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Strategy for reducing Heavy-Duty Vehicles' fuel consumption and CO₂ emissions

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1. INTRODUCTION

The Commission's Roadmap for moving to a competitive low carbon economy in 2050¹ and Transport White Paper² indicate that the transport sector should reduce its CO₂ emissions by around 60% of its 1990 level by 2050. By 2030, to support the recently proposed 2030 climate policy framework objectives³, the goal for transport will be to reduce greenhouse gas emissions to around 20% below their 2008 level. Greenhouse gas emissions from road transport increased by 29% during the period 1990 to 2007 but have since fallen on the back of high oil prices, increased efficiency of passenger cars and slower growth in mobility (by 6% between 2007 and 2011)⁴.

About one quarter⁵ of road transport CO₂ emissions are estimated to be produced by Heavy Duty Vehicles (HDVs). In view of increasing EU freight volumes, these emissions have been rising until the beginning of the economic crisis. In view of their absolute size, trend and relative share HDV CO₂ emissions need to be curbed for the targets of the Transport White Paper are to be met.

Car and van CO₂ emissions are measured and monitored under existing type-approval legislation. However HDV CO₂ emissions are not measured in a standardised way in the EU. This reduces transparency in the EU market. In contrast, Japan, the US and Canada have already legislated, and China is preparing action, to measure and curb HDV CO₂ emissions. This can affect the relative competitiveness of HDV manufacturing in these different regions as well as the businesses which rely on HDV transport. In view of this, EU action on HDV fuel consumption and CO₂ emissions is important for EU competitiveness.

In view of these considerations, in June 2007 the Council invited the Commission "to develop and implement policy instruments and measures to reduce greenhouse gas emissions from HDV vehicles"⁶. The Commission, in its April 2010 Communication on "A European strategy on clean and energy efficient vehicles"⁷, announced that it would propose a strategy targeting fuel consumption and CO₂ emissions from HDVs.

The objective of the strategy is to curb HDV CO₂ emissions in a cost-efficient and proportionate way for stakeholders and society. It should provide stakeholders with a clear, coherent policy framework and indicate likely regulatory developments, thereby facilitating decision making and investment planning.

1 COM/2011/0112 final

2 'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system', COM/2011/0144 final

3 http://ec.europa.eu/clima/policies/2030/documentation_en.htm

4 Source: European Environment Agency

5 Estimated at 26.6% of total EU GHG emissions by AEA-Ricardo in "Lot1" Report, Reduction and Testing of GHG emissions from Heavy Duty Vehicles, February 2011, p 170. Available at:

http://ec.europa.eu/clima/policies/transport/vehicles/docs/ec_hdv_ghg_strategy_en.pdf

6 <http://register.consilium.europa.eu/pdf/en/07/st11/st11483.en07.pdf>

7 COM(2010)186 final, p 6,

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0186:FIN:EN:PDF>

2. THE NEED FOR ACTION TO CURB HDV FUEL CONSUMPTION AND CO₂ EMISSIONS

2.1. Heavy-Duty Vehicles' CO₂ emissions trends are unsustainable

Since the mid-1990s and until the start of the economic crisis HDV freight transport has grown steadily driven by GDP growth while HDV passenger transport has remained broadly constant. Coupled with stable vehicle fuel consumption, these trends have led to increased HDV CO₂ emissions. Between 1990 and 2010 HDV CO₂ emissions are estimated to have grown by about 36%, despite the 2008-2009 economic crisis interrupting the steady growth previously observed⁸.

Total transport activity is projected to grow in the next 40 years but reducing fuel consumption will somewhat mitigate that effect on CO₂ emissions. Under current trends and policies HDV CO₂ emissions are projected to remain stable and thus be about 35% greater than their 1990 level in both 2030 and 2050. This cannot be considered compatible with the EU's policies to reduce GHG emissions and the Transport White Paper's objective to reduce EU transport emissions by 60% by 2050 versus 1990 levels.

2.2. Technology can reduce HDV fuel consumption and CO₂ emissions

Significant fuel consumption and CO₂ emission savings from HDVs are possible through technical improvements to the motor (including heat recovery), transmission, aerodynamics, tyres and auxiliaries, as well as light-weighting. Recent analytical work⁹ shows that cost effective reductions for some 35% of CO₂ emissions of new HDV can be achieved by employing state-of-the-art technologies on vehicles. Reduced fuel consumption makes this cost efficient both from the perspective of transport operators and society.

Furthermore, efficiency can be further enhanced by improved fleet management, better driver training, superior vehicle maintenance and improved capacity management with the benefit of Intelligent Transport Systems (ITS).

2.3. A knowledge gap and market barriers that need to be addressed

Despite the economic importance of fuel consumption, HDV CO₂ emissions are neither measured nor reported¹⁰. The resulting knowledge gap reduces market transparency hampering the entry of energy efficient, lower CO₂ emitting HDVs on the market. Addressing this knowledge gap is a necessary step to curb HDV CO₂ emissions.

A recent study¹¹ suggests a number of possible explanations for the lack of uptake of cost-efficient fuel saving technologies on new HDVs. These market barriers take different forms:

- in spite of fuel efficiency being the primary purchase criterion for transport companies when acquiring a new vehicle, the lack of uptake of fuel saving

8 Source: Odyssee-Mure database, available at: <http://www.odyssee-mure.eu/>

9 Study by CE Delft, Marginal Abatement Cost Curves for HDVs, 2012, http://ec.europa.eu/clima/policies/transport/vehicles/heavy/docs/hdv_2012_co2_abatement_cost_curves_en.pdf

10 HDV CO₂ emissions are not subject to EU legislation other than the future measurement of CO₂ emissions from engines under Regulation (EC) No 595/2009 (Euro VI) which comes into effect in 2014.

11 Study by CE Delft; Market barriers to increased efficiency in the European on-road freight sector; 2012; <http://www.theicct.org/market-barriers-increased-efficiency-european-road-freight-sector>

technologies is linked to the purchase process where few transport companies have data to evaluate technologies or compare vehicles;

- while offering optional fuel saving technologies, manufacturers do not offer them as standard on basic vehicles;
- HDV operators appear to depreciate vehicles over three years which is significantly below the estimated average HDV lifetime of eleven years;
- a lack of access to finance;
- split incentives, i.e. when the purchaser of the vehicle, e.g. a leasing company, does not benefit from fuel savings which accrue to the transport operator.

While aware of the main existing fuel saving technologies improving HDV performance, transport operators are in view of the knowledge gap unable to compare various new vehicles' performance and hence are not in a position to request cost efficient technologies to be included on new vehicles.

2.4. Other countries have already acted

In contrast to the lack of legislation in the EU, other countries have taken action. Japan introduced HDV fuel consumption legislation in 2007. The US regulated HDV CO₂ emissions in 2011, followed, in 2012, by Canada. The US and Canadian legislation targets engine and chassis-cabin CO₂ emissions, implemented via simplified performance values and manufacturers' declarations. The US is currently preparing more ambitious legislation, focussing on the measurement of whole vehicle emissions.

2.5. Action would benefit EU economy

European manufacturers have a leading position on the global HDV market accounting for over 40% of total global production¹². While the EU HDV commercial balance is positive with a significant surplus, this does not fully reflect the strong position of the EU industry as most of the EU manufacturers' production addressed to foreign markets is produced outside Europe. Since fuel consumption is a key purchase parameter, enabling investments by those manufacturers to further improve fuel economy will assist their competitiveness.

While the EU-based production of HDVs represents a lower share of world production (some 12-14%) the worldwide signalling role of EU standards can be considerable as clearly demonstrated by Euro standards for pollutant emissions that have been adopted by numerous other countries, notably China, India, Russia and Indonesia.

Without EU action cost effective opportunities to reduce HDV CO₂ emissions and contribute to lowering overall EU CO₂ emissions would be missed. EU manufacturing industry might not benefit from economies of scale in developing and deploying further CO₂ reducing technologies which might weaken its competitive position on the global market. EU businesses rely on HDVs for a large proportion of their transport. Cost effective reductions in HDV fuel consumption will secure a level of ambition that is affordable for transport operators and end-users, improve the competitiveness of those businesses and reduce energy imports.

12 Source: AEA-Ricardo report available on: http://ec.europa.eu/clima/policies/transport/vehicles/docs/ec_hdv_ghg_strategy_en.pdf, notably pp 26-27, based on statistics from the International Organisation of Motor Vehicle Manufacturers (OICA).

While EU initiatives have already been taken or set out in a number of areas such as vehicle design, management of transport operations, internalisation of external costs, decarbonising fuels and vehicle purchase decisions, a comprehensive EU strategy to curb HDV CO₂ emissions is needed. This will also provide industry with predictability about the future EU regulatory framework in this field.

3. AN EU STRATEGY TO CURB HDV FUEL CONSUMPTION AND CO₂ EMISSIONS

The main drivers of HDV CO₂ emissions and fuel consumption are *transport demand* which is linked to economic activity, *modal split* among road, rail, air and waterways, *fuel GHG intensity*, the *vehicle energy efficiency* and the *operation of HDV fleets*. While addressing overall transport demand is beyond the scope of the present strategy, a comprehensive strategy to curb HDV CO₂ emissions has to address the other main drivers.

3.1. Reinforcing EU policies addressing HDV fuel consumption and CO₂ emissions

The EU has already taken action to directly or indirectly address many HDV CO₂ emission drivers:

- *Modal shift* is a key dimension of EU transport policy which supports inter-modality. The draft EU guidelines for the development of the trans-European transport network¹³ foresee climate change mitigation criteria in the programming of EU funding for new infrastructure. These policies are expected to result in a slow reversal of the trend that led to an increasing share of road transport.
- *Measures to reduce fuel GHG intensity* have led to alternative fuels representing some 6%¹⁴ (2010) of energy use in road transport. Existing legislation¹⁵ aims to favour the use of lower GHG and renewable energy in transport and has set quantitative targets to this effect that are currently under review¹⁶. The recent “Clean Power for Transport” initiative and the revised TEN-T guidelines, supported by the Connecting Europe Facility, further supports the development of alternative fuel infrastructure and increased use of natural gas and biomethane for HDV^{17,18,19}. The Commission has also proposed²⁰ a revision of the “Energy Taxation Directive”²¹ that would restructure the current energy tax system and include a CO₂ element in fuel taxation.

13 COM/2011/650 final, expected to be adopted in mid-2013.

14 Source: Eurostat

15 Directive 2009/28/EC on the promotion of the use of energy from renewable sources (the "Renewable Energy Directive") has established a mandatory target of 10% for renewable energy in the transport sector. At the same time, an amendment to Directive 98/70/EC ("the Fuel Quality Directive") introduced a mandatory target to achieve by 2020 a 6% reduction in the greenhouse gas intensity of fuels used in road transport and non-road mobile machinery.

16 COM(2012)595, http://ec.europa.eu/energy/renewables/biofuels/doc/biofuels/com_2012_0595_en.pdf

17 Commission Communication COM(2013)17 "Clean power for transport: a European alternative fuels strategy", and proposed Directive COM(2013)18 on the deployment of alternative fuels infrastructure. <http://ec.europa.eu/transport/themes/urban/cpt/>

18 Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU
19 Regulation (EU) No 1316/2013 of the European Parliament and of the Council of 11 December 2013 establishing the Connecting Europe Facility, amending Regulation (EU) No 913/2010 and repealing Regulations (EC) No 680/2007 and (EC) No 67/2010

20 COM(2011) 168/3.

21 Council Directive 2003/96/EC of 27 October 2003 : Restructuring the Community framework for the taxation of energy products and electricity, OJ L 283, 31.10.2003, p 51.

- *Support for the development and rolling out of vehicles with a lower carbon footprint* is actively taking place. The "Green Car Initiative" under the Seventh Research Framework Programme included improving HDV fuel efficiency and reducing CO₂ emissions. Support to clean and efficient vehicles is also reflected in the proposed "Horizon 2020 - Framework Programme for Research and Innovation"²². EU legislation also actively supports the purchase of more environment friendly vehicles by public entities²³. The type approval legislation²⁴ on weights and dimensions recently introduced an allowance (50 cm) for aerodynamic devices fixed at the rear of new trucks/trailers. In line with this, the Commission has recently proposed²⁵ a revision of Directive 96/53/EC on weights and dimensions of vehicles in international traffic that goes further by proposing a new set of allowances that should support solutions to improve the aerodynamics of HDV.
- *The importance of vehicle fleet operation is also recognised and addressed.* Road user charging legislation contributes to improving transport efficiency and lowering fuel consumption and CO₂ emissions. Where applied, charges levied from heavy goods vehicles according to Directive 1999/62/EC²⁶ have optimised the use of road transport by reducing empty running and improving load factors, accelerated the renewal of fleets and created conditions for greater co-modality. The recent Intelligent Transport Systems Directive will contribute to accelerating the development and deployment of information technology in the field of road transport and for interfaces with other modes of transport²⁷. In addition, in December 2013 the Commission put forward specific recommendations for coordinated action between all levels of government and between the public and the private sector in urban logistics area, urban access regulation area, deployment of intelligent transport system (ITS) solutions and urban road safety area.

The transport policy framework will continue to be enhanced. As announced in the Transport White Paper, a number of initiatives are in preparation that will further strengthen it:

- *Modal share and shift* to low carbon modes will be further addressed. The foreseen *e-freight initiative* is expected to create a framework to streamline the electronic flow of information associated with the physical flow of goods. Several actions foreseen in the Transport White Paper²⁸ will also influence modal share, notably the development of multimodal goods transport and multimodal freight corridors, as well as new frameworks for inland navigation.
- A number of actions will influence the *operation of freight transport* and are expected to contribute to reduced energy consumption:

22 http://ec.europa.eu/research/horizon2020/index_en.cfm?pg=h2020

23 Directive 2009/33/EC, OJ L120/5, 15.5.2009

24 Regulation EC 661/2009 and Directive 2007/46/EC

25 COM(2013) 195 final

26 Directive 1999/62/EC as amended by Directives 2006/38/EC and Directive 2011/72/EU, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0062:20111015:EN:PDF> (consolidated version).

27 In addition to this, R&D support to the development of ITS is being provided under the current 7th Framework Programme and will be continued under the next EU framework programme for research and innovation for 2014-2020 (Horizon 2020).

28 Transport White Paper, actions 1 "internal market of rail services", 5 "a suitable framework for inland navigation", 7 "multimodal transport of goods", 33 "zero-emission urban logistics 2030", 35 multimodal freight corridors. See <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0144:FIN:EN:PDF>

- A recast of the driving licence directive in 2012 included *eco-driving requirements* for truck drivers' examinations and further efforts are planned to implement these provisions;
- An on-going *review of road user charging legislation* aims to promote a more systematic use of distance related road charging reflecting infrastructure and external costs based on the polluter-pays and user-pays principles;
- A *carbon foot-printing initiative* is under preparation to support improved transparency and end-user information on the CO₂ impact of freight and passenger transport;
- Finally, reviewing restrictions on road cabotage as proposed in the Transport White Paper might also help make road transport more efficient by increasing loading factors of vehicles if done gradually and if combined with measures to improve enforcement and measures to mitigate possible risks of induced road transport.

Nevertheless, to date, action has been missing at EU level to address the fuel consumption and CO₂ emissions of HDVs being placed on the market in a parallel manner to that put in place for cars and vans. The Transport White Paper identified the need for further action in this area²⁹.

3.2. Short-term action addressing the knowledge gap

As noted in section 2.3, a pre-requisite to address HDV fuel consumption and CO₂ emissions is to measure and monitor them. This will address some of the key current market barriers by increasing market transparency and vehicle comparability thus stimulating competition among manufacturers and end-user awareness. As a result it should lead to the production and purchase of more fuel efficient HDVs emitting less CO₂.

It is foreseen to achieve this in two stages:

- **Completion of a simulation tool**

Due to the diversity of HDV models and tasks (e.g. tankers, buses etc.) it is not appropriate to carry out HDV CO₂ testing in the same way as for cars and vans. A computer simulation approach has a number of advantages since it potentially covers all aspects of the HDV, is versatile and highly cost-effective. Since 2009 the Commission, in cooperation with industry stakeholders, has been developing a simulation tool, VECTO³⁰, to measure whole vehicle HDV CO₂ emissions, i.e. including emissions due to vehicles' motor and transmission, aerodynamics, rolling resistance, and auxiliaries. While other countries such as the US and Canada have recently adopted HDV CO₂ emission legislation based on engine and vehicle chassis/cabin emissions, VECTO is expected to be the first industry-wide methodology geared to estimate whole vehicle, including trailer, HDV CO₂ emissions.

The Commission's Joint Research Centre is closely involved in this project. In April 2013 it issued a "Proof of Concept Report"³¹ which concludes that at this point of the trial phase,

29 Action 26; "Appropriate standards for CO₂ emissions of vehicles in all modes, where necessary supplemented by requirements on energy efficiency to address all types of propulsion systems"

30 Vehicle Energy Consumption Calculation Tool (VECTO).

31 Available under: http://ec.europa.eu/clima/policies/transport/vehicles/heavy/studies_en.htm

VECTO provides CO₂ emission estimates sufficiently close to real-world values and reliable enough to form the basis of an EU system to measure HDV fuel consumption and CO₂ emissions.

Further adjustment and improvement of the simulation methodology will enhance its reliability and accuracy. It is expected that VECTO will be operational in May 2014 for at least three HDV categories which together represent more than 50% of HDV CO₂ emissions. It is intended to progressively extend it to other categories of HDVs.

- **Legislative action needed to measure, certify and report HDV CO₂ emissions**

VECTO provides a measurement of fuel consumption and CO₂ emissions for newly registered HDVs. These values, proofed and checked, could be provided for each newly registered HDV and could be reported and monitored. This requires two legislative actions that may be carried out in parallel.

(i) *Certification* of fuel consumption and CO₂ emissions requires adaptation of the relevant type approval legislation. This would require inclusion of the methodology for determining these values in the legislation thus allowing them to be certified by Member States' authorities. This information would thereby also be made available to purchasers.

(ii) *Reporting* is necessary to facilitate the monitoring and dissemination of certified newly registered EU HDV CO₂ values. This will require the adoption, through ordinary legislative procedure, of a new legislation on the reporting of HDV CO₂ emissions as calculated by VECTO by Member States to the Commission paralleling that existing for cars and vans.

Addressing the knowledge gap is a necessary step before more ambitious measures can be considered. While certification, reporting and improved consumer information are not expected to significantly curb HDV CO₂ emissions, they are expected to have a positive impact by enhancing transparency on vehicle efficiency in the market and thus improve competition.

3.3. Policy options for the medium-term

In order to reach ambitious greenhouse gas reduction goals for 2030 in a cost-effective manner transport will also have to make further contributions. A range of medium-term policy options could be considered to curb HDV CO₂ emissions. While the setting of mandatory CO₂ emission average limits for newly registered HDVs is the most apparent option as it *inter alia* ensures consistency with the way cars and vans emissions are regulated, other options could include modern infrastructure supporting alternative fuels for HDVs, smarter pricing on infrastructure usage, effective and coherent use of vehicle taxation by Member States and other market based mechanisms. The various options are not necessarily mutually exclusive. In any case, an impact assessment will be carried out in order to identify the most cost-effective option(s).

As a pre-condition for further action the VECTO simulation tool needs to be fully operational and legislation enacted for certifying and reporting HDV CO₂ emissions. Further work is also needed to confirm the technological potential, to gain a broader understanding of market barriers hindering technology uptake, and to re-assess the costs and benefits of HDV CO₂ abatement as well as the underlying incentive structure for more energy efficient HDVs.

4. CONCLUSION

HDV CO₂ emissions have risen over the last two decades, although the economic crisis has interrupted the steady growth previously observed, and without a change of policy are expected to remain significantly above their 1990 levels in the long-term. This is incompatible with the Transport White Paper's objective of lowering transport CO₂ emissions by 60% in 2050 compared to their 1990 level. A key element hampering action to address these emissions is a knowledge gap resulting from the fact that HDV CO₂ emissions are not measured, certified and recorded when new vehicles are registered.

There is a significant potential, through employing state-of-the-art technologies, to improve HDV performance and cut CO₂ emissions in a cost-efficient way. Market barriers currently prevent the full realisation of this potential. A comprehensive strategy based on an appropriate series of measures can unlock a larger part of this potential.

The proposed strategy, aiming at providing stakeholders with more predictability as regards policy and regulatory developments in this field, consists of short-term actions to bring more transparency to the market and foster emission reductions, being:

- a series of initiatives foreseen in the Transport White Paper reinforcing existing EU policies that directly or indirectly contribute to curbing HDV fuel consumption and CO₂ emissions;
- an action to address the identified knowledge gap by measuring HDV fuel consumption and CO₂ emissions by means of VECTO, as well as certifying and reporting newly registered vehicles' CO₂ emissions. The Commission is planning to make legislative proposals to this end in 2015.

Once these short-term actions are implemented, and based on the findings of further analytical work, medium term policy options, including the setting of mandatory CO₂ emission limits for newly registered HDVs would be considered in order to support the implementation of the EU 2030 climate and energy policy framework.

The Commission invites the Council and the European Parliament to endorse this strategy and to help to deliver the outlined actions. It further invites stakeholders, especially the automotive industry and transport services sector, to support this strategy to curb HDV fuel consumption and CO₂ emissions as part of the overall EU policy of moving to a low carbon economy.