2.52 are much higher than in v2.43b, up to 3.4 times. This originates from the shift from COPERT III to COPERT IV methodology and the assumptions made for the aggregation of emissions into TREMOVE heavy duty vehicle categories.

- The PM emission factors between the two versions are not much different, except for buses. However, all values are consistent with the COPERT IV emission factors.

- COPERT IV emission factors for HDV have a more detailed vehicle type categorization (19 classes), while COPERT III included 6 classes.

- v2.52 does not distinguish between Buses and Coaches as V2.43b did. V2.52 has only one category: "Buses".

The impacts of the emission limit value sub-options have been calculated also with version 2.52 of the model. The results are provided in Section 6.2.5.2.

It should be noted that the codes used for sub-options in the TREMOVE model runs are different from those used in this impact assessment.

6.2.5.1. Evaluation of sub-options with TREMOVE 2.43b

The sum of the PM and NOx pollution abated and the detailed cost and benefit analysis for each sub-option are the following:

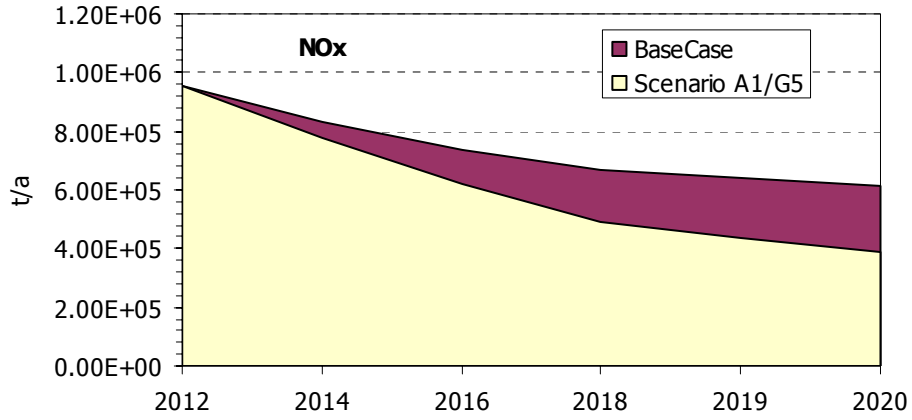
Sub-option A

Table 6: Total NOx and PM emissions - difference between baseline and sub-option A in 2020

	tons	percent
Total NOx	226929	37
Total PM	3290	22

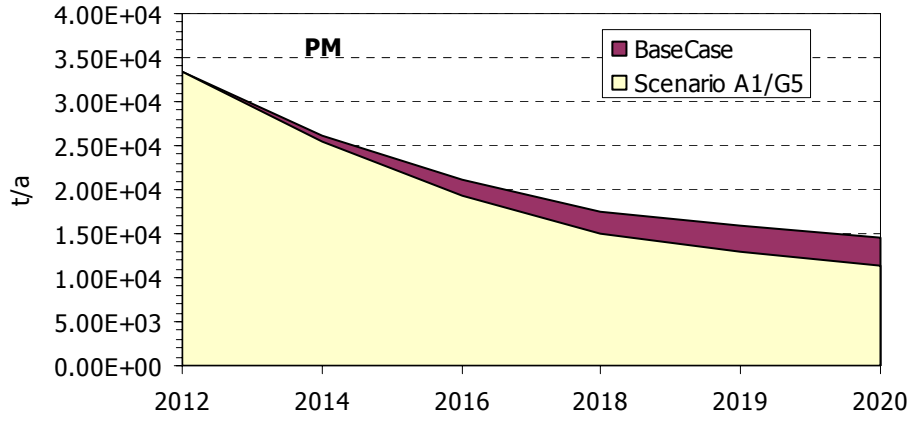
Source: LAT study, p. 46

Figure 1: Total NOx emissions – 2012-2020 – Sub-option A (in tons/annum)



Source: LAT study, p. 46

Figure 2: Total PM emissions – 2012-2020 – Sub-option A (in tons/annum)



Source: LAT study, p. 46

Table 7: Monetary impact of sub-option A in 2020 (million Euros)

Sum of utility of households	43.7
Sum of production costs	827.3
Sum of cost of public funds (general)	82.9
Total welfare effect w/o pollution benefits (general)	**953.9**
Sum of external cost CO	0.0
Sum of external cost CO2	12.7
Sum of external cost N2O	0.4
Sum of external cost NOx	3,455.9
Sum of external cost PM	270.9
Sum of external cost SO2	16.3
Sum of external cost VOC	224.4
Pollution benefits	**3,980.6**
Sum of welfare (general)	***3,026.7***

Source: LAT study, p. 45

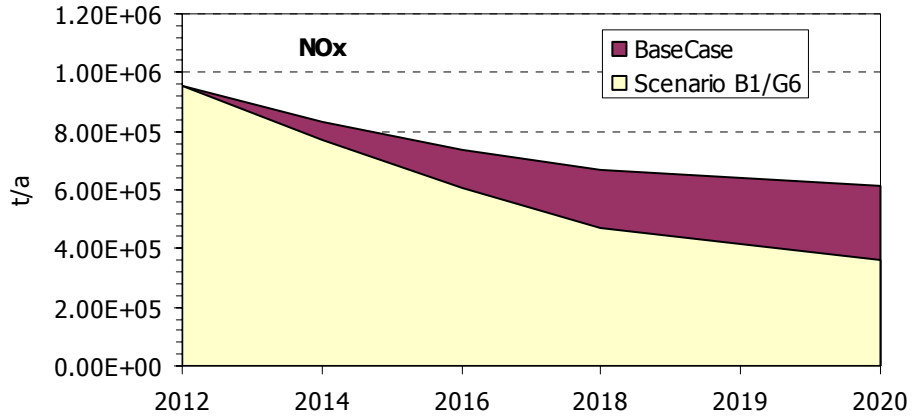
Sub-option B

Table 8: Total NOx and PM emissions -
difference between baseline and sub-option B in 2020

	tons	percent
Total NOx	255177	41
Total PM	1628	11

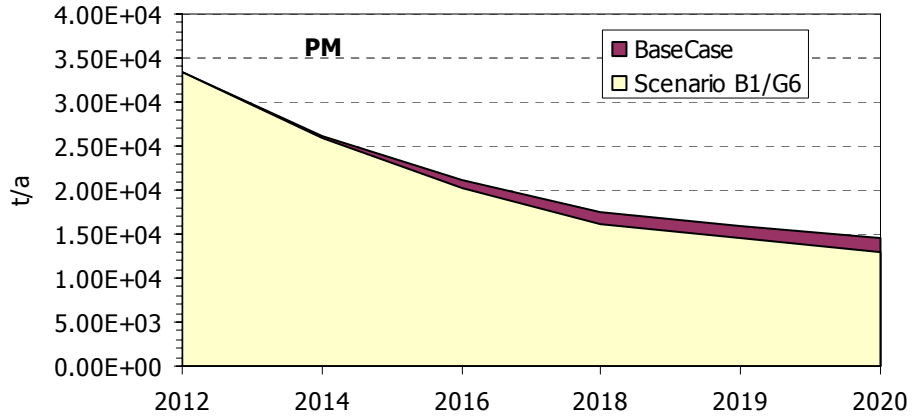
Source: LAT study, p. 48

Figure 3: Total NOx emissions – 2012-2020 – Sub-option B (in tons/annum)



Source: LAT study, p. 48

Figure 4: Total PM emissions – 2012-2020 – Sub-option B (in tons/annum)



Source: LAT study, p. 48

Table 9: Monetary impact of sub-option B in 2020 (million Euros)

Sum of utility of households	46.6
Sum of production costs	893.0
Sum of cost of public funds (general)	90.0
Total welfare effect w/o pollution benefits (general)	**1,029.7**

Sum of external cost CO	0.0
Sum of external cost CO2	13.7
Sum of external cost N2O	0.5
Sum of external cost NOx	3,885.9
Sum of external cost PM	136.6
Sum of external cost SO2	17.6
Sum of external cost VOC	2.8
Pollution benefits	**4,057.1**
Sum of welfare (general)	*3,027.4*

Source: LAT study, p. 47

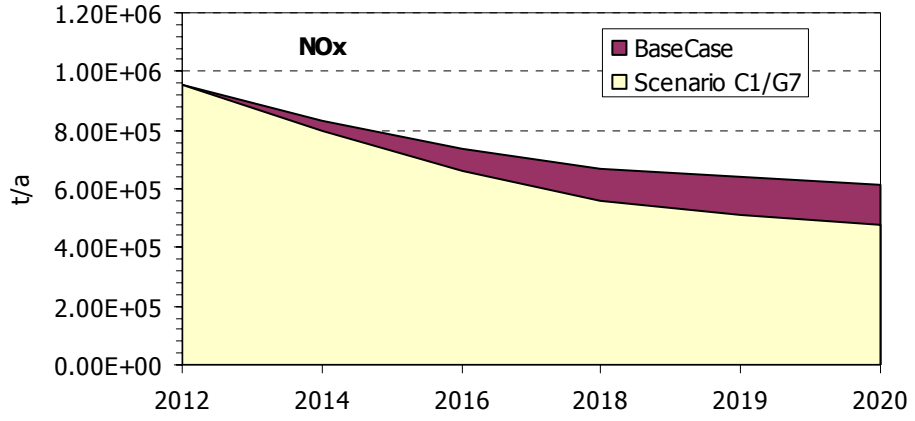
Sub-option C

Table 10: Total NOx and PM emissions - difference between baseline and sub-option C in 2020

	tons	percent
Total NOx	142030	23
Total PM	2459	17

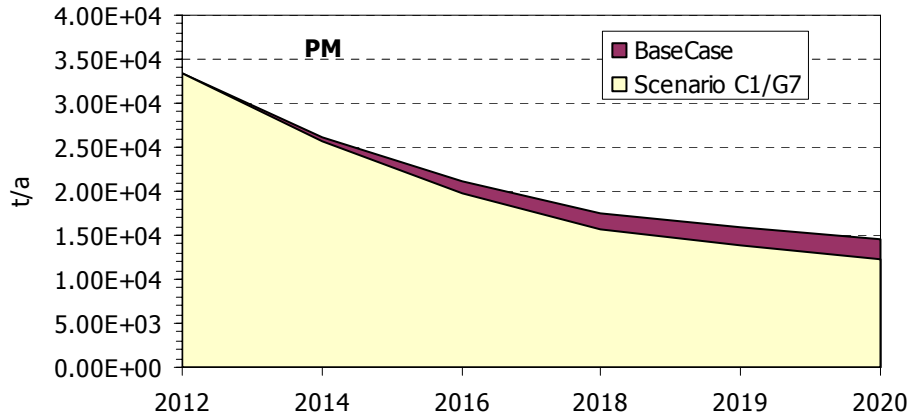
Source: LAT study, p. 50

Figure 5: Total NOx emissions – 2012-2020 – Sub-option C (in tons/annum)



Source: LAT study, p. 50

Figure 6: Total PM emissions – 2012-2020 – Sub-option C (in tons/annum)



Source: LAT study, p. 50

Table 11: Monetary impact of sub-option C in 2020 (million Euros)

Sum of utility of households	27.4
Sum of production costs	480.0
Sum of cost of public funds (general)	46.1
Total welfare effect w/o pollution benefits (general)	**553.5**
Sum of external cost CO	0.0
Sum of external cost CO2	7.2
Sum of external cost N2O	0.2
Sum of external cost NOx	2,162.2
Sum of external cost PM	201.7
Sum of external cost SO2	9.2
Sum of external cost VOC	1.4
Pollution benefits	**2,381.9**
Sum of welfare (general)	*1,828.4*

Source: LAT study, p. 49

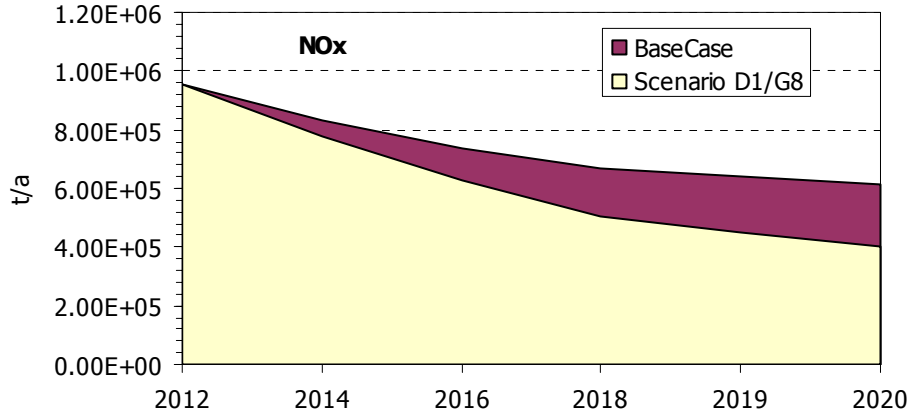
Sub-option D

Table 12: Total NOx and PM emissions - difference between baseline and sub-option D in 2020

	tons	percent
Total NOx	212806	35
Total PM	2459	17

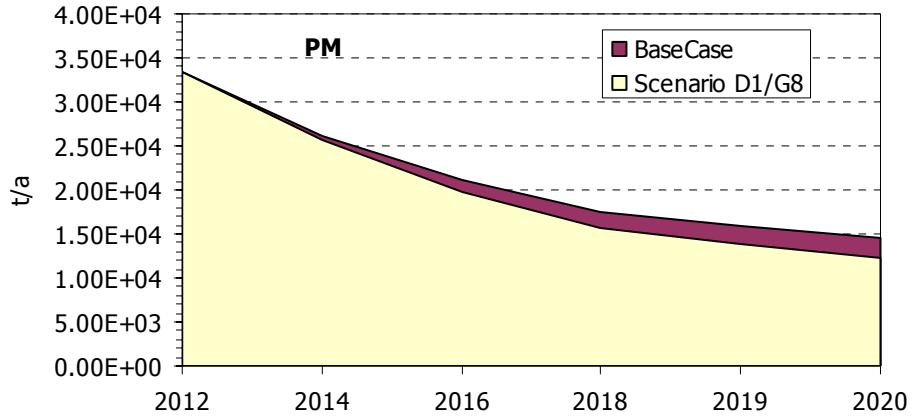
Source: LAT study, p. 52

Figure 7: Total NOx emissions – 2012-2020 – Sub-option D (in tons/annum)



Source: LAT study, p. 52

Figure 8: Total PM emissions – 2012-2020 – Sub-option D (in tons/annum)



Source: LAT study, p. 52

Table 13: Monetary impact of sub-option D in 2020 (million Euros)

Sum of utility of households	29.0
Sum of production costs	525.6
Sum of cost of public funds (general)	51.2
Total welfare effect w/o pollution benefits (general)	**605.9**
Sum of external cost CO	0.0
Sum of external cost CO2	7.9
Sum of external cost N2O	0.3
Sum of external cost NOx	3,238.4
Sum of external cost PM	201.9
Sum of external cost SO2	10.1
Sum of external cost VOC	1.6
Pollution benefits	**3,460.2**
Sum of welfare (general)	*2,854.3*

Source: LAT study, p. 51

On the basis of the performed TREMOVE model runs as described in Section 6.2.5.1, a summary of the monetary impacts in the year 2020 is provided in Table 14.

Table 14: Monetary impacts of Euro VI emission limit value sub-options in 2020 (in million Euros)

	Sub-option A	Sub-option B	Sub-optio C	Sub-option D
NOx limit value (g/kWh)	0,4	0,2	1,0	0,5
PM limit value (g/kWh)	0,01	0,02	0,015	0,015
Total cost	953,9	1.029,7	553,5	605,9
Pollution benefit (decrease in external costs)	3.980,6	4.057,1	2.381,9	3.460,2
Net benefit (general)	**3.026,7**	**3.027,4**	**1.828,4**	**2.854,3**

Source: LAT study (TREMOVE model sub-option runs, pages 16 to 18)

In the year 2020, sub-option A and B provide the highest value of net benefit. However, sub-option B appears to be more costly than sub-option A and would not result in substantially higher pollution benefits. Furthermore, as explained above, sub-option A represents limit values that correspond to the US 2010 values. Therefore, from the perspective of global harmonisation and the cost-benefit analysis, sub-option A should be preferred.

6.2.5.2. Evaluation of sub-options with TREMOVE 2.52

The sum of the PM and NOx pollution abated and the monetary impact for each sub-option are the following:

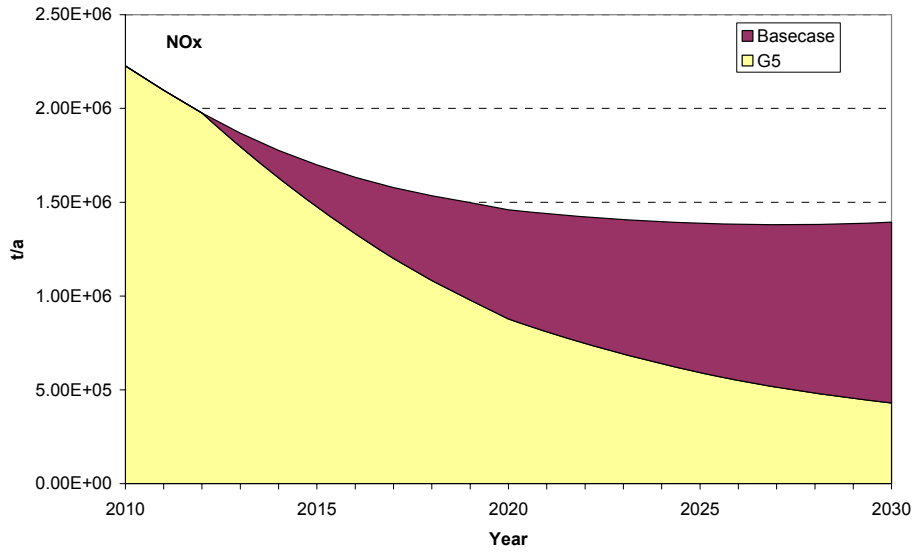
Sub-option A

Table 15: Total NOx and PM emissions - difference between baseline and sub-option A in 2030

	tons	percent
Total NOx	964437	69
Total PM	8341	55

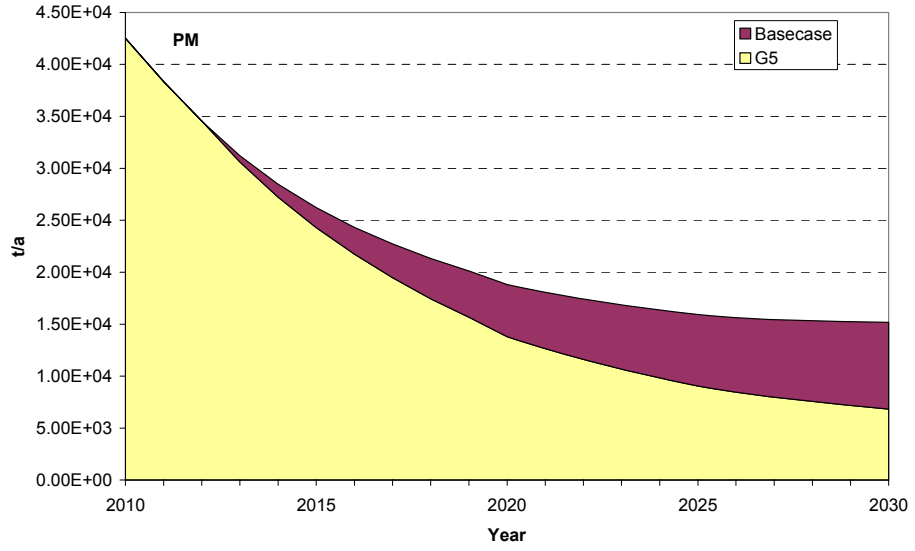
Source: TREMOVE 2.52

Figure 9: Total NOx emissions – 2012-2030 – Sub-option A (in tons/annum)



Source: TREMOVE 2.52

Figure 10: Total PM emissions – 2012-2030 – Sub-option A (in tons/annum)



Source: TREMOVE 2.52

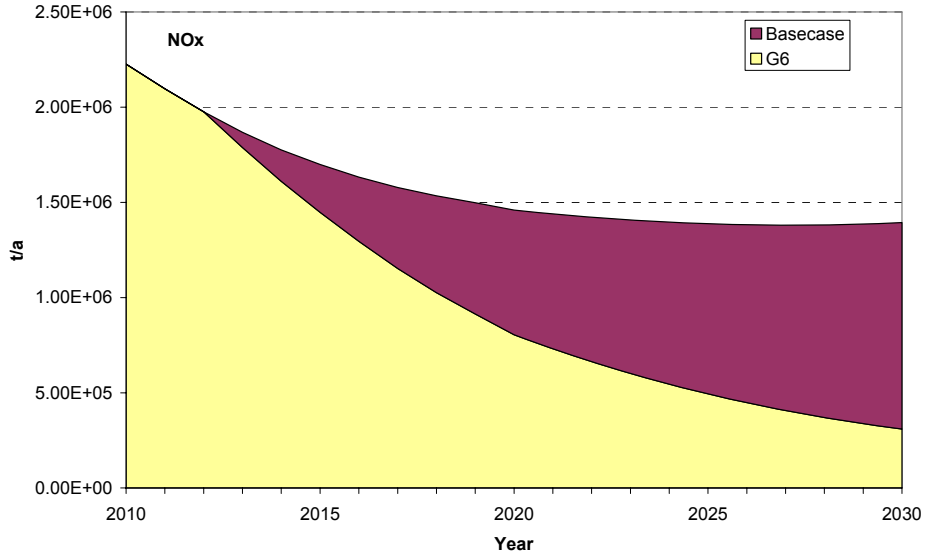
Sub-option B

Table 16: Total NOx and PM emissions -
difference between baseline and sub-option B in 2030

	tons	percent
Total NOx	1084084	78
Total PM	4145	27

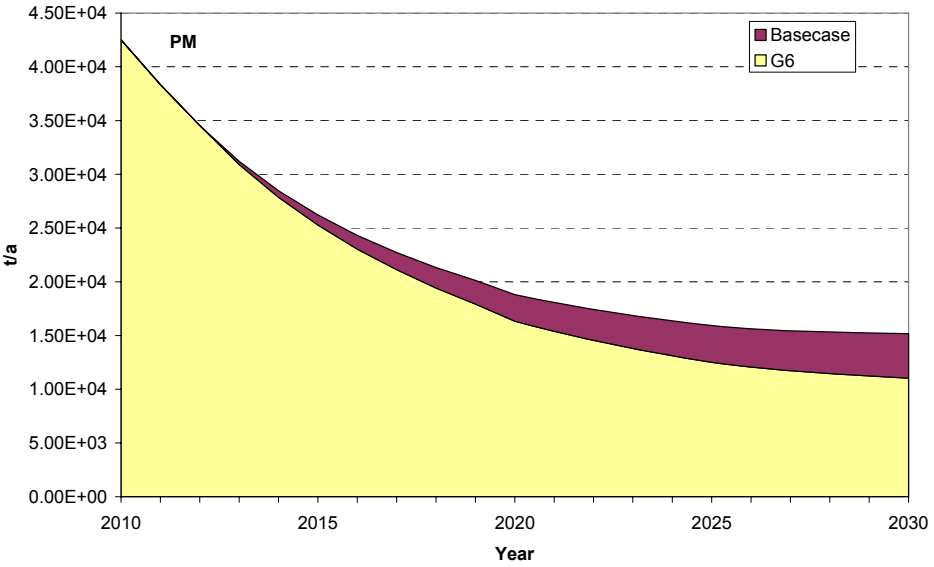
Source: TREMOVE 2.52

Figure 11: Total NOx emissions – 2012-2030 – Sub-option B (in tons/annum)



Source: TREMOVE 2.52

Figure 12: Total PM emissions – 2012-2030 – Sub-option B (in tons/annum)



Source: TREMOVE 2.52

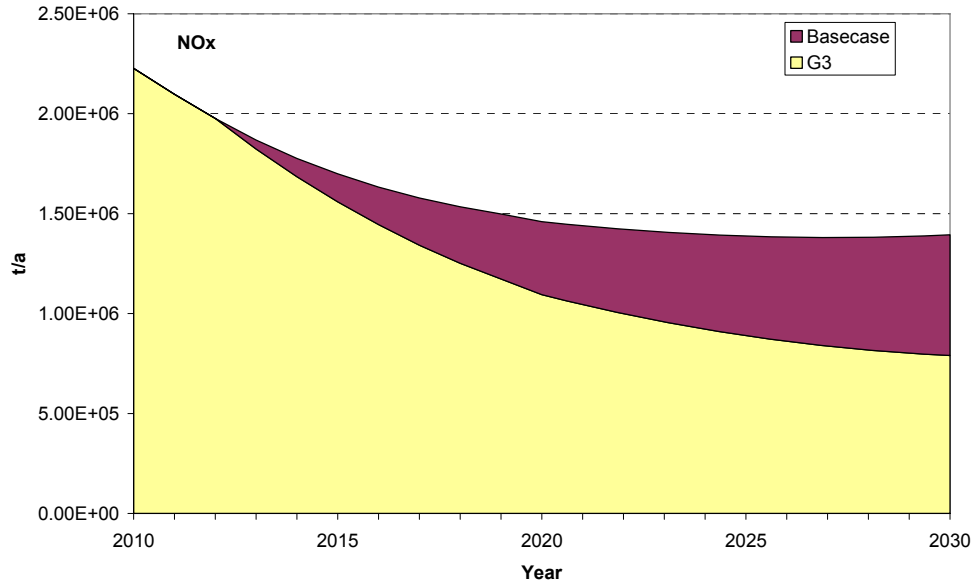
Sub-option C

Table 17: Total NOx and PM emissions -
difference between baseline and sub-option C in 2030

	tons	percent
Total NOx	604031	43
Total PM	6228	41

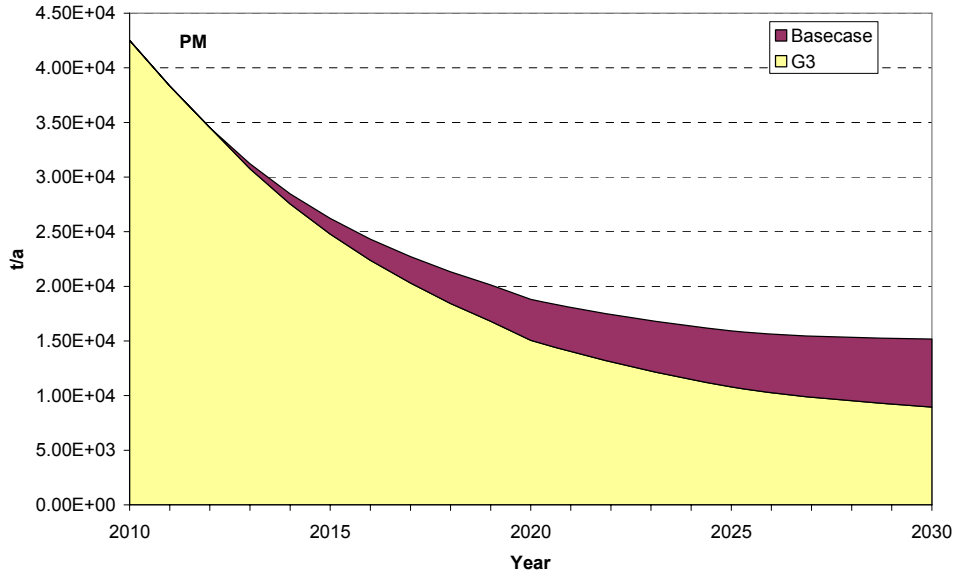
Source: TREMOVE 2.52

Figure 13: Total NOx emissions – 2012-2030 – Sub-option C (in tons/annum)



Source: TREMOVE 2.52

Figure 14: Total PM emissions – 2012-2030 – Sub-option C (in tons/annum)



Source: TREMOVE 2.52

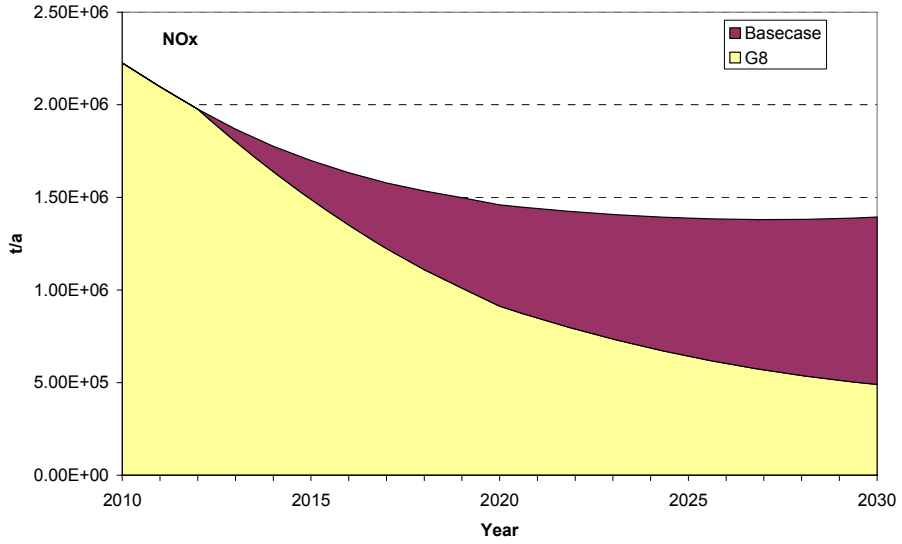
Sub-option D

Table 18: Total NOx and PM emissions -
difference between baseline and sub-option D in 2030

	tons	percent
Total NOx	903984	65
Total PM	6230	41

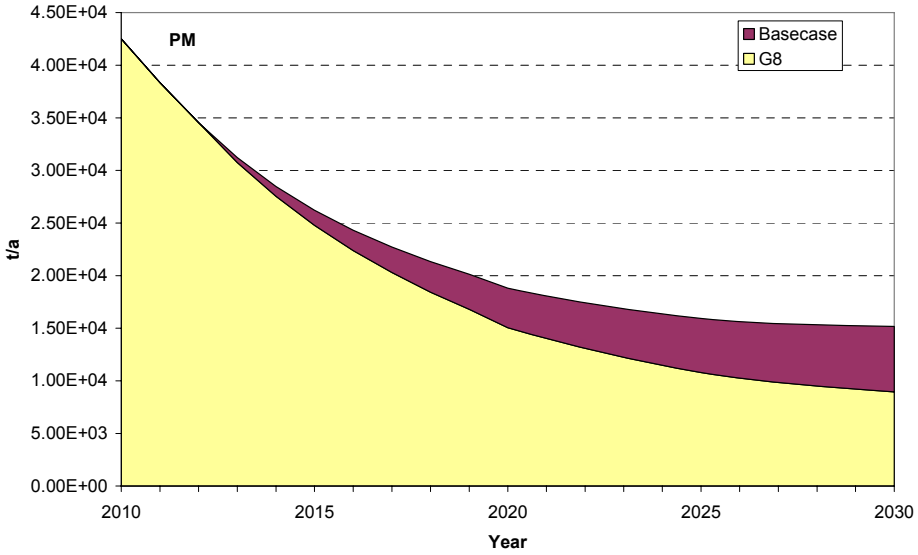
Source: TREMOVE 2.52

Figure 15: Total NOx emissions – 2012-2030 – Sub-option D (in tons/annum)



Source: TREMOVE 2.52

Figure 16: Total PM emissions – 2012-2030 – Sub-option D (in tons/annum)



Source: TREMOVE 2.52

Table 19: Monetary impacts of Euro VI emission limit value sub-options in 2030 (in million Euros)

	Sub-option A	Sub-option B	Sub-option C	Sub-option D
NOx limit value (g/kWh)	0,4	0,2	1,0	0,5
PM limit value (g/kWh)	0,01	0,02	0,015	0,015
Total cost	2.615,6	2.823,6	1.511,6	1.654,4
Pollution benefit (decrease in external costs)	5.689,7	6.221,9	3.587,4	5.250,3
Net benefit (general)	**3.074,1**	**3.398,4**	**2.075,9**	**3.595,8**

Source: LAT study No. 2, p. 24

It can be observed that in the year 2030, the net benefit of sub-option A is somewhat lower than the corresponding value for sub-option D or B. However, the pollution benefit of sub-option A is substantially higher than the corresponding value of sub-option D. With regard to sub-option B, it needs to be taken into account that it has the highest cost of all sub-options. In addition, its relatively high benefits come at the cost of a CO_2 penalty of 5 to 6% (see section 6.2.4. above).The cost of the CO_2 penalty has not been monetised but it is clear that it considerably reduces the environmental benefit of option B.

On the basis of the above considerations and taking into account the aspect of global harmonisation, **sub-option A is seen as the most appropriate for the introduction of the Euro VI stage of limit values**.

Furthermore, the LAT study has concluded that the costs associated with the different technologies required for meeting the different sets of emission limit values do not influence the transport demand, i.e. the application of even the most stringent set of limits would have no impact on road transport demand.[37]

6.3. Impact of other measures

In addition to the options for reducing emission limits there are a number of additional aspects that have been considered as part of the proposal. These measures contribute to the policy objectives of the proposal, i.e. ensuring the proper functioning of the internal market while providing for a high level of environmental protection.

The TREMOVE model is not designed to evaluate the impacts of measures, such as the extension of durability requirements and the introduction of requirements relating to 'access to vehicle repair information'. Therefore, the analysis has to be restricted to a qualitative evaluation.

[37] LAT study, p. 24

These measures are essential to achieve better control of emissions from heavy-duty vehicles and to ensure that the limit values are respected during their whole useful life. They will also contribute to improve the functioning of the internal market. This is shown by the fact that the majority of these measures have already been introduced with the latest stage of light-duty vehicle emission standards (Euro 5 and 6).

No re-distributional and employment impacts are foreseen due to the introduction of the measures mentioned below.

6.3.1. Particulate emission limits for gas (positive ignition) engines

The proposal includes the introduction of a particulate matter emission limit for gas engines. Particulates from gas engines are currently unregulated in the EU, although for the consideration of environmentally enhanced friendly vehicles (EEV) a PM limit of 0.02 g/kWh has been introduced. It is considered that the PM emissions from gas fuelled engines should be regulated.

In any case, the influence of the PM emitted by those engines, with respect to the total amount of PM coming from heavy duty vehicles, will be quite small since as stated above, gas engines in heavy duty vehicles represent less than 0.2% of the total number of those vehicles.[38]

However, results from the stakeholder consultation have suggested that the strictest limit values described in the above mentioned sub-options could be achieved without the use of any after-treatment technology.[39] Therefore, the introduction of such a limit value will not imply additional costs for manufacturers.

6.3.2. Regulating the number of particulates emitted

The proposal indicates that as soon as the results of the UN/ECE Particulate Measurement Programme for heavy-duty vehicles are going to be available, a particulate number standard will be introduced. The standards would be set so that they broadly correlate with the mass standards of the current proposal.

The existing regulation focuses on the total mass of particulate that is emitted. However there is serious concern about the health effects of ultra fine particulates (of very low mass). The main issues with ultra fine particles are summarised in Box 2.

Box 2: The importance of controlling emissions of ultra fine particles

Discussion on particulate pollution frequently focuses on impacts from two different size thresholds, these are all particles below 10µm (PM 10) and a subset of those which are smaller than 2.5µm (PM 2.5). Most diesel exhaust particles are considerably smaller than 2.5µm and thus contribute to both statistics. In addition, concerns have been raised about the health impact of ultra fine particles (commonly defined as those below 0.1µm). For example:

[38] LAT study, p. 7

[39] TNO Report, p. 34-35

- Wichmann (2003) reports that the limited numbers of available studies suggest that ultra fine particles do have health impacts beyond those of fine particles.

- The study on Health Effects of Air Pollution on Susceptible Subpopulations (HEAPSS) study reported that particle number concentration and CO, both originating from traffic and other combustion processes, were the pollutants most strongly associated with all the health effects considered (HEAPSS 2004).

In addition to effects on the function of the lungs and blood circulation, more recent evidence also points to a penetration of ultra fine particles into nerve tissue including the brain (see e.g. Oberdörster et al. 2005).

The Scientific Committee on Health and Environmental Risks (SCHER) of DG Health and Consumer Protection of the European Commission has stated in its opinion[40] that there is increasing epidemiological evidence that PM 2.5 may be related to adverse health effects especially in susceptible populations and vulnerable groups. An unambiguous threshold for PM 2.5 dose has not yet been established and it appears to depend on the health effect endpoint, populations and vulnerability.

The scientific evidence suggests that limiting emissions of ultra fine particles is especially important to health.

The much reduced particulate emission limits which the Euro VI proposal is considering will most likely be met by the use of diesel particulate filters. Current technological solutions use wall flow (or 'closed') filters which are effective at reducing emissions of all types of particles including the ultra-fine. Other filter technology also exists that operates on 'open' principles. These filters are effective at removing most of the mass of particulates from the exhaust stream, but may not result in significant reduction in the ultra-fine particulates. As development of filters continues it is possible that greater use will be made of open filters to reduce the mass of particulates. This would lead to a situation where high emission levels of ultra-fine particles continue to be created.

The use of a particle number standard is a means to ensure that emissions of ultra fine particles are controlled and that developments in filter technology continue to focus on the removal of ultra fine particles. Present test procedures set down in European legislation do not include a method for measuring particle number. Therefore a new procedure would be required to be adopted if such an emission standard were to be introduced. Work on developing and testing a new measurement protocol for both particulate mass and number is taking place at the United Nations Economic Commission for Europe (UN-ECE) under the World Forum for Harmonisation of Vehicle Regulations (WP 29) in Geneva. This work is at a very advanced stage for light-duty vehicles and particulate number standards will be introduced with the implementing measures of the Euro 5 and 6 Regulation[41]. The programme for heavy-duty vehicles has just been started. Once this work is complete, the new standard shall be implemented into European legislation.

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[40] Scientific Committee on Health and Environmental Risks (SCHER): Opinion on "New evidence of air pollution effects on human health and the environment", 18 March 2005, http://europa.eu.int/comm/health/ph_risk/committees/04_scher/docs/scher_o_009.pdf

[41] Regulation (EC) No 715/2007 of the European Parliament and of the Council of 20 June 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, OJ L171, 29 June 2007

Introducing a new test procedure introduces costs to industry and testing facilities in adapting their practices. However, given that the procedure will have already been implemented for light-duty vehicles and as a number of laboratories are involved in the work piloting the procedures, some of the costs have already been incurred.

Furthermore, the development of a more accurate variation of the current test procedure for measuring particulate mass is considered in order to provide repeatable results at low emission limits. Therefore there are good reasons for introduction of most of the measurement methodology to improve the accuracy of particulate mass measurement, irrespective of whether the number measurement component is used.

Consequently, measuring the number of particulates instead of their mass could be considered as a more effective means of regulation in the future.

6.3.3. Durability requirements

For the time being, existing legislation requires manufacturers to confirm the durability of pollution control devices in heavy duty vehicles depending on the category they belong to. The new proposal includes the extension of this durability period from 100,000 km to 160,000 km for vehicles of category M1, N2 and M2, in line with the requirements of the Regulation on light duty vehicles (Euro 5&6). The period would more realistically reflect the actual life of vehicles of the above mentioned categories and ensure that emission control systems continue to function throughout the life of the vehicle.

The current durability requirements for other vehicle categories would be reviewed when adopting the implementing measures of the regulation. Extending the durability requirements would therefore be in line with the principle of ensuring that a vehicle continues to produce low emissions for its entire lifetime.

At present, there are two ways in which manufacturers demonstrate the durability requirement:

- Manufacturers can test for durability using either operation on track, road, or on a chassis dynamometer using a defined test protocol; or

- A manufacturer may choose to apply standardised deterioration factors to the measured emissions limit. The factors vary for CI and PI angines and for the different pollutants. They reflect the general changes in performance that can be expected over time of standard emission control technologies.

The vast majority of manufacturers make use of the second approach as this avoids the need for extensive testing. Thus, changing the durability requirements will not impose any significant testing costs on manufacturers as they would apply an amended set of deterioration factors. It does not appear that this requirement as such imposes significant costs on manufacturers, as aftertreatment devices are designed to function for such distances without the need for replacement.

6.3.4. Access to vehicle repair information

The proposal requires the provision of vehicle repair information through websites in accordance with the specifications developed through the OASIS Technical Committee which the Commission chaired, in order to ensure access to this information for all

service and repair operators, whether independent or within the supplier's distribution system.

The obligation to provide this information already existed; the provisions in this proposal constitute the details necessary for that obligation to be implemented in practice. The Block Exemption Regulation imposed as a general requirement that motor vehicle suppliers provide all operators, whether independent or within the supplier's distribution system, access to the necessary information for repair and service of vehicles, but without further details of the method through which this obligation would be implemented. Directive 2005/55/EC regarding Euro IV and V, as amended, noted the need for unrestricted and standardised access to repair information, in particular related to on-board diagnostic systems and the diagnosing, service and repair of vehicles.

A standardised format for making such information available through websites has been developed by a technical committee of stakeholders under the framework of the OASIS consortium. Other attempts at developing international standards in this area have been unsuccessful. Access to this information, which forms a vital part of testing and monitoring emissions performance, has proved highly variable across the internal market.[42] Indeed, it is likely that access to this information will only prove more difficult and more variable due to the increasing complexity of electronic systems incorporated in vehicles, which creates the knock-on effects of requiring more specialised tools and further specialised knowledge in order to perform repairs and maintenance which might previously have been non-existent or routine.

The principle of non-discriminatory access to this information for both authorised dealers and those outside the supplier's distribution chain was already established in the legislation mentioned above, so no additional burden on manufacturers is being created. The provisions in this proposal do not require manufacturers to create new webpages nor do they require the creation of repair information in a new format for existing vehicles (*i.e.,* there is no retrospective obligation). The effect of the proposed measures is only to require manufacturers to provide the information on their web pages Similar requirements to those proposed here have already been in operation in the United States, where fees appear to be reasonable and vary with the length of time for which access is required. The impact of this measure on manufacturers is likely to be cost-neutral as they will be able to charge reasonable and proportionate fees for access to the information.

The benefits of the proposal are manifest. The proper flow of this information should create beneficial competition in the sector which will give consumers greater and freer choice of when and where to repair their vehicles. Access to this information in a reasonable and non-discriminatory manner is not only useful for routine maintenance, but can be crucial for motorists in more isolated or remote areas where there may be no choice of repairer, or when travelling from an area where one mark of vehicle may be common to an area where that is not the case.

Access on reasonable terms to this information for small and medium-sized enterprises in the sector is vital as they cannot afford the myriad specialised tools and dedicated

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[42] See study COMP/F-2/2003/26/S12.371920 performed by the Institut für Kraftfahrwesen Aachen, October 2004, which examined access to repair information for nine major car manufacturers and seven major truck manufacturers across eight Member States.

information services available to a distributor. Roadside assistance organisations, which need access to repair information in order to perform even simple tasks such as helping motorists with battery replacement, will benefit and in turn will be able to provide the service expected of them by motorists in difficulties. Expected benefits of the proposal will therefore exceed any incurred costs for manufacturers to make any changes required and they will be able to recoup those costs through charges for the information.

In the public consultation, the Association of independent repairers (AFCAR) requested that similar aftermarket provisions to those ones currently included in the Euro 5 and 6 Regulation be included in the new Euro VI Regulation.

6.3.5. Monitoring of carbon dioxide (CO_2) emissions

The Commission is considering the introduction of a standardised method of measuring fuel consumption and carbon dioxide emissions of heavy duty vehicles in order to monitor the contribution of this sector to the global emissions of greenhouse gases (GHG).

Carbon dioxide is not considered as a pollutant but its effect in the global warming of the earth makes it necessary to control it.

The introduction of this measurement will not impose any cost in the type approval process since the necessary equipment for the evaluation and calculation of CO_2 emissions are already present in the testing facilities.

6.3.6. Introduction of global harmonised requirements

Regulations governing the exhaust-emissions from heavy duty vehicles have been in existence for many years but the methods of measurement vary in the different regions of the world. To ensure the maximum benefit to the environment as well as economies of scale regarding engine design, it is desirable that as many countries as possible use the same high standards of emission control.

As manufacturers of heavy-duty vehicles are already operating in a world market, it is economically inefficient for them to have to prepare different models in order to meet different emission regulations which are, in principle, aimed at achieving the same objective. In order to enable manufacturers to develop new models in the most effective way, the Commission intends to include in the Euro VI proposal the technical requirements developed in the framework of the World Forum for Harmonisation of Vehicle Regulations (WP.29) of the United Nations Economic Commission for Europe.

Those requirements are based on research into the world-wide pattern of real heavy commercial vehicle use. From the collected data, two representative test cycles, one transient test cycle (WHTC) and one steady state test cycle (WHSC), have been created covering typical driving conditions in the European Union, the United States of America and Japan. Based on real life data a model was developed for translating the vehicle cycle into an engine cycle. The general laboratory conditions for the emission test and the engine family concept have been brought up to date by expert committees in ISO and reflect the latest technologies.

The WHTC and WHSC test procedures reflect world-wide on-road heavy-duty engine operation and provide a marked improvement in the test procedure for measuring the emission performance of existing and future heavy-duty engines.

Global harmonised provisions will also imply the introduction of requirements on on-board diagnostic (OBD) systems and on the verification of off-cycle emissions (OCE)

Since the above mentioned methodology will replace the currently existing one, it will not add any cost to vehicle manufacturers but for those manufacturers that are active in the global market, these measures will bring substantial benefits.

6.3.7. New methodology for in-service conformity.

Current legislation includes provisions regarding the conformity of vehicles and engines with the emission limits during the useful life of the engine installed in a vehicle under normal conditions when properly maintained and used. To verify that, the vehicle manufacturer has to provide to the type approval authority data on the performance of a range of representative vehicles or engines of which the manufacturer holds the type approval.

Considering that obtaining test data from the engine test bench, as required in the current legislation, is quite costly and time consuming (i.e. it requires the removal of the engine from the vehicle), the Commission is developing a new procedure, in cooperation with engine and measuring equipment manufacturers, type approval authorities and accredited technical services, to introduce in-service conformity provisions based on the use of portable emission measuring systems (PEMS).

When implemented, this procedure will reduce the burden of emission legislation for manufacturers.

6.4. Preferred Option

The preferred policy option is the 'Regulatory approach', which means further regulation of vehicle emission limits. This is seen as an essential means of sustaining a single market for vehicles and providing for better air quality in Europe, while safeguarding the affordability of vehicles at the same time. Taking into account the need for striking the balance between higher environmental standards and the continued affordability of heavy duty vehicles for the operators, the following emission limit values are proposed for compression-ignition and positive-ignition engines, which result in a significant overall reduction of pollutants.

6.4.1. Emission limits for compression-ignition and positive-ignition engines

A- 0.01 g/kWh for PM. It implies:

- Significant reduction 66% in particulate matter emitted

- It would imply the introduction of particulate filters for compression-ignition engines

- No additional filter for positive-ignition engines

- It is in line with the US standard and future global harmonisation.

B- 0.4 g/kWh for NO_X. It implies:

- Significant reduction 80% in the emission of NOx

- Contribution to the objectives of the National Emissions Ceiling (NEC) Directive

- Reasonable balance between NOx and CO_2 emissions

- It is in line with the US standard and future global harmonisation.

These values, that correspond to sub-option A, have been chosen as the most appropriate set of emission limit values, since they provide a high amount of environmental benefit at a reasonable cost. Further, their impacts on fuel consumption and thus, CO_2 emission are estimated to be negligible.

As explained in the previous sections, sub-option A provides an environmental benefit close to that of sub-option B and this at a lower cost. Sub-option B is the most costly and would result in a fuel consumption and CO_2 emission increase of 5-6%. This penalty could not be included in the monetised impacts. If it had been, it would decrease the benefits of scenario B considerably. At the same time, sub-option A would not result in a significant increase of CO_2 emissions, a fact that has been confirmed by the public consultation responses.

Furthermore, sub-option B would introduce a limit value for particulate matter which is double the value for sub-option A and the highest amongst all sub-options. The health concerns relating to particulate matter are significant and can be linked to reduced life expectancy. This higher PM limit value for sub-option B is not likely to ensure that diesel particulate filters (DPFs) are fitted on all heavy-duty vehicles. To current technology, DPFs need to be fitted to ensure effective removal of particulates from the exhaust.

In addition, the aspect of global harmonisation can not be included in the calculations of TREMOVE, but it is very important to be considered. As previously explained, sub-option A corresponds to the US 2010 values. With the introduction of a Euro VI standard that is equivalent to that in the US, engine and vehicle manufacturers would benefit from economies of scale linked to higher production volumes. Furthermore, considering that the daily cost for the use of an engine test bench is in the order of 2 500 € it can be seen that the benefit of global harmonisation for the industry is really important. This also has been confirmed by the public consultation.

6.4.2. Additional requirements

The additional aspects of the proposal ensure that the overall emission of road transport is reduced. For instance, the extension of the durability requirements provides for a stable environmental performance of the vehicles throughout a much longer period of their

actual life without imposing a significant cost on manufacturers. With the use of PEMS, manufacturers and type approval authorities will have a useful tool to ensure that the vehicles do not exceed the specified limit values during their lifespan. Furthermore, the introduction of a particulate number standard will reduce the risk that open filters are specified in the future as engine and filter technology develops. With global harmonised requirements the general objectives of air quality will be fulfilled at a lower cost for manufacturers.

6.5. Indicators of progress towards meeting the objectives

The key mechanism by which the proposed Regulation will take effect is through the vehicle type-approval process. Vehicle manufacturers will need to demonstrate that vehicles comply with – amongst other things – the emission limit requirements in order to receive a type-approval certificate. The core indicators of progress will therefore be the number of vehicles which are successfully type-approved according to the Euro VI standard.

6.6. Monitoring and evaluation

Monitoring of the effect of the Regulation is effectively undertaken by type approval authorities who oversee in-service conformity processes to ensure that requirements of the Regulation are met. More generally, monitoring data on air pollution levels and epidemiology on health impacts will point to the wider success of the policy.

Annex 1: Issues raised during the public consultation

At the date of closing the public (internet) consultation, a total of 55 replies were received to the request for comments. Of these the breakdown by source is as follows:

- Governmental organisations……. 9 replies
- Regional and Local official Organisations…….4 replies
- Industry and business organisations…….. 24 replies
- NGOs, consumer and professional groups……. 13 replies
- Individuals…….……. 5 replies

During the consultation, a number of issues were raised by stakeholders. This section summarises the substantive issues raised and discusses how they have been taken into consideration.

Almost all replies welcome the introduction of stringent limit values for the pollutant emissions from heavy duty vehicles. Very few replies state that the current limit values are still valid for the future and that energy efficiency, in terms of fuel consumption and CO_2 emission reduction should be the main priority.

The vast majority of stakeholders support **a single step** with limit values close to those in US2010 (sub-options A or D).

Just eight replies, and within them only two industrial organisations (AGU-CEFIC and CLEPA) are supporting the two step approach. Those organisations are in favour of the less stringent sub-options (sub-option C for Euro VI and sub-option D for Euro VII).

In general terms transport operators and some national administrations (IT and SW) support a fuel neutral sub-option (i.e. **sub-option D**; NOx=0.5 g/kWh).

The motor industry (ACEA) and some other national administrations (among which CH, DE, FR and NL) and non governmental organisations support the introduction of a more stringent set of limit values (i.e. **sub-option A**; NOx=0.4 g/kWh). Additional requirements on on-board diagnostic (OBD), off-cycle emissions (OCE) and in service conformity are also requested. In some replies it is stated that the foreseen fuel penalty associated to this sub-option would be reduced by technical improvements by the date of entry into force of the Regulation.

A vast majority of replies (including ACEA) express support for the global harmonisation of testing procedures and driving cycles (i.e. introduction of WHDC – world-wide harmonised driving cycle) as a means of reaching future global standards while reducing the testing cost for the vehicle manufacturers.

In some replies, including national Administrations such as NL, DK and CH, the Greater London Authority and other non-governmental organisations, the introduction of a limit value for particle number is requested.

Monitoring of CO_2 is supported in some replies.

Other issues can be summarised as follows:

- An independent research centre is proposing a change in the testing methodology and the use of different driving cycles according to the vehicle application but it should be reminded that the current test procedure (test of the engine by using an engine test bench) is the standard one accepted in US, Europe and Japan.

- In one reply the sender asks about the reason to allow higher NOx emissions, in some sub-options, to gas (PI) vehicles. On this issue, it should be noted that the possibility of considering one sub-option for CI engines and another for PI engines was open, as expressed in another reply in which sub-option D is supported for CI engines together with sub-option A for PI engines.

Taking the above comments into account, it seems reasonable to propose the following:

- Introduction of the limit values included in sub-option A, based on the currently applicable ETC (European Transient Cycle) in a single stage for both compression-ignition (CI) and positive ignition (PI) engines. It is to be noted that, in line with the current applicable legislation for natural gas fuelled engines, the limit value for hydrocarbons will be split in non-methane hydrocarbons (NMHC) and methane (CH_4) with values of 0.16 g/kWh and 0.50 g/kWh respectively. This cap for CH_4 was already considered in the questionnaire sent by the Commission and does not introduce any additional burden to natural gas fuelled vehicles since emissions from such vehicles are currently far below that cap.

- Introduction in a further step, through comitology, of equivalent limit values to those mentioned in the paragraph above but referred to WHDC as described in UNECE Regulation 49.

- Introduction of provisions regarding on-board diagnostic (OBD) and off-cycle emissions (OCE) as developed in the framework of UNECE WP29 (World Forum for the Harmonisation of Motor Vehicle Regulations).

- Introduction of provisions regarding durability of after-treatment systems.

- Introduction of requirements on in-service conformity of vehicles during their useful life with the application of portable emissions measurement systems (PEMS).

- Consideration of technologically neutral standards in relation to compression-ignition and positive-ignition engines except for the limitation of un-burnt hydrocarbons (HC) as in sub-option A.

- Introduction, through comitology, of the limitation of particle number taking into account the result of the particle measurement programme (PMP) developed under the auspices of the UNECE

- Monitoring of CO_2 emissions in order to obtain data about the contribution of heavy duty vehicles to the Green House Effect.

- Timing:

- 1 October 2013 for the approval of new vehicle and engine types

- 1 October 2014 for the registration of new vehicles

- Regarding simplification, the new Regulation will repeal four EC directives.

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