

Reducing Greenhouse Gas Emissions from Heavy-Duty Vehicles



The Role of the European Commission
Policy Instrument Recommendations

Client: European Commission
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Prepared by:
Jonpaul Simpson
Consultant

Approved by:
Jonathan James
Director

Reducing Greenhouse Gas Emissions from Heavy-Duty Vehicles:
The Role of the European Commission
Interim Report 1 – Initial Review of Measures and Policies

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Lynnfield House, Church Street, Altrincham, Cheshire, WA14 4DZ
Telephone: 0161 927 8200 Fax: 0161 927 8499 Website: <http://www.fabermaunsell.com>

Job No 50123

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Executive Summary

Executive Summary

In late 2006, Faber Maunsell, along with its project partners NEA, CSST and Newcastle University were appointed by the European Commission to carry out a research project into measures and policy instruments that could help reduce GHG emissions from Heavy Duty Vehicles (HDV). Ultimately, the outputs of this project provide a platform on which to develop potential policy instruments to be implemented by the European Commission to help meet its obligations to minimise the negative impacts of climate change.

The objectives of the project were threefold:

- To identify unexploited potentials for reducing the fuel use in heavy-duty road freight transport and bus passenger transport vehicles, looking both at short-term and longer-term options;
- To verify with operators and shippers that these potentials really exist; and
- To identify possible interventions at the EU level to help realise these potentials.

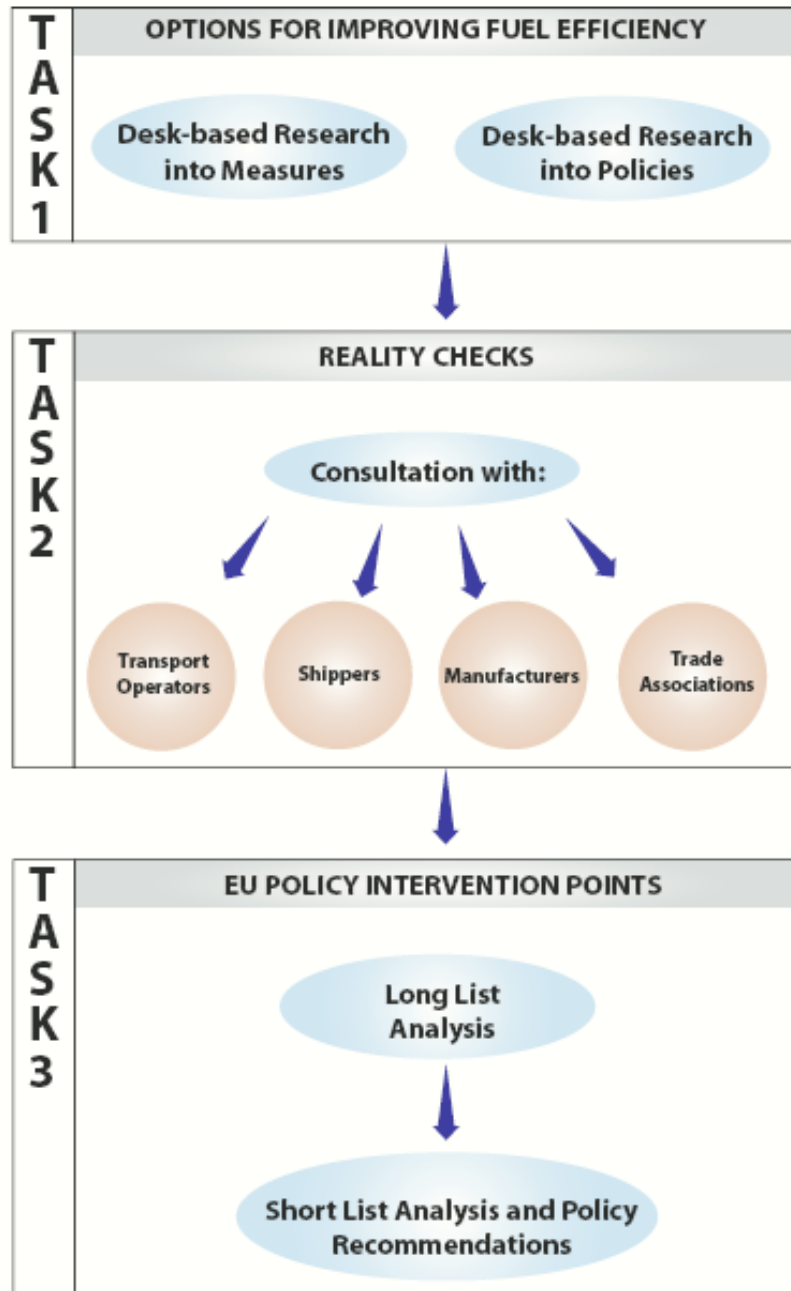
The key definitions used in this research are:

- 'HDV' are defined in this project as passenger transport vehicles of greater than 8 seats, including the driver and for freight transport, goods vehicles with a maximum permissible weight (mpw) in excess of 3.5 tonnes.
- A measure is any physical product or system that is intended to have the effect of reducing fuel consumption and emissions, for example it is an action that an individual or company can take to reduce fuel usage.
- A policy is an action or series of actions that an authority might take to achieve or encourage industry adoption of a measure for example a hybrid engine is a measure, but a non-binding engine standard is a policy.



Methodology

To meet these objectives, a clear and defined methodology was set out from the outset to ensure a focused approach (illustrated below):



Task 1 Desk Based Research

Task 1 of the research was divided into two phases; the first phase of the research was to survey possible measures which have the capability of reducing the fuel usage of HDV and reducing GHG emissions. The second phase of research surveyed policies that are in use, have been planned or have been considered, which have a relevance to this project.

Desk Based Research into Measures

The research involved identifying examples of current measures in existence and collating them to create 'measure summaries', or in other words, an overall initial assessment of their relative usefulness for the purpose of the project objectives.

While the first phase of the research focused on individual fuel saving measures, it is important to understand that fuel savings can be best achieved through a combination of different interventions. While a single measure can itself create significant savings, the best overall outcome is to create a combination of measures that influence each other to maximise the potential to reduce GHG emissions. For example, performance management is not in itself a direct measure to reduce CO₂, but it illustrates where interventions can be effectively used to cut emissions in an organisation.

Environmental targets and considerations are also an important element and can have benefits for both companies and society. However, it is essential to understand that environmental considerations alone will not provide a sufficient motive for companies to adopt fuel saving measures, as any commercial transport operator's main motive is ultimately profit and survival in a competitive market place. Therefore, whilst carrying out the research it was imperative to try and establish a bond between measures and policies that would, if applied, result in not only environmental benefits for society but also financial benefits for commercial companies.

With these considerations in mind, this task explored findings from our research in the following main measure categories:

- Performance Management and Fuel Management Systems;
- Information Technology Systems;
- Driver Training;
- Vehicle Specification & Aerodynamics;
- Operational Modifications;
- Vehicle Maintenance; and
- Improvements in Propulsion Technology;

Chapter 3 provides an overview of each measure, together with a discussion of their applicability to different sectors, 'in use' examples and overall comments based upon the initial assessment made by the research team.

Desk Based Research into Policies

The second phase of Task 1 surveyed policies that are in use, have been planned or considered with the objective of reducing fuel usage and emissions of GHG or that otherwise have a bearing in this field, both in Europe and globally. This stage of the research highlighted the applicability of a range of policies which have been assessed; provides a summary of their objectives; and comments on their potential usefulness to the EC in helping reduce GHG emissions from HDV. Unlike the measures examined in the previous section, policies relevant to the project could not be easily classified into discrete, mutually exclusive areas. However, to provide a basic framework, policies have been examined in the following main groups:

- Directives & Regulations;
- Action Plans;
- White Papers;
- Behavioural Programmes; and
- Research & Study Projects

Chapter 4 details the results of the research in detail.

Task 2 Reality Checks

Following the completion of Task 1 (desk based research), this second phase of work provides an opportunity to collect further information on relevant measures and policies to validate the information already gained from industry case studies and research projects. This phase of work was a key element to the overall success of the project as a whole. Research into the potential of different measures is important, but if the transport industry does not understand, nor implement these then such potential is wasted. This exercise therefore not only validated our findings, but also highlighted any problems with the implementation of measures and policies to reduce GHG emissions from HDV.

The reality checks took the form of an in depth semi-structured interview, where validation of the options list provided the starting point for a wider discussion which focussed on:

- Measures previously used, currently used and those under active consideration;
- Costs and benefits of these measures including practical non-financial benefits;
- Obstacles to implementing measures and solutions and measures that promise benefits but fail to deliver in practice; and
- Awareness of policy instruments.

Ensuring the best possible mix of industry partners was an important factor in ensuring the success of this stage of the project. We therefore ensured that a range of different sized manufacturers, vehicle operators, shippers and trade associations were visited, to gauge and understand varying levels of best practice throughout the European Union. The number of visits planned was small in relative terms and does not represent the level of detail necessary for an impact assessment prior to the implementation of regulation and legislation, however it was considered appropriate for the purpose of this project. For a detailed analysis of the reality checks please see Chapter 5.

Task 3 – Options List of Policy Recommendations

Analysis undertaken as part of Task 3 has, as far as possible, quantified the fuel savings and reductions in GHG which could be possible through the implementation of different measures. However, the wide scope of the project and range of areas considered has often made it difficult to generalise numeric estimates. The overall cost and usefulness of different measures has also been considered along with a range of other issues. Task 3 can be divided into two separate stages:

- The creation of a comprehensive policy options list (long list); and
- The creation of a short list of recommended policy instruments.

Essentially, the short list was to be derived from the long list, subject to feedback from the client and other internal European Commission stakeholders. Discussions with industry have been ongoing throughout the project, and in addition to work completed as part of Task 2, a meeting was held with the European Automobile Manufacturers Association (ACEA) on the 15th of October 2007 to provide feedback on work to date.

Long List of Policy Recommendations

It should be stressed at the outset that all potential actions discussed in the following sections could play a positive role in reducing GHG emissions. It is also important to understand that within a measure there are a series of 'micro' measures that can be adopted (e.g. within telematics there are various different IT systems that achieve different goals). This stage of the project involves the consideration of policy actions that could be taken by the EC, and it would be appropriate to relate these to such individual measures.

Ultimately, successful policies should be seen as encouraging the take up of a number of related measures within the policy's remit. Hence each measure considered in the following section can be thought of as a 'bundle' of related fuel saving actions. There are likely to be policy actions that can stimulate the take up of a range of measures at once (e.g. information and education campaigns which could cover a wide range of areas). These synergies have been noted where applicable. It is also important to note that some high level actions could be taken which would not relate to any specific group of measures (e.g. carbon trading).

Additionally, it should also be noted that each measure, though analysed separately for the purposes of the early stages of the project, can be integrated with other measures. For example, a performance management system can be integrated with IT systems and driver training.

We have provided a generalised view of the potential benefit that each measure/action (as listed in Task 1) may have, based on the following:

- Potential to reduce GHG Emissions (LOW 0-2%, MED 2-5%, HIGH >5%);
- Trade off with other pollutants;
- Tendency of the Market to take up, using SMALL <10 vehicles, MED 10-50 vehicles and LARGE >50 vehicles and LOW, MED & HIGH);
- Capital costs (annual cost per vehicle – LOW <€300, MED €300-600. HIGH >€600);
- Payback Period (SHORT <3 yrs. MED 2-5 yrs, HIGH >5 yrs);
- Type and recommended policy instrument;
- Potential to influence at EU level (LOW, MED & HIGH);
- General cost of implementation to industry (LOW, MED & HIGH);
- Cost to Public Authorities (LOW, MED & HIGH);
- Synergies & conflicts; and
- Type and recommended policy instruments' overall potential to reduce GHG.

For an in depth analysis please refer to Chapter 6

Each type of action is likely to have significant trade offs in terms of overall reductions in GHG emissions, costs to society and industry. For instance, a combined information and education programme would be relatively inexpensive and may be a logical first step to encourage change, but its voluntary nature means it may not be as effective as other options in the longer term. Legislation could be expensive to implement and might have a high cost to industry but could result in very significant long term reductions in emissions. Research and development is undertaken by industry irrespective of Government intervention, however the EC could play a minor but very positive role in a range of areas such as helping improve propulsion and IT systems and vehicle light weighting and aerodynamics.

It was also important to consider some of the potential conflicts that may exist between different policies. In particular trade offs between emissions of CO₂ and other pollutants must be acknowledged. Some efforts to reduce non CO₂ emissions can actively work against efforts to reduce CO₂ emissions.

Added to this, the differences between urban and inter urban transport operations are also significant. In urban areas, non CO₂ emissions are generally more of a concern than for long distance corridors. Policies that reduce non-CO₂ emissions at the expense of increased CO₂ emissions may well be acceptable in urban areas, provided significant efforts are made to reduce CO₂ in long distance transport. A two tiered approach to future policy making may achieve the best possible outcomes in terms of improving the local air quality, while at the same reducing the overall contribution of commercial transport operations towards global warming.

Following the establishment of this long list of policy instrument recommendations a selection of them were chosen to create a short list of policy options to be subject to more detailed analysis.

Short List of Policy Recommendations

The underlying aim of this research project was to identify constructive actions that the European Commission can take to reduce Greenhouse Gas Emissions from Heavy Duty Vehicles. To meet this requirement effectively the long list of potential options was reduced to create a short list of policy instruments, taking into account their effectiveness, deliverability by the Commission, cost to industry and the alignment with other EC policies and regulations.

These final recommended policy instruments, where possible, are based on quantified information. However, due to the complexity of the transport sector and the lack of consistent available and accurate data across the European Union, it was agreed with the Client that a three tiered approach would be adopted to ensure that important unquantifiable policy instruments were not overlooked nor ignored. The three categories are as follows:

- 1) Policy instruments evaluated using quantified information;
- 2) Policy instruments evaluated using professional judgement; and
- 3) Actions that are already considered, planned or being undertaken by the Commission.

Where an evaluation has been possible a consistent set of baseline data on the European vehicle fleet has been utilised. In order to generate a potential CO₂ and NO_x saving we established a reasonable baseline for each of the following criteria as each has a valid effect on the production of GHG in HDV:

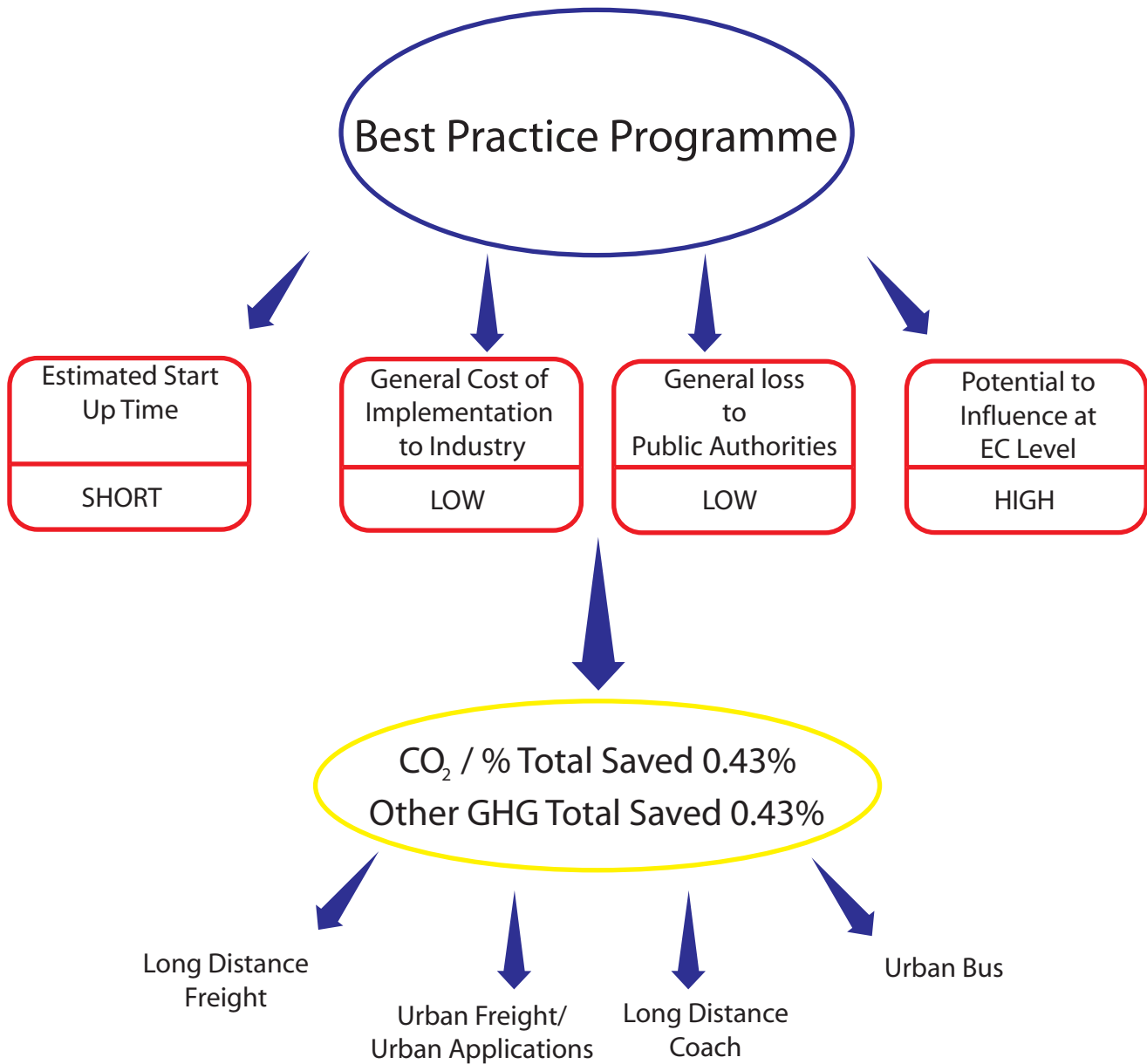
- European Vehicle KM (Buses & HGVs);
- European fleet age profile;
- Split between long distance and urban applications for HGVs and Buses;
- Estimated split between artic and rigid vehicles for HGVs;
- Average speed for Long Distance and Urban Bus and HGV operations;
- Emissions factor (grams/km) for CO₂ and NO_x in Urban/Long Distance HGV and Bus operations; and
- Estimated Total European Production of CO₂ and NO_x from HGVs and Buses/Coaches.

The purpose of using this baseline data was to create an estimated initial portrait of the impact that the recommended policy instrument can have on the transport industry in terms of reducing GHG emissions. The calculations and sources of data we have used are not assumed to be precisely accurate as there are significant variances in the quality of the European wide data available. Therefore, several assumptions and predictions have been incorporated into the calculations to give an indicative result. A complete breakdown of the calculations can be seen in Chapter 7.

Category 1: Policy Instruments Evaluated Using Quantified Information

European HDV Operational Efficiency Programme

There are a series of evaluated long list options that have demonstrable benefits in reducing GHG in HDV, but that would be difficult for the Commission to influence independently, either through legislation or through education. However, an education and behavioural change programme embracing a number of these individual components was considered as being worthy of further evaluation and consideration by the Commission (illustrated in the diagram below):



Section	Long Distance Freight	Urban Freight/ Urban Applications	Long Distance Coach	Urban Bus
Est total EV Kms (million)	14,622	136,131	39,617	8,378
Est Emmission factors (gram per vehicle km CO ₂)	1195	796.8	574	656.7
Est Emmission factors (gram per vehicle km NoX)	6.2	4.5	5.8	6.0
Est Total CO ₂ Production (thousand tonnes)	162,718	11,651	5,038	27,253
Est Total NoX Production (thousand tonnes)	850	65	48	239
Est Total CO ₂ Saving (thousand tonnes)	701	50.3	21.7	117.5
Est Total NoX Saving (thousand tonnes)	3.7	0.3	0.2	1.0

■ Potential Total CO₂ Industry Saving - 890,500 Tonnes
■ Potential Total NO_x Saving - 5,200 Tonnes

The first stage of the assessment of this policy instrument was qualitative in nature and concluded that the start up time of such a policy instrument would be SHORT in nature with a LOW cost to industry and a HIGH potential for European Union bodies to influence.

The only comparable policy instrument that has been applied and assessed in a quantitative manner is the English Freight Best Practice (FBP) Programme which is funded by the Department for Transport. This programme researches and then communicates operational efficiency measures to the operators of HGV in England. An independent impact assessment was carried out in 2007 and the results from this impact assessment have allowed the project team to estimate the potential GHG emission savings if such a programme was established across the European Union.

Overall, a conservative estimate of CO₂ and NO_x savings in Europe from the implementation of a HDV Operational Efficiency Programme are illustrated in the diagram below.

However, it is noteworthy that there has been no analysis of the further potential for FBP which could for example become significantly more or possibly less effective over time. Nor does this account for the relative baseline HGV efficiency in England compared to other member states. Additionally, this does not take into account increased funding, nor varying efficiency. It seems more likely that this estimate is a conservative one as the funding levels for FBP are relatively modest and it is therefore possible that a European wide programme would provide greater GHG savings. Chapter 7 explores further possibilities of a European HDV Operational Efficiency Programme.

Category 2: Policy Instruments Evaluated Using Professional Judgement

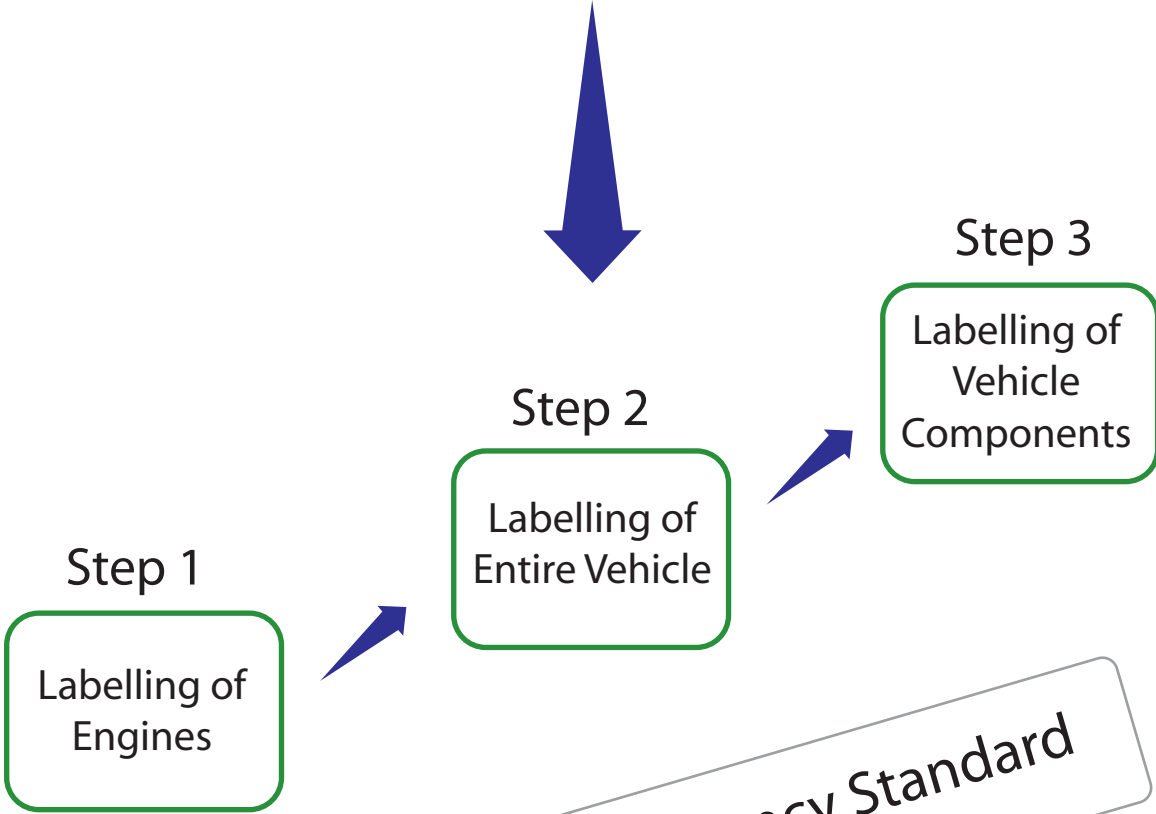
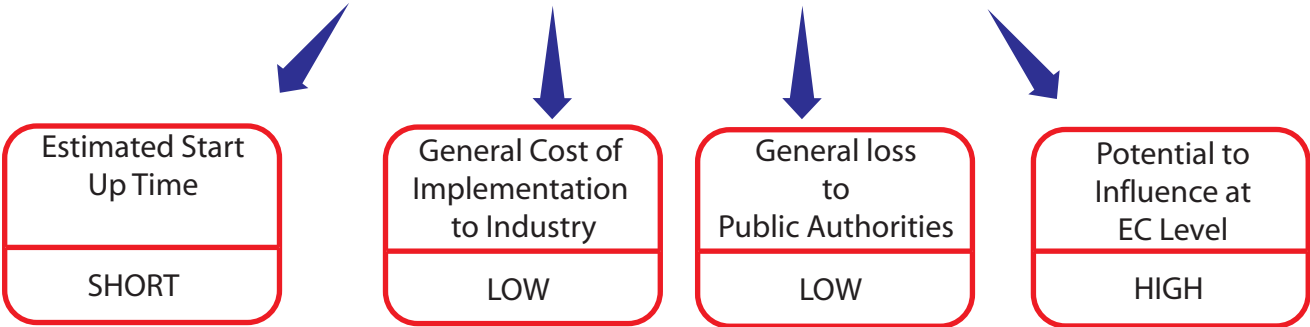
HDV Energy Efficiency Labelling Policy Instrument

A significant area where GHG emissions might be reduced in HDV is through a European wide engine efficiency labelling scheme. This measure has not been implemented previously in a manner that allows an accurate prediction of benefit. Therefore, it has not been possible to carry out a quantitative assessment for the purposes of this project.

This policy instrument is based on it only being applicable to new vehicles and consequently assumes that the benefits will only be felt over an extended period of time due to the relatively long lifecycle of currently operated vehicles. The implementation of a labelling scheme will be a progressive process which will entail the following three steps (illustrated in the diagram below):

- **Step 1:** Labelling of the CO₂ emissions from HDV engines as recorded by a standardised test procedure;
- **Step 2:** Labelling of entire vehicles predicting the overall efficiency of a whole vehicle combination in operation; and
- **Step 3:** Labelling of vehicle components (such as superstructures, trailers and semi trailers).

Labelling Scheme



Creation of Fuel Efficiency Standard

Step 1: Labelling of HDV Engines

The first step in creating a comprehensive labelling scheme is to create a labelling scheme for HDV engine efficiency, as has been achieved with passenger cars. An argument against this first step is that the manufacturing process of HDV is different to that of passenger cars. However, the Euro Emission Standards that are applicable to HDV engines are also subject to the HDV manufacturing process and those standards have been judged as contributing substantially to the reduction in non CO₂ greenhouse gas emissions.

It is unclear to what degree current HDV engines vary in their CO₂ performance, neither to what degree introducing a transparency to their performance would lead to an improvement in performance, or a consumer shift to more efficient engines. However, with the reporting of CO₂ emissions from HDV likely to become a reality through the introduction of the Euro VI engine standards step 1 of this policy instrument will be relatively easy to implement. Therefore, the impact on manufacturers should not initially be high, as engine efficiency levels are currently recorded during the current test and would simply have to be reported.

Step 2: Labelling of Entire Vehicles

The second step in creating a comprehensive labelling scheme is to take the initial step of labelling the HDV engine further by creating a labelling standard to whole HDV and vehicle combinations. This type of labelling scheme would have to take into account the final detailed vehicle specification and as such would be exceedingly onerous to mandate through legislation as many HDV would have to undertake a single vehicle efficiency test cycle. After discussions with the European Automobile Manufacturers' Association (ACEA) they have indicated that they have agreed in principle to look at the viability of creating a methodology of measuring the efficiency of the whole vehicle. We understand that this process would model the likely efficiency of any vehicle combination which would then be reported to the buyer.

Step 3: Labelling of Vehicle Components

It may also be possible, once a labelling scheme has been created for HDV engines, for major vehicle components, such as superstructures and trailers to be labelled with a CO₂ efficiency rating. This is a positive scenario but would take a long time to implement, but ultimately purchasers' decisions would be educated and logical when purchasing HDV vehicles and components. It is not clear if a voluntary scheme involving the manufacturers of super structures or trailers could easily become a reality. If legislative force compelled such a move it would have to be backed by a realistic and cost effective method of measuring or predicting CO₂ efficiency.

Category 3: Actions that are already Considered, Planned or being Undertaken by the Commission

It is helpful to understand this third category of interventions as they could have a substantial complementary effect to the new policy instruments described above. They can be divided into three broad sections:

- 1) Market-Based Instruments (MBIs);
- 2) Revision of the Weights and Dimensions Directive; and
- 3) Labelling of the fuel efficiency of tyres.

1) Market Based Instruments

It should be acknowledged that MBIs have and will add to the other suggested mechanisms for reducing GHG emissions. They use trading mechanisms, auctions and price signals to positively influence the behaviour of people managing natural resources and environmental assets. In terms of reducing GHG emissions in the transport market, the following concepts do or will have an effect in reducing GHG emissions from HDV;

- Taxation;
- Road User Charging; and
- Emission Trading Scheme.

These concepts are explored in more detail in Chapter 7 section 7.5.

2) Revision of the Weights and Dimensions Directive

The revision of the Weights and Dimensions Directive is a topical subject which does have the potential to reduce GHG emissions in HDV through increasing payload and volume. However, this project will not go into any detail on this matter as the “Study on the effect of adapting the rules on the weights and dimensions of heavy commercial vehicles as established within Directive 96/53/EC regarding their ability to match the needs of advanced logistics and sustainable mobility (TREN/G3/318-2007)” is doing exactly this.

3) Labelling of Tyres

As part of the EC’s CO₂ reduction strategy, tyres have been identified as potential sources for improvements in vehicle fuel economy. In particular, the use of low rolling-resistance tyres can significantly reduce fuel consumption and the use of tyre pressure monitoring systems (TPMS) can help ensure that tyres remain inflated to the optimum pressure to maximise fuel economy. Though there have been a gradual reduction in rolling resistance over the years, the development and use of LRRT needs to be encouraged and accelerated if they are to make a significant contribution to the CO₂ reduction strategy. This could be achieved by a combination of mandatory requirements and consumer information (i.e. tyre labelling). The EC’s proposed approach is to define four rolling resistance performance bands (A to D) each with a specified maximum rolling resistance value. Though these proposals are aimed at passenger cars, there is no logical reason why such a labelling scheme should not also encompass HDV tyres.

Conclusion

This project has followed a methodical approach in order to arrive at a logical and validated conclusion. Comprehensive global desk based research into efficient measures and relevant policies was successfully carried out through the broad spectrum and reach of the research team. This foundation of knowledge was then validated and built upon through detailed discussions with an array of interested stakeholders. The project team then collated this information and created a detailed structure for analysing the effectiveness and efficiency of potential measures and policies to reduce green house gas emissions in Heavy Duty Vehicles. Three categories emerged that justified recommendation to the client for further analysis. The next logical step to progress this research and associated recommendations would be for the Commission to consider conducting more detailed preparatory work to enact the recommended policy instruments, ultimately these will have the desired affect of reducing the European Union’s HDV GHG emissions in future years.

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1 Introduction

1 Introduction

1.1

Introduction

Reducing the emissions of greenhouse gases (GHG) is a priority for the European Union (EU) which requires wide ranging efforts. Within the road transport sector Trucks and Buses (Heavy Duty Vehicles or HDV) could have a prominent role to play in achieving this goal. In the context of the second phase of the European Climate Change Programme (ECCP II), the GHG emissions from heavy-duty vehicles (HDV) have been identified as a potential area for improvement. HDV have not been the subject of any detailed analysis until now. One reason for this may have been that the HDV market is perceived to be motivated by fuel efficiency to a much larger extent than that for private car users, given that for many applications the fuel cost is a large component of the total operating cost and HDV are almost exclusively operated in a commercial context. Therefore, the conventional wisdom is that, generally, cost-effective options for saving fuel are likely to have been already identified and put in place by the market, and that policy intervention is not necessary.

There are however signs that the market may not be fully effective in realising the optimum potential of fuel efficiency that can be reached in this sector, despite the fact that such increased efficiency would represent a true win-win situation as it would save money for operators while reducing GHG emissions and the dependence on fossil fuels. Options for improvement may be found both in the area of vehicle technology and in operational aspects, the latter including logistics and driver behaviour.

Indeed, the European Council of Ministers considered “that heavy-duty vehicles are subject to stronger market mechanisms than light-duty vehicles; invites the Commission to explore the possibilities to develop test procedures and cycles for measuring the fuel consumption and CO₂ emissions of complete heavy-duty vehicles and other appropriate options at EU level, and to seek active collaboration with manufacturers, the research community and other countries, to develop and implement policy instruments and measures to reduce greenhouse gas emissions from those vehicles”¹ in their June 2007 session.

Public sector intervention to specifically encourage reduction in non CO₂ GHG emissions has been successful through the introduction in 1992 of Euro engine emission standards. However CO₂ reduction schemes in HDV, in other words fuel efficiency improvements, in the EU have been more piecemeal. In England the Freight Best Practice programme has had some success in engaging with the freight industry and achieving CO₂ reductions through encouraging great operational efficiency in HDV. However outside the EU, an increasing number of initiatives have started in this area. Japan has introduced a fuel efficiency standard for HDV. In the United States, WestStart/CALSTART has been active for several years in supporting the development of more efficient HDV technology. The US-EPA supports a programme for improving the fuel efficiency in the freight sector called Smart Way Transport Partnership. In Canada, an information and education programme called FleetSmart has been successful in assisting fleet operators and individual owner-operators in reducing their fuel consumption.

These activities from around the world appear to hold the potential of improving the fuel efficiency of HDV in their respective areas of operation. Therefore, it seems appropriate to investigate the potential of such activities also in the EU. This means researching and assessing the state of the art and the likely future possibilities to make HDV operations more fuel efficient in the EU, and identifying any appropriate measures that could be taken at, or influenced by, the EU level in order to reach this goal.

¹ <http://register.consilium.europa.eu/pdf/en/07/st11/st11483.en07.pdf>

Therefore, in late 2006, Faber Maunsell, along with its partners NEA, CSST and Newcastle University were appointed by the European Commission to carry out research into measures and policies that could help reduce GHG emissions from HDV. The outputs of the project provide a platform on which to develop potential policy instruments to be implemented by the European Commission to help meet its obligations to minimise the negative impacts of climate change.

1.2 Defining Fuel Saving Measures and Policies

It is important at the outset to define the differences between a fuel saving 'measure' and 'policy', as these terms will be used throughout the report and are fundamental to the research project. The following definitions explain the context of their use in this report:

A **measure** is any physical product or system that is intended to have the effect of reducing fuel consumption and emissions, for example it is an action that an individual or company can take to reduce fuel usage.

A **policy** is an action or series of actions that an authority might take to achieve or encourage industry adoption of a **measure** for example a hybrid engine is a measure, but a non-binding engine standard is a policy.

1.3 Project Team

The European Commission contracted the following companies to carry out the project:

- Faber Maunsell Ltd/AECOM (Project Managers and Transportation Specialists);
- Centor Studi sui Sistemi di Trasporto (CSST);
- NEA; and
- Newcastle University.

Each of the partners offers a significant track record in fuel efficiency measures in HDV. Each partner also combines a broad expertise and experience whilst also having specialised knowledge in specific key areas as shown below:

Table 1.1 Project Team Expertise

Faber Maunsell	UK	Technical and operational and management of freight operations of all types, benchmarking and urban bus operations. Policy and strategy development
NEA	Holland	Long Distance Passenger Transport, alternative fuels, propulsion technology and benchmarking, strategy and policy development
Centro Studi Sui Sistemi di Trasporto,	Italy	Freight transport management measures and alternative fuels
Motor Transport Institute - ITS	Poland	Urban Passenger Transport and alternative fuels and freight
Newcastle University	UK	Urban freight transport including service vehicles and logistics measures, policy development

The synergy in skill areas between the partners was used effectively to provide a wide geographical and sector based coverage across the EU. Faber Maunsell has an efficient auditable Integrated Management System that ensures effective and reliable work methods both within our own staff and from sub contractors. The partners bring together competent and confident levels of experience and knowledge that will deliver added value and effective information search. This will allow a fast track to a phase of analysis, synthesis and conclusion.

The team have a wide range of contacts and personal experience involved in the manufacture and operation of HDV which can be called upon for practical advice and experience and knowledge that will deliver added value and effective information search. This will allow a fast track to a phase of analysis, synthesis and conclusion.

1.4 Objectives of the Project

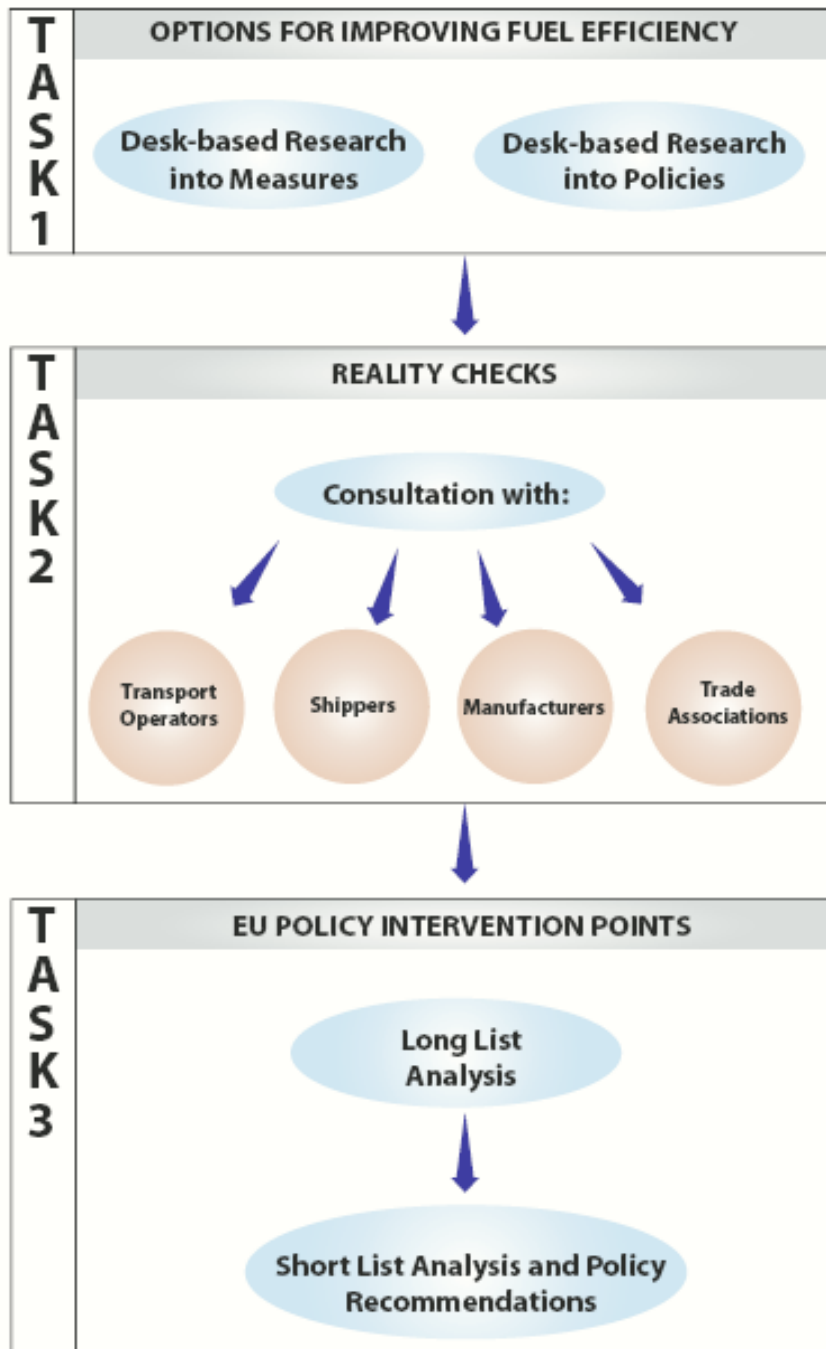
The objectives of this project are threefold:

- To identify unexploited potentials for reducing the fuel use in heavy-duty road freight transport and bus passenger transport vehicles, looking both at short-term and longer-term options;
- To verify with operators and shippers that these potentials really exist; and
- To identify possible interventions at the EU level to help realise these potentials.

1.5 Project Methodology

To meet the objectives of the project a clear and defined methodology must be set out from the outset. The following diagram illustrates the approach taken by the project team:

Figure 1.1 Project Methodology



1.5.1

Task 1: Options for Improving Fuel Efficiency

Task 1 entails carrying out a survey of possible options to improve the fuel economy of HDV. These surveys distinguish between concrete measures that operators or shippers can take, from the policies that policy makers can take to make these measures a reality. The desk based research survey included the following aspects for potential measures:

- Long-distance freight transport;
- Freight Distribution;
- Various Urban Applications such as refuse trucks and service vehicles;
- Long-distance passenger transport;
- Urban Buses; and
- Any other relevant application area.

The research also included the following types of measure:

- Performance Management and Fuel Management Systems;
- Information Technology Systems;
- Driver Training;
- Vehicle Specification & Aerodynamics;
- Operational Modifications;
- Vehicle Maintenance;
- Improvements in Propulsion Technology; and
- Alternative Fuels.

Additionally, the following time horizons were also considered:

- Short-term actions that can be implemented immediately or that are commercially available today;
- Medium-term actions that could become operational within 10 years; and
- Longer-term options

The desk based research survey included the following aspects for potential policy instruments:

- Location: instruments already in place in Member States and outside the EU;
- Type of organisation: instruments put in place by governmental and non-governmental bodies;
- Status: existing, planned or discussed in the literature; and
- Type of instrument: regulatory, incentives and information campaigns.

Throughout this task the geographical scope was not limited and extensive amounts of information was gathered from around the world.

1.5.2

Task 2: Reality Checks

Once the information gained from Task 1 was analysed it was tested with a representative sample of industry stakeholders to ensure its accuracy and to collect further relevant information. This was an extremely important part of the project as we actively sought to find out what industry is currently doing to improve efficiency and reduce GHG emissions. The information gained from the industry partners covered the following aspects:

- Current status: Is the industry partner already applying any measures as contained in the list established in Task 1? Is the industry partner applying any measure not contained in the list? What is the experience with the measure currently applied? What has been the cost and the result in terms of fuel saving? Have any measures been tried and abandoned, and if so, why?
- Planned or considered measures: Is the industry partner considering applying any measures in the near future? When? Is this already decided? If not, what does the decision depend on?
- Awareness: are there any measures in the list that the industry partner has not been aware of?
- Non-financial aspects: are there any issues with any of the measures apart from costs and savings that are relevant for the practical use value (e.g. implications for maintenance etc).

- Obstacles: are there any measures that the industry partner would consider attractive but that cannot be taken for some reason? What are those obstacles? How could they be overcome?
- Myths: are there any measures in the list that are good in theory but that the industry partner finds impractical? Why? Could they be adapted to become practical? If so, how?
- Policy instruments: is the industry partner aware of any policy instruments such as incentive programmes, best practice programmes, regulations or other instruments aimed at spreading the take-up of fuel saving measures? What is the experience with these? What policy instruments would be workable?
- Any other relevant aspects.

A semi structured questionnaire was used as the basis of the discussions, allowing both the consistency of results and the ability to react flexibly to stakeholders evidence and information. Based on the results of this field work, the list of options was then revised and validated. The new list was then reviewed and agreed by the Commission peer group.

1.5.3

Task 3: EU Policy Intervention Points

An analysis of possible policy instruments was then carried out. This analysis made use of the outputs of Tasks 1 and 2 to determine realistic and validated recommendations. The precise format of carrying out the analysis quantified, as far as possible, the fuel savings and reductions in GHG emissions that could be achieved by the policy instruments recommended. Firstly, a "long list" of policy recommendations was created, taking into account the previous identified measures. After an initial consideration of this wide range of possible policy instruments, a limited number were then subject to a detailed analysis. The choice of instruments to be considered for detailed analysis was determined in the course of working on Task 3 and with the agreement and advice of the Commission steering group.

Finally recommendations for the Commission's further consideration were reduced to a short list of policy instruments, taking into account their effectiveness, deliverability by the Commission cost to industry and the alignment with other Commission policies and regulations.

1.6

Structure of the Report

This report will address the objectives, through the methodology, in the following format:

- **Chapter 2: Background: Greenhouse Gases and the Transport Industry;**
- **Chapter 3: Task 1: Research into Fuel Saving Measures;**
- **Chapter 4: Task 1: Survey of Current Policy Instruments;**
- **Chapter 5: Task 2: Reality Checks;**
- **Chapter 6: Task 3: Development of Long List of Options; and**
- **Chapter 7: Task 3: Final Recommended Policy Instruments.**

2 Background: Greenhouse Gas Emissions and the Transport Industry

2 Background: Greenhouse Gas Emissions and the Transport Industry

This section of the report outlines the background to the problems associated with the growth of greenhouse gas (GHG) emissions and its link with the transport industry.

2.1

What are Greenhouse Gas Emissions?

There is little doubt about the concept of climate change is rising to the forefront of environmental concerns worldwide. There is a strong scientific consensus is that the cause of climate change is due to emissions of GHG from human activity. According to the Intergovernmental Panel on Climate Change, mean temperatures are expected to continue to rise over the coming decades, and average temperatures will have increased by +1.4° to +5.8° Celsius globally by the year 2100, compared to 1990 temperatures². This temperature rise could have disastrous effects on the economy, society and the environment and there is little doubt that society as a whole need to take action sooner rather than later to avoid such devastating consequences.

It is important to understand what we mean by the term greenhouse gases. The major greenhouse gases are;

- Carbon dioxide (CO₂);
- Methane (CH₄); and
- Nitrous oxide (NO_x).

All of these have both natural and synthetic sources. In contrast, the three industrial gases are:

- Hydrofluorocarbons (HFC);
- Perfluorocarbons (PFC); and
- Sulphur hexafluoride (SF₆).

These are potent greenhouse gases but do not occur in nature, and hence only originate from anthropogenic sources. These six greenhouse gases comprise the 'basket of emissions' against which reduction targets were agreed at the Third Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto, Japan in December 1997, also known as the Kyoto Agreement.

For the purpose of this report we will focus on reducing CO₂ and NO_x as CO₂ accounts for 82% of total GHG emissions, of which road transport accounts for 23% and NO_x accounts for approximately 8%, of which road transport accounts for 6%³. Though the other GHG are important it was noted that in the Annual European Community Greenhouse Gas Inventory 1990-2005 and Inventory Report 2007, these did not register as accountable to the road transport industry.

2.2

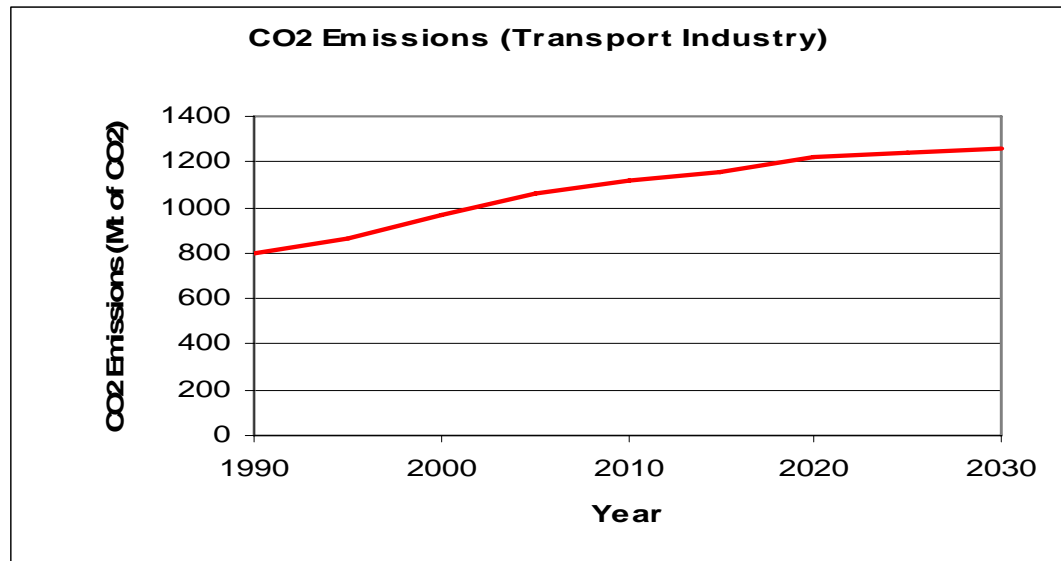
Growth in Greenhouse Gases

This phenomenon of growth in greenhouse gas emissions is a recent development in terms of human history and has the potential to fundamentally change the world climate. The wholesale use of fossil fuels only began in earnest during the industrial revolution 300 years ago and the rate of energy consumption and consequent emissions has accelerated over the last hundred years. One of the key causes of this, both directly and indirectly was the invention and widespread use of the internal combustion engine. The indirect effect of our ability to transport people and goods quickly and seamlessly over all manner of distances has played a vital part in facilitating economic activity and population growth. This has resulted in a great increase in domestic and industrial greenhouse gas emissions. Although not the majority source of emissions, motor transport continues to provide a major cause of concern and its contribution has been estimated to continue to rise in coming years as shown in Figure 2.1 below.

² <http://europa.eu/scadplus/leg/en/lvb/l28157.htm>

³ EEA - Annual European Community greenhouse gas inventory 1990-2005 and inventory report 2007

Figure 2.1 Anticipated Growth in EU CO₂ Emissions in the Transport Industry⁴

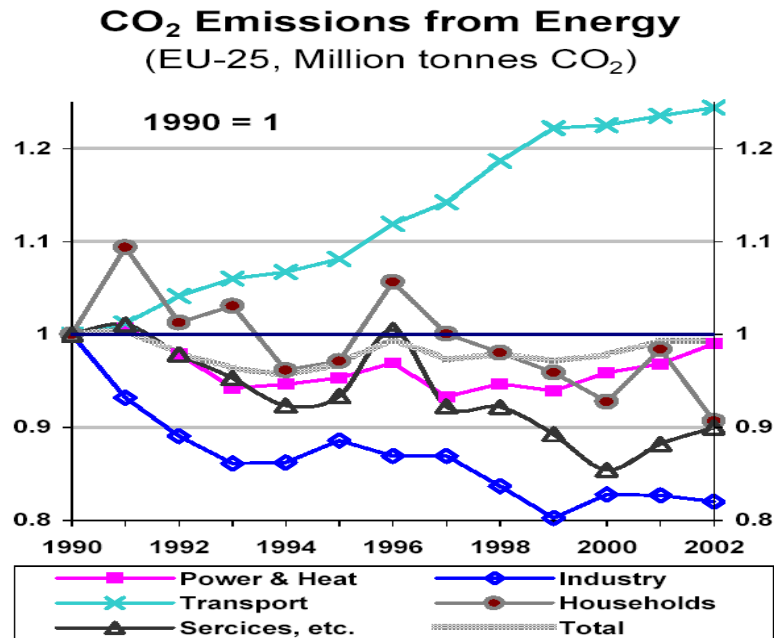


2.3

The Transport Industry’s Contribution to the Problem

While serious attempts are now being made across Europe to address the problem of rising greenhouse gases, CO₂ emissions have continued to rise, especially in the transport sector. The requirement for transport has tended to increase in correlation with industrial output and economic growth. Figure 2.2 below illustrates the increase in CO₂ emissions from the transport sector during 1990-2002:

Figure 2.2 CO₂ Emissions from the Transport Sector⁵



Source: Eurostat

* Note: Includes "own use" by power and heat generation sector

⁴ Directorate-General Energy and Transport, 2003, European Energy and Transport – Trends to 2030

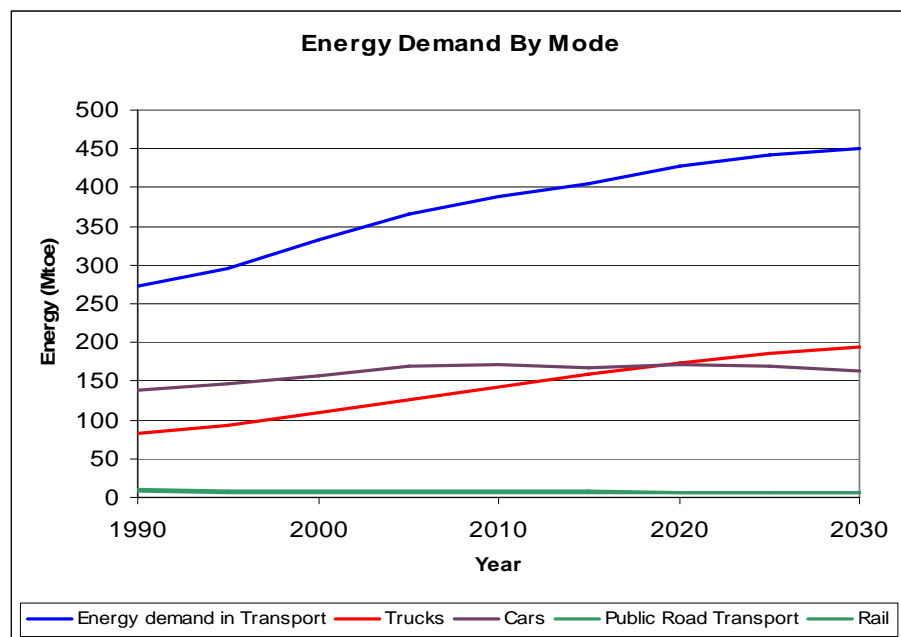
⁵⁵ **Energy & Transport** : Figures and Main Facts *Statistical pocket book 2006* Fig 2.6.1

Despite the fact that there have been, and continue to be improvements in vehicle efficiency continued population growth and forecast trends in road traffic counteract the benefits that arise through vehicles being less fuel consuming. CO₂ emissions of any fuel that contains carbon are proportionately linked to the amount of fuel usage. This means that only decreases in the volume of diesel used will reduce greenhouse gas emissions in the transport industry. Decreases in the volume of diesel used can be achieved in one of three ways;

- Using fuel more efficiently;
- Reducing the need for fuel use; or
- Substituting a fuel for diesel that produces proportionately less CO₂ emissions than diesel fuel on a well-to-wheels basis.

Figure 2.3 shows the projected increases in energy demands for key travel modes to 2030. Significantly, the energy needs off heavy goods vehicles are predicted to be higher than cars within the next 20 years.

Figure 2.3 Energy Demand by Mode⁶



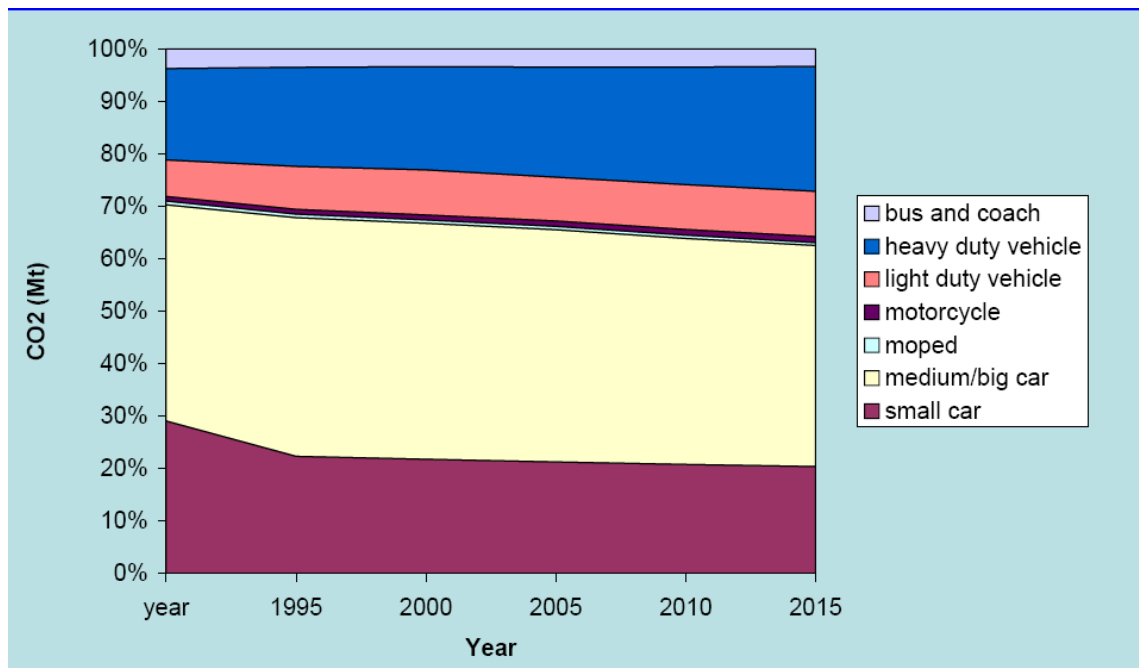
HDVs were responsible for 39.2% of NO₂ emissions within the road transport sector within the EU-15 in 2000 and 47.2% of PM emissions within the transport sector. These proportions are projected to increase by 2010 with HDVs accounting for 48.6% of NO₂ emissions and 47.3% of PM emissions.⁷

⁶ **European Energy & Transport: Trends to 2030; Summary of Energy Balances and Indicators**

⁷ EEA Report Transport emissions of air pollutants, Term 2003

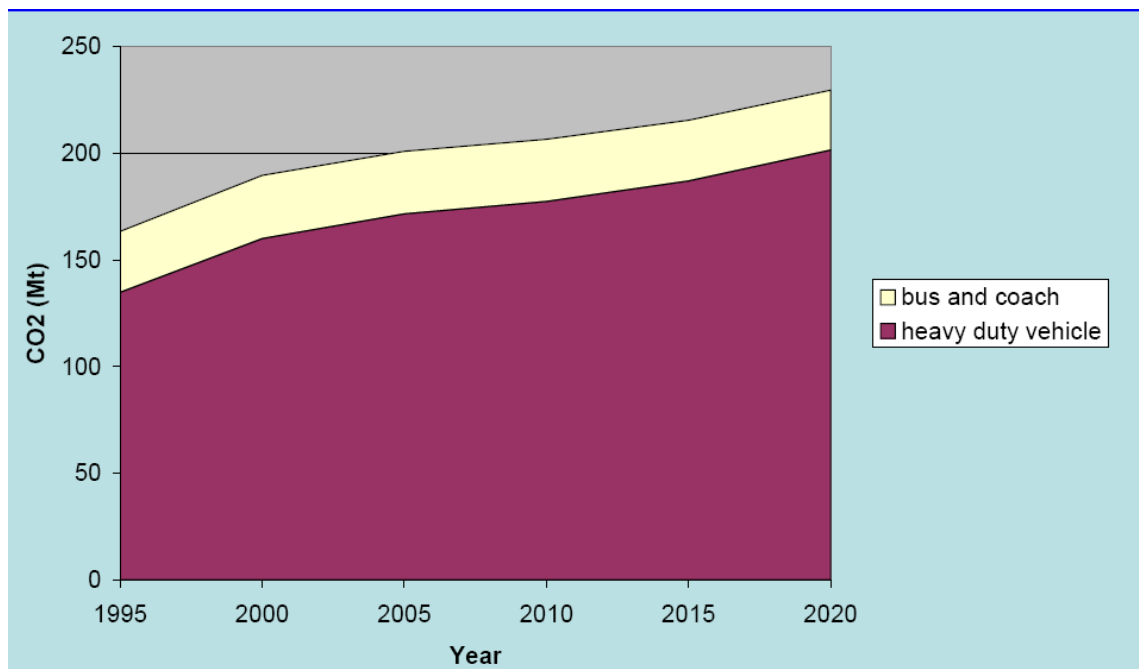
Additionally, for reference the TREMOVE database has predicted that the Road Transport CO₂ shares are as follows:

Figure 2.4 TREMOVE Database Baseline (2.41) Road Transport CO₂ Shares



Therefore, it has been predicted by the model that in 2015 approximately 23% of transport related CO₂ will result from HDVs (including bus and coach). Furthermore, on analysing this proportion, Figure 2.5 illustrates that HDVs (excluding bus and coach) are the major contributor to this sector.

Figure 2.5 TREMOVE Database Baseline (2.41) CO₂ from HDV



Historically, it was assumed that the transport industry itself would implement measures to reduce GHG emissions due to the fact that reduced fuel use equates to healthier profits. However, it has become apparent that not all HDV users implement such measures due to either a lack of resources or in many cases a lack of information and education. Therefore, several questions need to be answered to successfully see a reduction in these harmful GHG emissions in HDV, including:

- What measures and steps can be taken to reduce emissions in HDV?
- How and under what conditions could such measures be adopted?
- What policies could be implemented to successfully promote the reduction in greenhouse gases without having a negative effect on industry?

This first stage of research aims to provide preliminary answers to these questions. The second task seeks to explore solutions further with operators, shippers, manufacturers and trade associations. The third and final task will recommend potential policy instruments. Prior to this analysis, it is important to define HDV and the different applications and sectors in which they are generally used.

2.4 What are Heavy Duty Vehicles?

Firstly, 'Heavy Duty Vehicle' is defined in this project as passenger transport vehicles of greater than 8 seats, including the driver and for freight transport, goods vehicles with a maximum permissible weight (mpw) in excess of 3.5 tonnes.

A HDV purchaser chooses a vehicle to perform its essential job. So far as buses are concerned they are generally favoured by current transport policy interventions as providing a lower emission level per person kilometre travelled than would be the case if bus passengers use a car. However, only 16% of the total passenger kilometres in the EU were travelled by buses and coaches whereas around 70% was travelled by cars in 2007⁸. Therefore there is a scope for the EU, member states and local authorities to increase this share by taking further measures. However, for buses and coaches and other polluting road vehicles efforts need to be made to reduce their emissions of greenhouse gases. There are also examples where bus operations, especially in deregulated conditions that create fierce competition between companies, can lead to anomalies such as greatly over served routes resulting in empty vehicles thus creating unnecessary CO₂ emissions.

The EU has no option but to use HDV in order to improve or maintain the economic and consequently social welfare enjoyed by many EU member states. There are cases where overall supply chain road kilometres could be reduced, where alternate modes could be used or where the transport of product could be dispensed with altogether. However in many cases this is not and will not be the case without incurring a significant economic penalty.

Therefore the aim of a project focussing on heavy duty passenger and freight vehicles requires that minimising and mitigating GHG emissions is a constructive and realistic stance. Prior to starting the research we must first of all define the different sectors in which HDV are utilised.

2.5 Classification of HDV and Sectors Researched

This research has divided HDV into the following categories:

- Long-distance freight transport;
- Freight Distribution;
- Various Urban Applications such as refuse trucks and service vehicles;
- Long-distance passenger transport;
- Urban Buses; and
- Any other relevant application area.

These categories were outlined by the client and examined by the research team in the early stages of the project and were found to be sufficiently comprehensive and meaningful for the project. The following sub sections provide a brief overview of each of these sectors.

⁸ Eurostat: Passenger Mobility in Europe Statistics in Focus:
http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-07-087/EN/KS-SF-07-087-EN.PDF

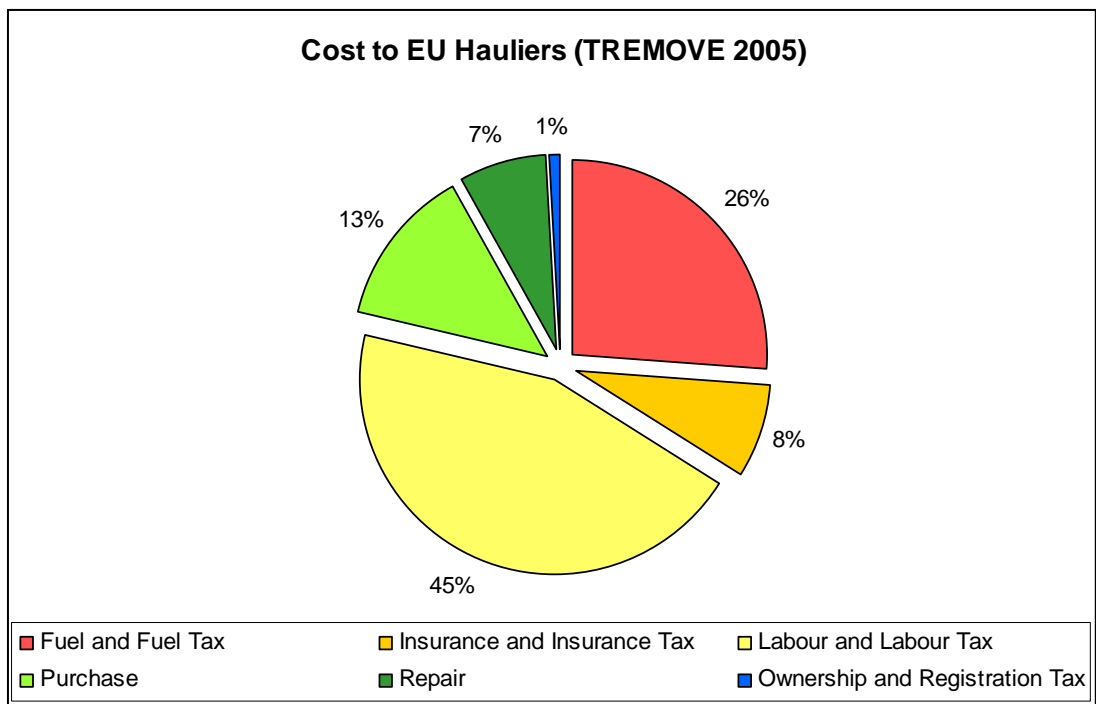
2.5.1

Long Distance Freight Transport

Long-distance freight transport by road has changed substantially in recent decades. On average general haul length has increased as distribution hinterlands have increased. This trend has been exacerbated by the expansion of the EU and by the creation of an internal market. Increasingly finished goods, agricultural produce and raw materials are routinely moved by road across the EU.

The makeup of the long distance vehicle fleet that conducts this work is generally articulated vehicles with a maximum weight of 40 tonnes on five axles, and a maximum height of four metres. Fuel is typically around one third or more of total running costs. The TREMOVE 2005 data illustrates this as 26% (see Figure 2.2 below), but this typically higher in operations and is assumed to rise as fuel prices rise. This picture changes across the EU with differences in fuel duty and maximum vehicle weights and heights for domestic purposes. However, overall these changes are marginal and for any operation fuel represents a very significant operating cost and therefore any fuel savings are beneficial to the profits of the operator.

Figure 2.2 Costs to EU Hauliers – TREMOVE 2005



While comprehensive vehicle fleet statistics are difficult to find at the EU level, due to a lack of unified methodology across Europe, it is worth noting that the average age of vehicle fleets, which can be closely related to GHG emissions, can vary substantially. The oldest average goods vehicle age can generally be found within the eastern European states where investment and economic activity levels were historically low prior to joining with the EU. Though individual countries will not be analysed in this project it is important to note that recommended policy instruments will generally substantially benefit the countries where the least fuel efficient fleets operate.

2.5.2

Freight Distribution

Freight distribution can be defined as the secondary movement of goods to a regional or sometimes national hinterland. However as with most aspects of freight movement the true situation is more complex than this simple statement suggests. Goods vehicles can typically be 18 tonne two axle rigid vehicles but in many cases are just as likely to be articulated vehicles. This has been an increasing trend with retail stores increasing in size and the grocery sector becoming dominated by larger corporate stores.

However there are a whole host of other applications which must be accounted for, one notable subsection is that of aggregate movement by construction vehicles, often four axle rigid 32 tonne maximum gross weight (mgw). Smaller goods vehicles, typically down to 7.5 tonnes mgw are also frequently used for smaller consignments. Where these are adequate for the job and fully utilised, then they normally offer a reduced emission rate, than when using a larger vehicle, which is not fully utilised, for the same load.

Added to this consideration are more general issues relating to the nature of production and supply chains. Supply chains for major manufacturing operations are now increasingly spread over many different countries and can shift rapidly in response to changes in economic and political conditions. The growth of Just in Time (JIT) production methods means that an increase in supply chain efficiency can often come at the price of transport inefficiency where smaller loads are transported more frequently and goods vehicles and containers are viewed as 'inventory in transit'. The 2004 EU enlargement has triggered a new round of EU supply chain restructuring, as was seen in the past when the internal market expanded. Broader manufacturing and land use patterns have a fundamental effect on the efficiency of freight systems, and are more difficult to regulate and control compared to the vehicles themselves.

2.5.3

Urban Freight Applications such as Refuse Trucks and Service Vehicles

Urban distribution and servicing, including reverse logistics (the transportation of returned goods, pallets, cages, etc) utility vehicles and other service vehicles, form a crucial part of everyday life for every citizen in the EU. The intensity of such operations varies according to the location, but they are also used in rural areas. These operations will be examined within two sections:

- Urban logistics, where products are delivered to what is normally the point of final sale or consumption; and
- Servicing, reverse logistics and utility vehicles.

Urban logistics has been the subject of substantial amounts of research and debate amongst policy makers as well as the freight industry. It provides the most substantial interface between goods vehicles and pedestrians in areas that are normally under the highest demand from other road users. Due to the close proximity of goods vehicles, people and buildings the concentration of emissions is often at its highest within urban areas, significantly affecting air quality. For this reason there is a high benefit in reducing the quantity of emissions from urban freight distribution. It is also an area where regulation and management measures can be effectively applied through pedestrianisation, consolidation centres, and through the better design of servicing access. It is worth noting however that regulation at the urban level is often the responsibility of local authorities, and hence further thought is needed on how the EC could encourage positive changes within this sector. The European Commission's Green Paper: Towards a new culture for urban mobility⁹ does exactly this.

2.5.4

Long Distance Passenger Transport

There is a comprehensive network of scheduled long distance road passenger services across Europe. These consist of inter-city coach services within each member state and also many through services that serve major European cities. Several services call at individual towns on route whereas other services run just between major cities. The nature and patronage of these services varies between each Member State but relates closely to average income, levels of car ownership and availability and price of competitive services for example cheap air fares and good rail services.

As well as the network of scheduled coach services there is the charter coach market for holiday, school or business companies and tourist excursions. The type of vehicle used on this work varies from the exclusive, executive coach with few seats to the low cost market where seat spacing is less generous.

Overall bus and coach travel, including scheduled local bus routes, has increased at a different rate in many member countries for example in 1970, 1990 and 2003 the passenger kilometres in France were 25.2, 38.0 and 42.7 billion (less than double) respectively whereas in Spain they were 20.9, 28.1 and 49.3 billion passenger kilometres (more than double) over the same

⁹ COM (2007) 551 Final

period¹⁰. Once again individual countries will not be explored in this project, but it is worth noting the different effects that a policy can have on individual countries.

2.5.5

Urban Buses

Whilst modal shift from road to rail and light rail is a worthy goal the design, implementation and running of such a solution is capital intensive, requires significant passenger volumes and can be inflexible over time. In towns where such an initiative is not viable, buses are, like lorries, cost effective and flexible over the short to medium term. In some cities and countries, such as London in particular and the UK in general, all modes except buses are congested. In this situation funding to support modal shift from car has to be directed at buses.

Therefore, buses are significant vehicles in the urban setting. Due to direct input of the state either as an operator or nowadays as a regulator and subsidiser, new fuel technologies have been trialled more widely in buses. Similarly initiatives such as Bus Quality Partnerships (UK) have been able to co-ordinate activity and initiatives in this field.

2.5.6

Other Applications

One form of HDV not conveniently covered examined so far by the specification is that of agricultural vehicles. In addition to vehicles working off road many agricultural vehicles also operate on road, either travelling between places of work or transporting produce, livestock, fertiliser etc. The work of farm machinery can often be stop/start and extremely seasonal, thus issues relating to engine idling and preventative maintenance are relevant in terms of improving fuel efficiency. In addition, they may also be fuelled by lower grade diesel formulations and differing taxation rates make fuel efficiency relatively less important in terms of cost.

¹⁰ European Commission DG for Energy and Transport, 2006

3 Research into Fuel Saving Measures

3 Research into Fuel Saving Measures

3.1 Introduction

Task 1 of the research was divided into two phases, the first phase of the research, contained within this chapter, was to survey possible measures which have the capability of reducing the fuel usage of HDV and reducing GHG emissions. The second phase of research, in chapter 4, surveys the policies that are in use, have been planned or have been considered.

The research involved identifying examples of current measures in existence and collating them to create measure summaries, or in other words, an overall initial assessment of their relative usefulness. The process was iterative in nature and involved all partners undertaking research according to selected areas of expertise and geographic location.

The following sections outline the methodology used for this first stage of the work and the topics and scope of areas researched. Real life application of these measures in transport operations and research projects are also discussed along with potential/proven benefits and applicability to the outputs of this project.

3.2 Methodology

It was considered important at the outset of the project to take advantage of the collective expertise and knowledge held by the research team, a whole research team meeting was held to develop an initial spreadsheet of suggested measures to focus on (although this did not prelude finding other measures as the research progressed). The next logical step was to build upon these foundations and identify examples of the known measures in use, and provide an initial assessment of the overall benefits of each measure.

A data collection tool was developed using Microsoft Access Database for the purpose of uniformity and guidance. This established a method by which each partner could input their data into a central database which could be compiled and analysed by Faber Maunsell.

Over a period of three months extensive desktop research was undertaken and the results collated and presented to the Commission. The remainder of this chapter summarises the identified measures and comments on the assessment of potential benefit in reducing GHG emissions. Appendices 1-7 provide further details of case studies to endorse our summaries.

3.3 Types of Measures Researched to Reduce Greenhouse Gas Emissions

While the first phase of the research focused on individual fuel saving measures, it is important to understand that fuel savings can be best achieved through a combination of different interventions. While a single measure can itself create significant savings, the best overall outcome is to create a combination of measures that influence each other to maximise the potential to reduce GHG emissions. For example, performance management is not in itself a direct measure to reduce CO₂, but it illustrates where interventions can be effectively used to cut emissions in an organisation. The process of selecting and implementing fuel saving measures for a transport operator needs to take into account different operational characteristics, costs and potential benefits.

Environmental targets and considerations are also important and may have a different resonance between EU member states, but it is essential to understand that environmental considerations alone will not provide sufficient motive for many companies to adopt fuel saving measures, as any commercial transport operator's main motive is ultimately profit and survival.

With these considerations in mind, the following section explores findings from the first stage of research looking at fuel saving measures, according to the following main categories:

- Performance Management and Fuel Management Systems;
- Information Technology Systems;
- Driver Training;
- Vehicle Specification & Aerodynamics;
- Operational Modifications;
- Vehicle Maintenance; and
- Improvements in Propulsion Technology;

These categories are based on those originally defined in the original work specification (contained in Annex I of the contract); however they have been refined and expanded slightly through brainstorming sessions during the early stages of the project. An overview is provided for each measure, together with a discussion of their applicability to different sectors, 'in use' examples and overall comments based upon the initial assessment made by the research team. Additionally, Appendices 1-7 provide a sample of the examples of each measure identified.

Despite the potential environmental benefits of different alternative fuels, several arguments have been raised to the actual well-to-wheel benefits of certain fuels. After discussions with the client, it was decided that alternative fuels would not be analysed in detail in this project as there are already various projects specifically targeting the issue of alternative fuel use currently being undertaken by the EC. It has therefore been agreed that this project will not recommend any policy instruments in relation to alternative fuels. However, it is important to make reference that on 31 January 2007 the European Commission proposed new standards for transport fuels that will reduce their contribution to climate change and air pollution, including through greater use of biofuels. The proposed changes to Directive 98/70 underscore the Commission's commitment to ensure that the EU combats climate change and air pollution effectively. The new standards will not only make petrol, diesel and gasoil 'cleaner' but will also allow the introduction of vehicles and machinery that pollute less. A key measure is that, to encourage the development of lower-carbon fuels and biofuels, suppliers will have to reduce the greenhouse gas emissions caused by the production, transport and use of their fuels by 10% between 2011 and 2020. This will cut emissions by a cumulative total of 500 million tonnes of carbon dioxide by 2020.

3.4 Performance Management & Fuel Management Programme

3.4.1 Overview

Performance monitoring and management is essential for making sustainable long term improvements to any transport operation. To carry out well informed, tactical and strategic decisions about an operation, there is a need to accurately measure the resources used to deliver services. Only then is it possible to identify areas for improvement and assess how effective any operational changes have been. A performance management programme can be the starting point for making operational improvements. Measuring Key Performance Indicators (KPIs) and setting targets on a regular basis should be encouraged for all types of HDV operations.

Performance monitoring can generally be thought of as 2 separate processes:

1. Internal benchmarking; and
2. External benchmarking

Monitoring internal processes is paramount to understanding the effectiveness of fuel saving measures and there are a variety of systems in place that can help collect the necessary management information to do this, such as fleet management IT packages, fuel management systems, digital tachographs etc. It is also extremely useful and beneficial to know how an individual operation compares to others in the same sector. However, this is much more difficult to do in practice as competing fleets are wary of sharing information with each other, and because collecting and analysing data is generally resource intensive.

In terms of performance management, a main consideration for any transport operation is fuel as it accounts for a third of most operators' expenditure and therefore in terms of performance management within a transport operation the monitoring of fuel is essential in creating an efficient operation. There are many aspects which can influence fuel consumption and there is evidence to show that improved awareness of these factors within an organisation can result in significant savings in fuel consumption and CO₂ GHG emissions. A fuel management programme is essentially a structured method of managing fuel throughout its lifetime – from acquisition through to storage, issue and use. Such a programme is pivotal to performance management within a transport operation.

Fuel management is a core concept of the UK Freight Best Practice programme, which recommends that operators of freight fleets establish a fuel management system as a starting point for making other operational improvements – the argument being that other measure will be more effective when there is a system in place to measure their success (i.e., see their impact on fuel use). Freight Best Practice experience has shown that a surprisingly large number of operators (particularly those with a small number of vehicles) do not have any information on fuel use, despite the fact it typically represents a third of operating costs

A fuel management programme is a management system rather than a 'hard' fuel saving measure, and as such success depends largely on effective people management. Experience in the UK suggests that these programmes are most successful when there is a high degree of support from top management, and when a person who is respected and empowered to make decisions is appointed as a 'fuel champion' to oversee and run the programme.

3.4.2

Comment

Performance/fuel management programmes encompass a set of 'soft' actions that are taken by transport managers to ensure effective monitoring of performance and fuel use. When effectively adopted this can be an extremely powerful system because it focuses attention on the issue of fuel use and operational efficiency and can act as a driver for consideration of other changes to improve operational efficiency. The magnitudes of benefits that can result from this vary and depend on which other operational changes are made as a result. Evidence from the UK suggests fuel savings of around 5% are achievable if a performance/fuel management programme is applied appropriately.

In principle the concept of performance/fuel management can be applied to all HDV, however there is little evidence to suggest this is widely practiced among passenger transport operators at present. As Appendix 1 shows, one multinational company, two UK based operators and one Switzerland based operator all benefited by having fuel management programmes in place. By monitoring performance, these organisations then actively sought strategies to improve their performance and the information gained leads to key decisions about using IT, alternative fuel etc.

As performance/fuel management programmes are a set of managerial actions, it would be difficult to make this a mandatory practice for HDV operators. If this was achieved, a standard would need to be developed, but even then it would be seemingly difficult to enforce companies to embrace the concept. Therefore, it would be beneficial for an educational programme to be devised, highlighting the benefits and implementation procedures of a performance/fuel management system to small/medium sized companies.

Additionally, examination efforts made for other sectors might be useful. However, a variety of systems are available to help transport operators measure and monitor KPIs. External benchmarking is more difficult in practice and there may well be a role for market intervention in the form of sponsored benchmarking initiatives.

3.5

Information Technology Systems

3.5.1

Overview

The appropriate application of IT systems in HDV operations can make day-to-day tasks easier and improve efficiency, thus reduce GHG emissions. There are a range of different IT systems that can be used for commercial transport operations. Whether providing directions for drivers, developing more efficient route plans, or recording and monitoring fuel use, the important aspect of IT systems is that they exist to make tasks easier and improve efficiency. IT systems can effectively assist performance/fuel management programmes by generating accurate real

time data for analysis. A classification scheme has been developed by the UK Freight Best Practice programme¹¹ which groups systems into the following categories:

- Deliveries – paperless manifest/Proof Of Delivery systems, online freight exchanges, traffic information systems, simple journey planning tools, Computerised Vehicle Routing and Scheduling (CVRS) systems and job costing tools;
- Vehicles – in cab communication systems, vehicle tracking devices, satellite navigation systems, vehicle diagnostics systems;
- Loads – trailer tracking systems, telematics-temperature monitoring systems, vehicle weighing systems and security systems;
- Drivers – driver information systems, digital tachographs and hours compliance tools;
- Fuel - fuel recording systems;
- Products - warehouse management systems, voice picking systems, product scanning and tracking systems (including Radio Frequency ID or RFID) and supply chain management systems; and
- Performance – fleet management systems.

A great deal of information is available on two particular types of systems, notably telematics and Computerised Vehicle Routing Systems (CVRS). Vehicle telemetry systems (usually referred to as telematics systems) relate to a wide variety of applications for HDV, including tracking vehicles to ensure they are used productively, monitoring driver behaviour, way finding and ensuring security of vehicles, drivers and loads and ensuring services are delivered as planned. These types of systems are applicable to HDV, but the emphasis lies with the freight industry.

CVRS systems combine customer location data with delivery or collection data, whilst taking account of a range of constraints such as vehicle capacity and drivers' availability and working time to develop an efficient delivery schedule for a fleet of vehicles. This application is most typically used in freight operations that have a large customer base and a complex delivery network. This type of application is much less applicable to bus and coaches where travel usually takes place on well defined routes.

When used appropriately, these applications and other forms of technology can allow vehicles and fleets to operate more productively and can have a significant impact on improving fuel efficiency and reducing harmful greenhouse gases.

3.5.2

Comment

The majority of examples found during this phase of work related to the use of telematics and CVRS applications in freight fleets (see Appendix 2). There are many UK based case studies on telematics that have been published by the Freight Best Practice Programme and the UK Freight Transport Association (FTA). A range of case studies were also found on CVRS systems in the UK and to a less extent in the Netherlands. While many case studies developed by suppliers often report potential savings of up to 10% for telematics and CVRS, a more conservative figure of approximately 5% is often considered more realistic by industry. Additionally, the Impact Assessment of the freight logistics action plan (SEC (2007) 1321) calculates that IT systems can represent a potential fuel saving of 8 to 10%.

The benefits of IT, and in particular systems that focus on planning routes and managing overall vehicles, are well proven. However, it is important to understand that the cost of IT systems vary immensely, depending on the type of product and size of fleet. What is critical to understand in the following stages of the study is

- The extent to which these systems are used outside leading European economies such as the UK, Germany and France, and whether the benefits found in the UK are realistic for other countries;
- The extent to which telematics systems are currently used in bus fleets for monitoring efficiency (e.g. driver behaviour, making improvements to routes) rather than being used as a customer service tool (e.g. informing passengers of arrival times). The latter enhances service delivery, but may not necessarily improve efficiency; and

¹¹ Freight Best Practice, Information Technology for Efficient Road Freight Operations, <http://www.freightbestpractice.org.uk/download.aspx?pid=171&action=save>

- Enhanced telemetry applications that may become available through development of the Galileo system, and whether there is anything above and beyond this the EC can do to encourage further development in this area, and the mechanisms that could be used to achieve this.

3.6

Driver Training

The driver is possibly the most important factor for achieving fuel savings. Training drivers on safe and fuel efficient driving techniques can save a substantial amount of fuel. By implementing driver training as part of a fuel management programme, a fleet's fuel consumption can typically be reduced by at least 5%. Key elements focused on as part of driver training programmes, such as Safe and Fuel Efficient Driving (SAFED-UK) and the Het Nieuwe Rijden (Netherlands) programmes, include:

- Use of cruise control where safe and appropriate;
- Use of exhaust brake;
- Forward planning and keeping the vehicle moving;
- Using the momentum of the vehicle;
- Keeping the engine speed within the 'green band' and using the highest possible gear;
- Keeping the height of the trailer or load to a minimum;
- Positioning loads as close as possible to the body on flat trailers;
- Changing gears as few times as possible;
- The need to avoid overfilling the fuel tank as leads to fuel loss;
- The need to avoid speeding;
- Planning routes effectively to reduce lost running;
- Using constant speeds as far as possible;
- Checking the condition of tyres; and
- Ensuring familiarity with the vehicle's technology.

Driver training is an attractive type of intervention, mainly because it provides benefits at a variety of levels, i.e.

- For HDV Drivers - Reduced stress levels and enhanced satisfaction of driving;
- For transport operators: Reduced fuel spend, increased productivity and vehicle utilisation, improved resale value of fleet, reduced running costs (particularly relating to maintenance and tyres), potential reductions in insurance premiums; and
- For organisations and the environment: - The development of a health and safety culture within an organisation, effective risk management, reduced CO₂ and other harmful vehicle emissions, reduced vehicle and personal injury accidents/incidents.

3.6.1

Comment

Evidence examined to date suggests that one of the key benefits of driver training is that it is applicable to a wide variety of vehicles and operational settings. This fact has been recognised by the roll out of the SAFED standard in the UK from HGVs to van fleets and buses. Research undertaken as part of Freight Best Practice in the UK has shown that a driver holding top gear for 87% of the distance and using cruise control for 89% of a journey would use 21% less fuel than a driver who was in top gear for 71% and in cruise control for 25% of the same route and driving the same vehicle. In the UK, a significant amount of work has been undertaken on the benefits of driver training via the development and implementation of SAFED. At a European level, the ECODRIVEN initiative (for cars) and the Het Nieuwe Rijden programme have also illustrated similar benefits. The ECODRIVEN initiative is considered in more detail in the next chapter.

The benefits of driver training appear to be well established. As shown in Appendix 3, a selection of case studies from the UK illustrates an average fuel saving of 6% after driver training. One potential shortcoming of this measure is that repeat efforts must be made to ensure drivers do not revert back to bad habits. This suggests that a one off campaign to educate drivers may not necessarily result in long term benefits. At this early stage of the project it is apparent that driver training is something that can have a real benefit on company efficiency as well as reducing harmful GHG.

3.7 Vehicle Specification and Aerodynamics

3.7.1

Overview

Accurate and appropriate vehicle specification can play a significant role in reducing environmental impacts from HDV. Ensuring vehicles are closely matched to the tasks they are expected to perform will improve both fuel and overall operational efficiency. This can lead to cost savings, increased profitability and reduced environmental impacts. Vehicle specification is largely the responsibility of the vehicle purchaser, although certain elements such as aerodynamic styling are often fitted to commercial vehicles as a standard feature. Key areas of vehicle specification include:

- Engine and transmission characteristics, i.e., making sure the engine power is appropriately matched to the loads that will most typically be moved;
- Body size and type, including double deck trailers (presently only permissible in the UK), swap body demountable trailers, light weight materials;
- Extra body features and auxiliary equipment such as aerodynamic styling; and
- Low Rolling Resistance Tyres.

Most manufacturers provide an extremely large range of options for engines and transmission, however vehicle operators may not always make the most appropriate choice for their type of operation either because they do not properly understand the need to match the vehicle as closely as possible to their operational circumstances, or because they lack information and awareness to make the right decisions. However, it should be noted that some manufacturers do offer guidance software to their sales agents to enable purchasers to find the best vehicle for their application.

Similar issues surround body size and type, although operational circumstances may provide less flexibility for choice compared to engine and transmissions specification. A key issue being, that operators may benefit from alternative trailer and vehicle combinations/designs that are less commonly used, such as swap body demountables and 'urban artics' (3 axle articulated vehicles).

Longer and heavier vehicle combinations, such as the 60t combinations can improve efficiency in appropriate circumstances, although such vehicles are only permitted in a small number of countries at present, notably Scandinavian countries, but some others, for example the Netherlands have also trialled such vehicles. Double deck trailers are also becoming a very common feature within certain types of operations in the UK, although weights and dimensions regulations mean that operators on the continent cannot currently use these types of vehicles. Such a regulatory measure concerning longer and heavier vehicles has been determined to be out of the scope of this project as the European Commission has begun the tendering process for a study on the effect of adapting the rules on the weights and dimensions of heavy commercial vehicles as established within Directive 96/53/EC regarding their ability to match the needs of advanced logistics and sustainable mobility (TREN/G3/318-2007).

Appropriate to weights and dimensions is the development of light weight materials in recent years. Although steel may be the main construction material for trucks for the next decade or so, several alternatives have recently become commercially viable. The main alternatives being aluminium and fibre reinforced plastic (carbon fibre, aramid fibre and flax fibres, etc). Compared to ordinary steel based trucks, aluminium seems to have a small positive effect but the fibre based alternatives seem to be very promising alternatives from steel. However, there seems to be a strong "blocking" factor; the low financial benefits seen from transport operators point of view.¹²

¹² Sources of information from "Reducing life cycle CO₂ Emissions of articulated trucks"; presentation by Bernard Gilmont; Building and Mass Transport Director; European Aluminium Association

"Trucks and Semi-Trailer as CFRP – Monocoque-Construction"; presentation by Helmut Stichlmair; Managing Director; PPO GmbH and Hans Lange; Ria Kaiser; Managing Directors; TTT The Team GmbH

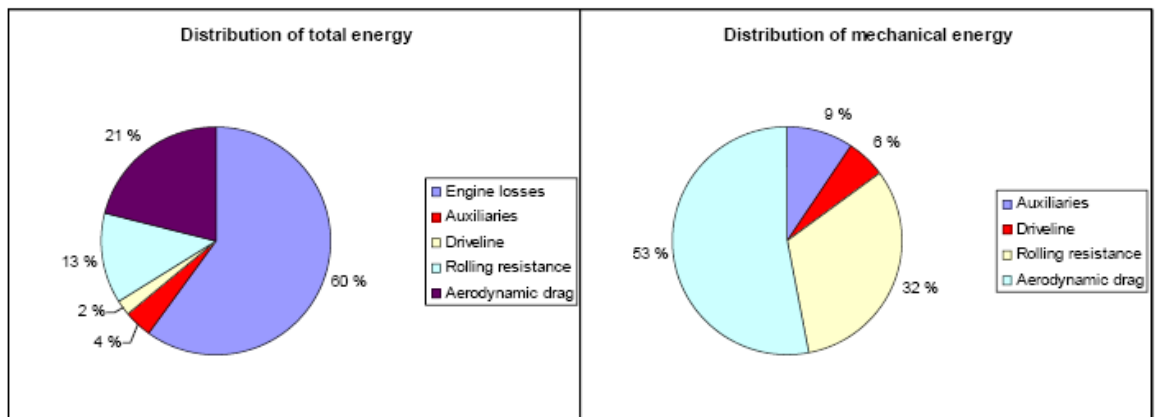
"Goldfeather: lightweight composite isothermal trailer"; Aad van den Engel; Project Manager; NEA

"Lightweight GIGA trailer"; Aldert Verheus; Managing Director; Lightweight Structures B.V.

The use of alternative materials when considering the construction of the chassis of a vehicle can reduce the tare weight, therefore increasing operational efficiency and lowering tailpipe emissions. MEMS Power Generation operates at the heavy end of their transport sector; the payload can consist of generators (Weighing over 10 tonnes per unit) and heavy cabling (Each cable set weights approximately 330 kilograms). MEMS conducted a study into how to reduce the number of trips which require 2 vehicles per delivery. After considering a trips strategy MEMS invested in a light weight chassis truck. The lightweight vehicles have increased the Miles Per Gallon significantly from 9MPG to 11MPG, and payload has increased from 10 tonnes to 11.2 tonnes. This has meant that one vehicle can be cut out of the loop per job. Fuel savings and environmental impacts of light weight materials should be considered in more detail in the aforementioned tender contract.

Aerodynamics is the study of forces acting on objects moving through the air. When a vehicle moves, the air exerts a force on the vehicle that resists its motion. This force is the aerodynamic drag and it has a significant effect on the fuel consumption of vehicles (please see Fig 3.1 below for the distribution of total energy). Drag is affected by vehicle shape, frontal area and speed. The greater the frontal area of a vehicle, the greater the aerodynamic drag will be. Similarly, the higher the vehicle speed, the greater the aerodynamic drag will be. The primary function of aerodynamic styling fitted to trucks is to reduce aerodynamic drag, thereby reducing vehicle fuel consumption and thus realising cost savings as well as reducing environmental impacts. According to US EPA air drag at the end of a box truck or trailer accounts for about one-third of total air resistance, if this could be halved (without decreasing load capacity) fuel savings could be between 4-5%.

Figure 3.1 Relative Distribution of Energy/Power for a Semi-Trailer Combination at a Constant Speed of 104 km/h. Distribution of Delivered Energy on the Left, Distribution of Mechanical Energy on the Right¹³

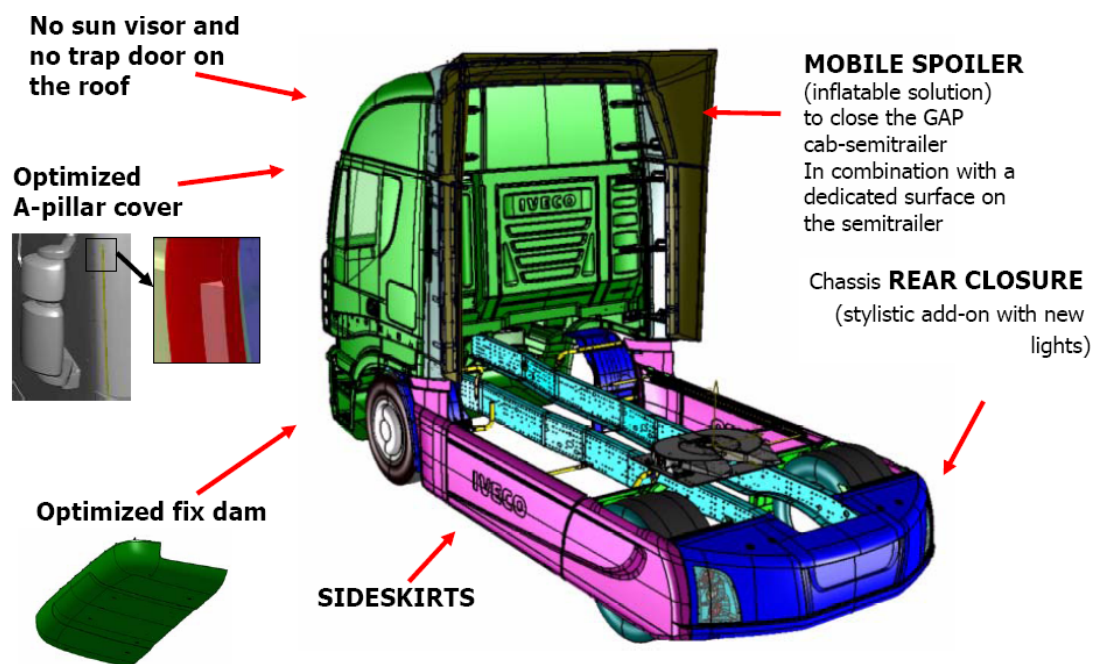


¹³ Fuel Saving for Heavy Duty Vehicles, "HD Energy" – Summary Report 2003-2005, Nils-Olof Nylund, VTT, March 2006

It is important to specify a well-styled aerodynamic vehicle from new. However, there is a range of add-on features available that can significantly improve the aerodynamics of many vehicles on the road today. Such add-ons features are listed and detailed below:

- Tractor Aerodynamics:
 - No sun visor and no trap door on the roof;
 - Optimized A-pillar cover;
 - Optimized fix dam;
 - Mobile spoiler (Inflatable solution) to close the gap between tractor and trailer. Works in combination with a dedicated surface on the trailer;
 - Sideskirts covering the wheel arches; and
 - Chassis rear closure.

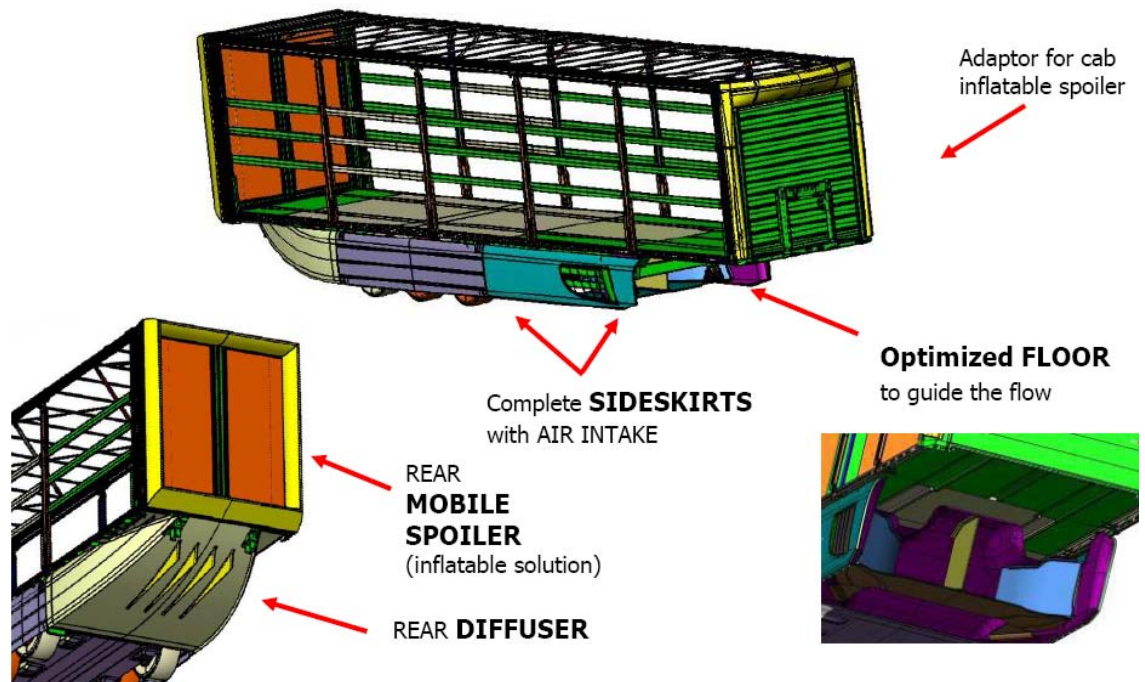
Figure 3.2 Illustration of Tractor Aerodynamics¹⁴



¹⁴ "CO2 Emissions from HDV" Contribution of Aerodynamic; presentation by Giovanni Margaria; Iveco; http://www.iea.org/Textbase/work/workshopdetail.asp?WS_ID=306

- Trailer Aerodynamics:
 - Adaptor for cab inflatable spoiler;
 - Complete sideskirts with air intake;
 - Optimized floor to guide the flow;
 - Rear mobile spoiler (Inflatable solution); and
 - Rear diffuser.

Figure 3.3 Illustration of Trailer Aerodynamics¹⁵



With the above add-ons the tractor and trailer combination shall reduce aerodynamic drag by 14%. This saving can occur as follows, 15% from the tractor and 85% from the trailer¹⁶.

Aerodynamics plays an important role in vehicle specification, and is generally most useful for operators involving large vehicles and who travel long distances at high speeds. As such, a vehicle that spends much of its life making urban deliveries may not generate savings to justify the expense of add-on aerodynamic equipment.

Additionally, low rolling resistance tyres (LRRT) have about 20% lower rolling resistance compared to normal tyres of the same dimensions. According to an ACEA meeting on carbon emissions from Heavy Duty Vehicles (October 2007), the rolling resistance from a vehicle can account for one-third of all resistance. Therefore if a vehicle were to change from conventional tyres to LRRT, fuel consumption is reduced by 6-7%. However this figure does not take into consideration road irregularities. Generation two LRRT is suggested to make a saving of 9% on fuel consumption; however this statement is from a manufacturer and may alter in a real life operation.

3.7.2

Comment

Several examples were examined relating to vehicle specification and aerodynamics, relating to a wide range of applications, such as alternative truck/trailer body type designs including longer heavier vehicles and the use of low bed, double deck and demountable trailers (see Appendix

¹⁵ ditto

¹⁶ ditto

4). Changes to body size and shape of lorries have been shown to enable increases in vehicle utilisation and reductions in the number of trips.

A number of examples identified for light weight materials, two of which were experiments conducted in the Netherlands and one undertaken by the European Aluminium Association. This research shows that light vehicle materials could lead to fuel savings in certain operational settings. Lighter vehicles either reduce fuel consumption through reductions in body mass, or allow increased payload capacity, which can translate into fewer overall trips.

On the whole, passenger transport operators are likely to have less flexibility than freight operators with vehicle specification, as decisions are mainly based on overall vehicle size (i.e. number of seats) or client requirements.

The Freight Best Practice Programme in the UK provides a detailed guide on improvements that can be made by fitting the appropriate aerodynamic features on HGVs¹⁷. It also provides a spreadsheet based tool which enables detailed calculation of fuel savings based on the vehicle and operational characteristics. A key issue to explore is the extent to which further fuel efficiency gains can be made through increased take up of these measures. Aerodynamic features are often fitted as standard to new HGVs, though this may vary between different Member States and manufacturers. Significant aerodynamic styling and body work improvements appear to have been made in the coach sector over recent years, however published examples of these were difficult to find.

3.8 Operational Modifications

3.8.1

Overview

There are also steps that can be taken to improve efficiency which relate to organisational characteristics. Measures such as strategic partnerships and consolidation centres are good examples of methods that can increase vehicle utilisation and reduce empty running. These types of measures have a fundamental effect on fuel consumption, but are often more difficult to implement compared to other measures. Some key types of operational modifications include:

- Improved physical location of production and distribution points.
- Improved allocation of deliveries within a supply chain. Within many supply chains locations are not always served by their nearest distribution centre as they may not have sufficient capacity, carry the right products etc. Optimisation of distribution centre size and network structure can reduce unnecessary mileage.
- Strategic Partnerships are partnerships between the freight industry, local government, local businesses, the local community, environmental groups and other interested stakeholders. They aim to develop an understanding of freight transport issues and problems and to promote constructive solutions, which reconcile the need for access to goods and services with local environmental and social concerns.
- Collaboration with outside organisations – collaborative initiatives are gaining momentum with the European Logistics Users Providers and Enablers Group (ELUPEG) actively promoting collaboration, which can either take the form of shared facilities or shared vehicles and in both instances can help reduce empty running and improve vehicle utilisation.
- Increased collaboration within the supply chain to enable greater vehicle utilisation for example full load ordering, vendor managed inventory and factory gate pricing and measures to smooth demand peaks within a supply chain such as nominated day delivery and replacement of the monthly order invoicing system.
- Back-loading is the practice of making use of spare capacity on the return leg of a delivery journey. It makes more efficient use of resources by finding loads that need to be shipped between similar areas as those visited by the returning vehicle. Increased back-loading can be achieved through rationalisation of reverse logistics, increased back-loading within a supply chain e.g. suppliers picking up retailers goods for onward delivery or outside of a supply chain – there are many websites devoted to filling empty journey legs with deliveries for other companies.

¹⁷ Freight Best Practice, Truck Aerodynamic Styling Guide,
<http://www.freightbestpractice.org.uk/download.aspx?pid=126&action=save>

Additionally, the research has also highlighted that, reductions in speed limits for HDV could also reduce GHG Emissions, and have recently been proposed by the Federation Nationale Des Transport Routiers (FNTR) in France. Although speed limits are determined by Member States, Directive 2002/85/EC sets restrictions for speed limiters which must be fitted to all passenger vehicles with more than 8 seats, and goods vehicles exceeding 3.5 tonnes. These limits are 100 km and 90 km respectively. It would be possible to reduce this limit and hence GHG emissions on the basis that vehicles often operate more efficiently at lower speeds. This would require legislative change, and could be opposed by significant sections of the freight industry. If motorway speed is reduced to 80kph the average European speed will drop from 86.3 kph to 80 kph. This kind of action could have the potential to have a positive environmental effect.

3.8.2

Comment

Operational improvements can have a fundamental effect on efficiency and environmental impacts, but in many cases may be difficult to implement in practice, at least in the short term (e.g. changing the location of production and distribution points). Appendix 5 show a range of different examples of such changes such as strategic partnerships and consolidation centres, all of which appear to have resulted in travel and energy use savings.

A key difficulty lies in quantifying the benefits of these measures and identifying the applicability of such a measure to the European Commission. The concept of strategic partnerships and supply chain collaboration can be effective but are 'slippery' concepts that are difficult to measure. Estimates on the effects of operational changes need to be made on a case by case basis, and even practices such as backloading in the freight industry will have varying benefits depending on the size of an operation and number of vehicles involved. It is worth noting that it can be assumed that the European Commission's role in such an area would be limited to providing information and advice.

3.9

Vehicle Maintenance

3.9.1

Overview

Preventative maintenance can be thought of as a proactive management strategy, rather than a set of individual actions. It is a strategy that involves making sure that vehicles are always kept in good order to help minimise the chance of major defects occurring, whilst finding ways to improve vehicle efficiency above merely ensuring that basic roadworthiness is attained.

This strategy can include daily vehicle checks, as well as systematic, thoroughly documented safety inspections at programmed intervals, whilst ensuring that proper procedures are in place for dealing effectively with any vehicle faults. Records of these activities are the foundation of a preventative maintenance programme, and the system should be supported by capable and responsible staff and adequate maintenance facilities.

Other proactive preventative maintenance measures also include tyre management and laser wheel alignment. These measures are relatively cheap actions for an operator to carry out and have real fuel efficiency benefits. In terms of the EC's, it could be possible to extend the scope of labelling passenger car tyres to also include HDV tyres.

3.9.2

Comment

In general it was difficult to find examples of preventative maintenance regimes in use within HDV operators within the EU or in other countries around the world. Those found are detailed in Appendix 6. A good example relates to laser wheel alignment undertaken by a number of UK operators, which improved fuel consumption by 2-5%, and increased tyre life by up to 40,000 km. A freight operator in the Netherlands was also reported as saved 5% due to more effective tyre management. Information was also found on two research based programmes which looked at vehicle diagnostics systems and better communication between manufacturers and customers. From the limited evidence available it appears that developments in this area are occurring in the medium to long term.

In overall terms, preventative maintenance systems appear to offer potential benefits, but the benefits remain unproven and it will therefore be important to examine the extent to which operators feel improvements in maintenance regimes can contribute towards efficiency improvements. The UK Freight Best Practice Programme is currently undertaking a study on preventative maintenance and aims to produce a practical guide on how to implement a preventative maintenance system. Additionally, the guide will also include benefits that companies may hope to achieve by adopting such systems.

3.10 Improvements in Propulsion Technology

3.10.1

Overview

The potential for improvements to vehicle efficiency via 'hard' engine technology and propulsion systems may potentially offer significant reduction in emissions from HDV. However, the diesel process has a maximum thermal efficiency of 62-65%. Take away one fifth for friction and losses the maximum practical efficiency for a vehicle is approximately 50%. The United States Department of Energy has also set a target of 50% peak efficiency. However, independent research carried out by ADEME in France illustrates a more optimistic picture¹⁸.

Over the past decade, vehicle manufacturers have made significant improvements in the reduction of non CO₂ greenhouse gas emissions, in particular in compliance with Euro engine specification standards. As there is a separate consultation by the European Union, this project will not explore the concepts of Euro engine standards, however it is important to take these actions into consideration when deciding on recommendations for this measure to avoid the potential for replication or conflicts with work done elsewhere. Euro engine standards do not however address fuel efficiency and therefore production of CO₂. Indeed there can be a conflict between reductions in non CO₂ emissions whilst simultaneously reducing CO₂. However, some technologies (two-stage turbocharging and high-pressure injection) may be used both to reduce fuel consumption and to reduce pollutant emissions, as mentioned in the supporting study¹⁹ for the impact assessment of the Commission proposal on a new Euro VI standard²⁰. Outside of the commitments stemming from Euro limits, another key focus area for engine and vehicle manufacturers is the development of new solutions available, especially hybrid engines.

Hybrids are a relatively new concept in the history of engine technology. However, in recent years their popularity has begun to grow as research and aid has been directed at producing such vehicles. In the United States of America the WestStart/Calstart programme has established the Hybrid Truck Users Forum (HTUF). The goal of this forum is to "speed the development and introduction of commercially viable medium and heavy duty hybrid trucks in the U.S." The user driven process now involves more than 80 fleets with over a million trucks and there is also a joint programme between WestStart and the US Army. HTUF has six core working groups which focus on utility/speciality, parcel delivery, refuse, bus trucks and a Class 8 and Incentives Working Group. The first HTUF WG Deployment of a Hybrid Electric Utility Truck saw 24 pre-production trucks deployed. The initial results show a 40/60% fuel economy improvement (projected) and a greatly improved total emissions of 30-60% (NO_x, PM and CO₂)²¹. Initially, it seems that hybrids would be most beneficial in an urban driving environment and a number of HDV applications could benefit from recent hybrid developments, including urban delivery and urban buses.

It is important to note that unlike other measures which could generally be applied to all HDV throughout Europe, improvements in vehicle propulsion systems can mainly influence new vehicles. Potential benefits of policy actions in this area should be viewed as long term in nature, and will be influenced heavily by the natural lifespan of vehicles and their subsequent replacement.

¹⁸ Gabriel Plassat, CAS-TR, Document General Evolution Technologiques des Vehicules lourds & efficiate energetique pour 2020, version 2du 15/11/07

¹⁹ http://ec.europa.eu/environment/air/pdf/euro_6.pdf

²⁰ http://ec.europa.eu/enterprise/automotive/pagesbackground/pollutant_emission/index.htm#eurovi

²¹ www.htuf.org

3.10.2

Comment

Fewer examples of improvements to propulsion systems were found compared to other measures, perhaps because manufacturers prefer to keep R&D developments confidential than to make information publicly available. Appendix 7 details initiatives relating to fuel saving units tested by the EPA, Homogenous Charge Compression Ignition and Continuously Variable Transmission. These types of initiatives are likely to benefit all types of HDV including buses, although the differences in the types of applications being developed for freight and passenger transport will need to be explored further.

It is difficult to make generalisations about the benefits of improvements in propulsion technology, simply because they are often made in a wide range of circumstances for different types of vehicles. In general, the development of these types of measures tends to take place over the medium to long term, and innovations generally take a long time to reach the market. Commercial manufacturers will always have an incentive to develop new technology, but the Commission can stimulate innovation in this sector.

3.11

Reflection on Task 1: Research into Efficient Measures

This desk based research exercise was valuable to the outcomes of the project and created the foundation on which to formulate educated assumptions and conclusions. The measure research enabled the project team to decipher options that have the real potential to reduce GHG emissions on a European scale. On consolidating this information, the project team then took these findings onto Task 2 of the project: Reality Checks.

4 Survey of Current Policy Instruments

4 Survey of Current Policy Instruments

4.1 Introduction

The second phase of Task 1 surveys the policies that are in use, have been planned or considered with the objective of reducing fuel usage and emissions of GHG or that otherwise have a bearing in this field, both in Europe and globally. A policy is defined as an action or series of actions that an authority might take to achieve or encourage industry adoption of certain fuel saving and emission reducing measures. This stage of the research will highlight current Directives/Regulations, Action Plans, White Papers, Behavioural Change and Research and Development Programmes that are applicable to reducing GHG emissions in HDV. However, please note that this is a sample of examples and not a comprehensive list of every policy that exists in the world.

4.2 Methodology

An initial list of relevant policies was provided to the project team by the client at the project inception stage and it was agreed that the early policy review would focus on looking at these instruments in more detail, as well as uncovering any others that might be relevant to the project. The brief for this phase of work was wide scoping, and the search for additional policies was not limited to any particular level of government or region. Known policies were divided between the project team members and information was gathered using a policy specific data collection tool, developed using Microsoft Access as described in the previous chapter.

For each instrument examined, the following key information was collected:

- Location: Instruments already in place in Member States and outside the EU;
- Type of Organisation: governmental and non-governmental bodies;
- Status: Existing, planned or discussed in literature; and
- Type of instrument: regulatory, incentives, information campaigns, etc.

The following section highlights the applicability of a range of policies which have been assessed; provides a summary of their objectives; and comments on their potential usefulness to the EC in helping reduce GHG emissions from HDV. Unlike the measures examined in the previous section, policies relevant to the project could not be easily classified into discrete, mutually exclusive areas. However, to provide a basic framework, policies have been examined in the following main groups:

- Directives & Regulations;
- Action Plans;
- White Papers;
- Behavioural Programmes; and
- Research & Study Projects

Although policies are discussed individually, links between different mechanisms are included within the text.

Over a period of 3 months, extensive desktop research was undertaken and the results collated and presented to the Commission. The remainder of this chapter summaries the identified policies and comments on the assessment of the potential for public authority influence in achieving reductions GHG emissions.

4.3 Directives & Regulation

4.3.1 *European Directive 2003/59/EC – Initial Qualification and Periodic Training for Drivers of Road Vehicles for the Carriage of Goods or Passengers.*

This Directive, which was proposed and accepted in 2003, established that in conjunction with holding a driving licence, professional drivers will also have to hold a 'certificate of professional competence' (CPC), which is obtained by attaining an initial qualification or by completing a periodic training programme. The initial qualification applies to all new drivers and the periodic training to existing drivers. In addition, extra training must be given every five years to ensure that professional drivers are still attaining high standards. This has been introduced to encourage greater training and staff development for professional drivers, who work within a sector generally characterised as one that provides very little investment in advancing its workforces' skills. In the UK, this problem has been recognised by the establishment of the Skills for Logistics programme.

This Directive sets out training requirements for safety and workplace training. However, interestingly the environmental aspect covered by this policy refers more to the general work environment rather than anything related to GHG emissions. As discussed in the previous section, driving styles have a very significant effect on fuel consumption and GHG emissions, and hence this policy could be enhanced by the EC, through encouraging greater take up of fuel efficient driver training programmes. Annex 1 of the Directive lists the subjects that must be covered in order to gain a CPC, and within this there appears to be scope to extend the environmental and efficient standards to improve efficiency. This could be supported through a uniform fuel efficient driving standard that could be created for the EU (along similar lines to SAFED in the UK). This could also be supported by the ECODRIVEN programme (see below).

4.3.2 *Regulation (EEC) No 881/92 on Access to the Market in the Carriage of Goods by Road Within the Community to or from the Territory of a Member State or Passing Across the Territory of one or more Member States.*

Since January 1993, any road transport operator wishing to carry out an operation between Member States, (i.e. between at least two Member States of the European Union), must hold a Community Licence, which is issued by a Member State. This document gives the company free access to the whole single market. To obtain it, operators must meet the conditions contained in regulation 881/92. They must be established in a Member State in accordance with that Member State's laws and they must be entitled in that Member State to carry out the international carriage of goods in accordance with the legislation of the Community and the Member State concerning admission to the occupation of the road haulage operator.

The objectives of this existing policy are to regulate the access to the transport markets of other Member States. In summary, the Directive authorises international transport and the general policy objectives are to create liberalisation and harmonisation of the transport markets in the European Union. This policy is aimed at all companies who are in the business of carrying goods by road for hire or reward within the territory of the European Community. The scope of this regulation essentially affects all journeys in international road freight transport.

Given that this policy is essentially about liberalising a market, it would appear to have limited scope in helping reduce GHG emissions, unless a caveat was introduced which explicitly bound access to the market for "clean vehicles" only. This could achieve a reduction in GHG emissions, but it would be extremely difficult to implement and opposition maybe generated from operators who already have a licence and do not meet the "clean" vehicle standards.

4.3.3 *Regulation (ECC) No 3118/93 – Cabotage.*

In July 1998 road cabotage in the movement of freight was liberalised. The policy is aimed at any road haulage carrier for hire or reward who holds a Community Licence (which is obtained through the Regulation (EEC) No 881/92, as aforementioned). Essentially, a company can transport goods, on a temporary basis, between two points within another Member State. "On a temporary basis" means that these transport operations must not be carried out over a long period of time, systematically or continuously. For example, a haulier can go from their country of registration to the country of delivery and cabotage in that country three times in a week and then he must return home, irrespective on whether he has full return load. He can not try for loads in another Member States. Therefore, in essence there is still protectionism and hence sub optimal efficiency and fuel use. Importantly, the haulier does not need to have a registered office or other establishment in that Member State that they wish to operate in. The top level

objective of this policy is to further liberalise transport markets and to contribute towards creating a single market in road freight transport.

There are some indicators that cabotage transport has considerably increased in the past few years. According to EUROSTAT the figures show an increase of 7.4 to 13.8 billion tonne km from 1999 to 2004. The main countries that benefit from this type of regulation are smaller, centrally located countries such as Luxemburg, although this has also had a significant impact in other countries such as the UK.

Overall, the scope to amend this regulation for reducing GHG emissions appears to be limited. Again, a caveat could be introduced to only allow "clean" vehicles to have access to cabotage but the same issue of existing licence holders would arise. However, the regulation does have the affect of increasing competition in the market place hence companies will seek to reduce fuel usage to increase profits and offer competitive prices.

4.3.4

Regulation (EC) No 484/2002 of the European Parliament and of the Council of 1 March 2002.

This regulation establishes a uniform document for driver attestation which certifies that the driver of a vehicle carrying out road haulage operations between Member States is lawfully employed by the Community transport operator in the Member State where they are registered. This document enables inspecting officers in all the Member States to check the employment status of drivers carrying out transport operations between Member States in Community vehicles and with a Community license, thereby helping the authorities to combat effectively the use of irregularly employed drivers and the resulting distortions of competition.

Once again the scope of reducing GHG emissions in HDV is limited with regards to this regulation. However, a caveat stating that a driver must have a certain degree of efficient driving skills could be implemented to help reduce GHG emissions. However, there does not appear to be an appropriate mechanism for achieving this, and it would be unlikely that Member States would agree to such an onerous obligation.

4.3.5

Regulation (ECC) No 684/92 (as Amended by Regulation 11/98) on Access to the Road Transport Market for Passenger Transport.

This regulation lays down the common rules, defines the conditions for applying the principle of free movement and simplifies the administrative procedures associated with admission to the transport market for public transport companies.

The Regulation defines the different types of coach and bus service as regular services, special regular services (e.g. the transportation of schoolchildren), occasional services (e.g. a one off tourist trip) or own-account transport and related authorisations and rules. With regard to requirements; national authorisations are still required for regular services for hire or reward, a journey form is needed for occasional services and a contract must be made between the organiser and the transport operator for special regular services. For own-account transport a certificate is required which is issued by the Member State in which the vehicle is registered. The Community license also allows hire or reward transport operators to perform international passenger transport operations on European Union territory, regardless of nationality or place of establishment.

This regulation is fundamentally about access to markets, and again appears to have limited scope in reducing GHG emissions from buses and coaches. In principle, different classes of licence could be given when applying for cabotage rights, which would create a ranking/repute system. This would identify those who had excelled in environmental performance and could urge others to follow in pursuit. However, from a regulatory standpoint this would not be a simple process and a detailed impact assessment would need to be carried out.

4.3.6

Regulation (ECC) No 12/98 on Passenger Transport Cabotage

Passenger Transport cabotage operations are those that are carried out in a non-resident Member State and on a temporary basis. Generally they are limited to specialised regular services and occasional services. Cabotage is permitted for regular services on a temporary basis, provided that it forms part of an international service and that the laws, regulations and administrative provisions of the States which the service passes through are adhered to. The limitations of this regulation in terms of reducing GHG emissions are the same as those for Regulation (ECC) No 3118/93, as aforementioned.

4.3.7 *Directive 2003/96 of 27 October 2003 Restructuring the Community Framework for the Taxation of Energy Products and Electricity (the Energy Tax Directive or ETD) and Recent Proposal for Increasing Rates (COM(2007) 52)*

Directive 2003/96 lays down the taxable products concerned for certain industrial and commercial purposes or for heating, for the purposes of this study – motor fuel. Only the structure of excise duties is harmonised across the Community and gas oil and unleaded petrol duties were set as follows:

Table 4.1 Fixed Excise Duties

In euros per 1000 l	1 January 2004	1 January 2010
Unleaded Petrol	359	359
Gas Oil (diesel)	302	330

The ETD also gives Member States the possibility to create a specific level of taxation for commercial gas oil, providing that the minimum levels are observed and that the rate for commercial gas oil does not fall below the national level of taxation in force on 1 January 2003.

The recent proposal for increasing rates (COM (2007) 52), aimed to reduce the distortion of competition related to excise differentials which affect haulage markets. The main aim is to foster growth, jobs and competitiveness, by enabling the advantages of a single market to be fully exploited. Secondly, the proposal aimed to meet common transport policy objectives and will provide better protection for the environment.

4.3.8 *Recasting of Road Transport Regulations (ECC) 881/92, 3118/93, 684/92, 3118/93, 12/98 and 484/2002.*

The objective of recasting these “access to the road transport markets” regulations is to create a more focused and consistent methodology to gain access through the creation of one single regulation. This single regulation will enable consistent treatment and coherence of the regulatory approach to the transport market in the European Union.

Ultimately, the objective is to ensure a harmonised application of the rules, have a clear understanding of what is required, to ensure protection of the right of establishment, rationalise the market, to improve service quality and to improve road safety. The amendment of the existing rules is to strengthen, clarify and simplify access to the market, cabotage conditions and the applicability of driver attestation to EU drivers.

The recasting approach is aimed at all international companies who operate in road haulage and road passenger transport operators. Although the policies all relate to the single market in road transport and are therefore aiming to improve competition in the market, the recasting of these policies does not seem to substantially encompass measures to reduce GHG emissions in the transport sector. The recasting is merely aiming to harmonise existing regulations and decrease the burdens of bureaucratic “red tape”.

Based on the consultations of 2006, the impact of this procedure does not seem to alter market conditions in terms of emission reductions and will only have a modest effect on operators and road transport operations. Importantly, it may have a more influential effect on the authorities of the Member States that enforce the legislation.

These regulations will only be useful to the Commission, with regards to GHG emissions, if in the recasting process it is decided that access to geographic markets will be bound to the use of “clean” vehicles. However, such issues did not arise in the 2006 consultations, and like other regulations discussed, this would not appear to be an appropriate vehicle nor cost effective method in which to achieve the final goal of reducing GHG emissions.

4.3.9 *Recasting of Directive 96/26/EC & Directive 98/76/EC.*

The objective of recasting these Directives is to ensure the harmonisation of the rules, create a clear understanding of what is required from operators, maintain mutual recognition of qualifications, protect the right of establishment, rationalise the market, improve service quality and improve road safety. The recasting of the Directives will also strengthen, clarify and simplify the application of the three qualitative criteria of good repute, financial standing and professional competence, by which operators gain admission to the occupation.

This recasting of the Directives is aimed at goods haulage operators and road passenger transport operators. Freight operators using vehicles of less than 3.5 tonnes are exempt from the Directive. However, Member States may also lower this limit for all or some categories of transport operators.

The major changes to Directive 96/26/EC, as amended by Directive 98/76/EC were aimed at:

- Improving requirements for financial standing;
- Strengthening professional competence requirements for operators (certificate of professional competence requirements), among other things, by emphasising the importance of road safety, the environment and the harmonisation of requirements for the organisation of examinations. In addition, it makes all operators, even those with five years relevant experience, subject to an examination or test which has the aim of limiting 'CPC Tourism'; and
- Checking at least every five years whether companies still fulfil all the criteria.

According to information available to the International Road Transport Union (IRU), the European Commission intends to survey the implementation of Directive 98/76/EC in EU Member States in order to analyse whether the examination standards are sufficient to cover the consequences of the highly competitive market and to meet the quality demands of the road transport sector. If the findings indicate that these rules do not satisfy their purpose, then the Commission could create more stringent rules that also set higher environmental standards, with the aim of reducing GHG emissions.

The possibility of the EC using this Directive to reduce GHG emissions in HDV is limited. However, it would be possible to strengthen the environmental competence or good reputation requirements or make these more explicit. Another option would be to bind the good reputation criteria more explicitly to the use of "clean" vehicles. It is still true that operators working in the normal market environment will seek to reduce CO₂ emissions anyway, in order to reduce fuel consumption. However, many operators may not understand the techniques in which to maximise the benefits associated with this. In addition, the CPC requirements could be enhanced to focus more on efficiency and environmental aspects via fuel efficient driver training.

4.3.10

Weights and Dimensions Directive 96/53/EC, 2002/7/EC

The maximum length of goods vehicles in the EU is set by the EC Directive 96/53/EC and is limited to 16.5 metres for articulated vehicles and 18.75 metres for drawbar combinations. The Directive does not set absolute height or weight limits but specifies certain limits which, if met, guarantees free circulation within the EU, being 4 metres and 40 tonne respectively. The Directive allows member states to permit vehicle combinations that are longer and heavier than those specified above by assembling combinations of standard length vehicles together, provided that they do not significantly affect international competition in the transport sector. This is sometimes referred to as the European Modular System (EMS).

This has been in use in Sweden and Finland for a number of years and uses existing vehicle and trailer components in a way that on long haul routes, two trucks and thus two drivers could do the work of three. It is worth noting that the Directive was changed to allow the use of the modular concept to allow these 2 countries to continue using these vehicles when they entered the EU. This effectively provided other member states with the opportunity to use longer and heavier vehicles (LHV) at a national level either by amending their own regulatory policies, or through trails (which typically do not require changes to legislation).

Over the past few years, LHV have been trialled, or considered for use in a number of member states. Most notably, a trial of LHV is currently ongoing in the Netherlands which consists of around 150 vehicles that are limited to suitable major routes and local access thereto. The main phase of the trial began in November 2004 and ran for 2 years. Reported findings have been positive. LHV are expected to remove 2000 – 5000 vehicle combinations from Dutch roads, and have only modest effects on mode shift (mode share of inland water and rail transport is expected to decrease by 0.2 - 0.3% and 1.4 - 2.7% respectively). No evidence was found from the trial to suggest that LHV would pose a higher safety risk compared to regular combinations. As a result of reductions in mileage, fatal accidents are expected to decrease by 4 - 7%, with a corresponding decrease in injuries of 13 - 25%. Following this 2 year phase, the trial has been extended for a further 12 months to November 2007 while the Government

reviews the consequences of LHV on infrastructure, including finding suitable places for parking. A further 'experience phase', starting no later than November 2007 and lasting for some time thereafter, is being planned to fill research gaps, gain international support and prepare for legislation.

Germany has launched a 6 year national trial of 300 14.9m semi trailers, which are 1.3m longer than existing semi trailers. These longer trailers increase the total length of an articulated vehicle from 16.5m to 17.8m; however weight is restricted to the existing national limit of 40t. Localised trials of EMS combination vehicles are taking place in Stuttgart (60t 25.25m combinations) and Hanover (25.25m combinations restricted to the existing weight limit). No nation-wide trials of these vehicles are being undertaken in Germany. Denmark has been reported as recently authorising a trial of EMS vehicles, initially for airport and ferry routes.

A recent study of LHV has been undertaken in Belgium, and the UK Department for Transport are also undertaking a desk based research study on LHV to inform policy and decision making. The latter study has been deliberately timed to coincide with the Dutch trial to take advantage of information generated by this.

Interestingly, vehicle manufacturers appear to be polarised on the issue. Northern European manufacturers such as Volvo, Scania and Mercedes Benz favour the 60t modular concept, while southern manufacturers such as IVECO favour a step changed approach initially involving the adoption of longer semi trailers and progressively moving towards LHV over a longer time frame.

Clearly there are benefits associated with LHV; however these need to be assessed against potential impacts safety, infrastructure, other road users and more environmentally friendly modes of freight transport such as water and rail. The provisions of EC Directive 96/53/EC already allow member states to amend regulations to trial or operate LHV, however the lack of consensus among Member States about the role of LHV suggest that it may be too early for the Commission to adopt a view on whether modular vehicles should be allowed to operate between Member States. Importantly, it should be noted that this project will not go into any major detail on this matter as the "Study on the effect of adapting the rules on the weights and dimensions of heavy commercial vehicles as established within Directive 96/53/EC regarding their ability to match the needs of advanced logistics and sustainable mobility (TREN/G3/318-2007)" does exactly this.

4.3.11

Eurovignette Directive

The main objective of the Eurovignette Directive is to ensure road usage better reflects its true impact on society and the environment at large by introducing a "user pays" and a "polluter pays" principle. It also aims to shift freight away from roads onto other modes of transport such as rail and waterways. Road charges and tolls on heavy commercial vehicles vary widely across EU member states, in terms of both the amounts charged and the systems used to calculate the levy. The Eurovignette directive was tabled in July 2003 to make up partly for this regulatory mosaic by proposing a harmonised EU framework for charging heavy goods vehicles on European motorways. It also came as one of the Commission's major tools proposed to meet some of the objectives laid down in the 2001 Transport White Paper: "*European Transport Policy for 2010: Time to decide*, namely:

- To ensure national toll systems reflect the 'external costs' of transport, including environmental damage, congestion, and accidents; and
- To finance alternative modes of transport (cross-financing) to operate a 'modal shift' of freight away from roads (rail, inland waterways).

The Directive's main innovation is to introduce the possibility for individual states to integrate the 'external costs' of road transport into toll prices. It was agreed that these 'external costs' can include congestion costs, environmental pollution, noise, landscape damage, social costs such as health and indirect accident costs which are not covered by insurance.

As of 2012, Eurovignette will apply to vehicles of 3.5 tonnes or more, a significantly lower threshold compared to the previous version of the directive (1999), which only applied to vehicles of more than 12 tonnes. However, the compromise allows room for derogations under strict conditions. Member states are also given extra flexibility on how to levy tolls or charges. In particular, these can now be raised on the entire road network, not just motorways.

As a road pricing Directive is in place, extra consideration could be given to whether the cost of environmental damage is truly reflected in the current price structures. This option is out of the scope of this project but continuing research into the viability of road pricing by environmental impacts should continue.

4.3.12

Japanese Fuel Efficiency Standards for HDV

Future fuel efficiency standard targets for road vehicles have been addressed and reported by the Japanese Government within the scope of international initiatives. The Japanese Government had already established an "Energy Conservation Law" in 1979 for passenger vehicles and 1998 this was amended by the introduction of the Top-Runner Standard as the basic approach to the definition of future target standards on fuel efficiency in the road transport sector and the obligation for manufacturer to provide information about and demonstrate fuel efficiency performance. As a result, specific standards for the improvement of the average fuel efficiency of new passenger vehicles were established in 1999, using base year 1995 data, target years 2005 (diesel vehicles) and 2010 (gasoline vehicles). The Japanese Government also defined target fuel economy standards for HDV in 2006, with base year 2002 data and target year data to 2015.

The Top Runner approach is an approach which sets the standard at the highest, fuel efficient engine sold during the base year and then provides tax incentives for buyers of vehicles with fuel efficiency better than the target values and a tax penalty for the buyers of vehicles which do not meet the target values. However, this is an engine standard only and the rest of the vehicle is being simulated in a standard configuration. Therefore, the standard does not capture any improvements of elements other than the engine. Additionally, the drive cycle is heavy on urban driving, which is why the standard looks poor by typical European consumption figures.

In June 2007 a first ex-post evaluation of results from the April 2006 introduction of the HDV Fuel Efficiency Standards Regulation was performed, the results are as follows:

- Out of the 11 Categories of trucks other than tractor with target standard values between 10.83 and 4.04 km/l, fuel economy performance better than the target values was found on 182 vehicle types distributed in 9 of the 11 corresponding categories with numbers of HDV types exceeding the target values ranging from **1** per category (1 vehicle type in the category of GVW from 3.5 to 7.5 t with pay-load > 3t and 1 vehicle type in the GVW from 8t to 10t category) to a maximum of **84** vehicle types (also in the category of GVW from 3.5 t to 7.5 t but with 1.5 t <pay-load < 2t).
- Out of the 2 Categories of tractors with target standard values between 3.09 and 2.01 km/l, fuel economy performance better than the target values was found on **28** vehicle types all included in the first category with GVW >20 t.
- Out of the 5 Categories of Route buses with target standard values between 6.97 and 4.23 km/l, fuel economy performance better than the target values was found on **24** vehicle types all included in the category with GVW >14 t.
- Out of the 7 Categories of Ordinary buses with target standard values between 9.04 and 3.57 km/l, fuel economy performance better than the target values was found on **8** vehicle types in the category with 14 t <GVW <16 t and on **5** vehicle types in the category with GVW >16 t.

All the vehicle types tested were new vehicles (released after April 2006) in compliance the new-long term emission regulation (JP05) which, according to one estimate, generally lowers fuel efficiency by around 5%. In conclusion, this first ex-post evaluation performed by simulating new HDVs performance on an engine-dynamometer test facility has already demonstrated an achievement rate of the fuel standard (among vehicle types in the market as of June 2007) of 13.1 % for freight vehicles, 38.1% for route buses and 25.0% for ordinary buses. As a next step, to get real fuel efficiency figures, it is planned to carry out fuel efficiency measurements on sampled HDVs from the market. A new Fuel Economy measurement methodology is also being developed to implement more realistic driving cycles (JC08) by including hot and cold starts.

4.3.13

The New De Minimis State Aid Rule.

This regulation mainly applies to financial state aid given to small industry or business enterprises within the context of the current EU rules about competition. These are mainly used by member states to address short and medium term business issues such as addressing negative impacts of unforeseeable events. However, the new de minimis regulation, which was adopted on 28th December 2006 states in recital 3 that all transport sectors are included in the Rule, but there are some exceptions on road transport to avoid over capacity and congestion. The following restrictions include:

- The ceiling for the road transport sector is lower than the norm, being €100k over any three fiscal year period instead of €200k over the same period (See Art 2.2 of the Regulation); and
- Aid for the acquisition of road freight transport vehicles by undertakings performing road freight transport for hire and reward should be excluded (Recital 3);

Therefore, in theory, a baker who wants to buy a new delivery truck or install retrofitting systems, etc, which cost less than €100k would be eligible to apply for aid. Additionally, it is also stated in recital 3 that for professional HDV “this does not call into question the Commission’s favourable approach with regard to State aid for cleaner and more environmentally-friendly vehicles in Community instruments other than this Regulation.” Therefore, the following section is applicable.

4.3.14

Environmental State Aid Guidelines

As a milestone in the creation of the Energy Policy for Europe, the European Council supported a comprehensive Energy Action Plan for the period 2007-2009 and invited in particular the Commission to submit the proposals requested in the Action Plan as speedily as possible. One of these proposals related to the review of the Community guidelines on State aid for environmental protection.

The primary objective of State aid control in the field of environmental protection is to ensure that State aid measures will result in a higher level of environmental protection than would otherwise occur without the aid and to ensure that the positive effects of the aid outweigh its negative effects in terms of distortions of competition, taking account of the polluter pays principle²².

These guidelines set out the rules the Commission will apply in the assessment of environmental aid, thereby increasing legal certainty and transparency of its decision making. The guidelines also lay down the rules for two types of assessments: a standard assessment for measures under a certain threshold and a detailed assessment above that threshold. It is the first of these assessments that would have any applicability to this project.

Point 74 states that “the aided investment shall fulfil one of the following two conditions:

- (a) The investment enables the beneficiary to increase the level of environmental protection resulting from its activities by improving on the applicable Community standards, irrespective of the presence of mandatory national standards that are more stringent than the Community standard, or
- (b) The investment enables the beneficiary to increase the level of environmental protections resulting from its activities in the absence of Community standards.

Additionally, point 85 states “aid for acquisition for new transport vehicles for road railway inland waterway and maritime transport complying with adopted Community standards is permissible, when such acquisition occurs before their entry into force and where the new Community standards, once mandatory, will not apply retroactively to already purchased vehicles”.

Point 86 further comments that “for retrofitting operations with an environmental protection objective in the transport sector the eligible costs are the total extra net costs involved according to the methodology of calculating eligible costs...if the existing means of transport are upgraded to environmental standards that were not yet in force at the date of entry into operations of those means of transport”.

²² http://ec.europa.eu/comm/competition/state_aid/reform/environmental_guidelines_en.pdf

Therefore, the Environmental State Aid Guidelines could possibly be a useful mechanism for entities to apply for capital to adopt measures to reduce GHG in HDV. However, to what extent is it still a precedent.

4.4 Action Plans

4.4.1 *Freight Transport Logistics Action Plan*

This action plan establishes the importance of Freight transport within the EU and also addresses the role that the European bodies have within the industry. Freight is primarily a business-related activity and a task for industry. Nevertheless, the authorities have a clear role to play in creating the appropriate framework conditions. Estimates put the share of the logistics industry in Europe at close to 14% of GDP and over recent years the logistics industry has had growth rates above the average European economies. The action plan specifically states that in a political role, "logistics policy needs to be pursued at all levels of governance. There is a growing need for a coherent EU approach to logistic considerations that offers an opportunity for reinforced co-operation and co-ordination between the different dimensions of transport policy and must become an underlying factor in decision-making²³." Essentially the action plan addresses the following topics:

- E-Freight and Intelligent Transport Systems (ITS);
- Sustainable Quality and Efficiency;
- Simplification of Transport Chains;
- Vehicle Dimensions and Loading Standards;
- Green Transport Corridors for Freight; and
- Urban Freight Transport Logistics.

These topics are extremely useful to this project and are in line with the project objectives. The e-Freight and ITS discussion highlights that they can greatly contribute towards co-modality by improving infrastructure, traffic and fleet management, facilitating a better tracking and tracing of goods across the transport networks and better connecting business and administrations. Within the sustainable quality and efficiency section the following areas are discussed:

- Continuous bottleneck exercise;
- Freight transport logistics personnel and training;
- Improving performance;
- Benchmarking intermodal terminals;
- Promotion of best practice; and
- Statistical data.

These topics are highly relevant for this project and our recommendations will incorporate such ideals in the later stages of this report. Essentially, the Logistics Action Plan outlines a set of actions that are designed to help the freight transport logistics industry towards long term efficiency and growth by addressing issues such as congestion, pollution and noise, CO₂ emissions and dependence on fossil fuels that if left unchecked, would seriously threaten the industry's efficiency. Therefore, the action plan fundamentally validates projects such as his one.

4.4.2 *Energy Efficiency Action Plan COM (2006)545*

The Commission Action Plan outlines a framework of policies and measures with a view to realising a saving of 20% or more in EU annual primary energy consumption by 2020. The Plan lists actions to be taken immediately and those that can be achieved over time. The Plan also states that for the transport sector, 'a comprehensive and consistent approach targeting different actors, including motor and tyre manufacturers, drivers, oil/fuel suppliers and infrastructural planners is necessary.' Importantly, it also states that 'increased awareness and behavioural change are called for from the outset.'

²³ Communication from the Commission, Freight Transport Logistics Action Plan, 2007 p2

With specific reference to transport, the plan indicates that it is essential to realise the potential for energy efficiency gains in this sector. It continues by highlighting that these gains can be achieved by 'ensuring fuel efficiency of cars, developing markets for cleaner vehicles, ensuring the maintenance of tyre pressure, and by improving the efficiency of urban, rail, maritime and aviation transport systems, as well as changing transportation behaviour.' The plan specifically highlights "co-modality" as a way of utilising transportation.

While the Plan is currently under development, the position taken at present suggests that if voluntary commitments of vehicle manufacturers are not honoured, then legislation should be used instead. In addition, the Commission would be recommended to continue its efforts to develop markets for cleaner, smarter, safer and energy-efficient vehicles through public procurement and raising awareness. Information and communications will also be increasingly used, which would be a huge benefit for the freight industry in particular. The labelling of cars is being considered, but it is acknowledged that this could also be extended for HDV.

The Commission is also committed to issuing a mandate for a recognised European norm and possible international standard for maximum rolling resistance limits and labelling for road tyres. Interestingly, the Commission also mentions facilitating appropriate financing of energy efficiency investments for small and medium enterprises. This will mean companies may gain grants to implement energy saving devices identified in energy audits. This could be particularly useful in the freight sector where haulage companies could gain grants to implement efficient technology.

Also of interest, the Commission will prepare a Green Paper on indirect taxation (2007) and will subsequently review the Energy Tax Directive in 2008 to facilitate a more targeted and coherent use of energy taxation by integrating energy efficiency considerations with environmental issues. In the short term, it has been recommended that vehicle taxation is more directly relevant to emissions of CO₂ from vehicles. Although taxation is aligned with engine size for cars in many member states, extension of this to HDV could help encourage HDV owners and operators to reduce the amount of CO₂ that they emit.

Overall, the Commission can build on its recommendations in this Action Plan and use the Plan to encourage future policies in relation to the reduction of greenhouse gases in HDV. The development of this plan coincides well with the timing of this study, and its eventual recommendations are likely to support, or provide supporting drivers for policies recommended by this project. The development of the Action Plan will continue to be monitored closely as work progresses.

4.5 White/Green Papers

4.5.1 *European Commission White Paper - European Transport Policy for 2010: Time to Decide*

The White Paper's main goal is "to strike a balance between economic development and the quality and safety demands made by society in order to develop a modern, sustainable transport system for 2010". The White Paper outlines regulated competition between modes, by disfavoured road transport in favour of rail and waterways to achieve modal shift. The expectation was simply to reduce road dominance over other modes with the aim to reduce harmful emissions. However, in 2006 in the mid-term review of the White Paper, the European Commission realised that the object of modal shift had not occurred, and road continues to dominate the transport sector. The review stated that 'the largest share of intra-EU transport is carried by road, which accounts for 44% of freight and around 85% of passenger transport.

As a result of these findings the European Commission has more recently adopted the policy of 'Co-modality' which is defined as the efficient use of transport modes operating either on their own or in multimodal integration in the European transport system to reach an optimal and sustainable utilisation of resources. As such, the EC has now adopted a formal policy of encouraging alternative fuels and technology advancement for HDV and cars to achieve the 'optimal and sustainable utilisation of resources'.

The purpose of this current research is entirely consistent with this revised thinking, and the White Paper provides a basis for the Commission to encourage and influence the European Parliament to make more HDV environmental friendly legislation. Either policies enforcing efficiency or information campaigns promoting efficiency are justified at a high level through by this White Paper.

4.5.2 *Public Procurement of Clean Vehicles – Green Paper Towards a New Culture for Urban Mobility (COM(2007) 551)*

Unfortunately, the proposal on green public procurement is not yet in public domain and will be available in the first quarter of 2008. However, the Green Paper Towards a new culture for urban mobility summarises the new stance. This states that the further promoting of a broad market introduction of new technologies could be achieved through economic instruments, such as incentives for the purchase and operation of clean and energy efficient vehicles by public authorities, and non-economic instruments, such as restrictions for heavy polluters and privileged access for low-emitting vehicles in sensitive areas.

The market introduction of clean and energy efficient vehicles could be based on the internalisation of external costs by using life-time costs for energy consumption, CO₂ emissions and pollutant emissions linked to the operation of the vehicles to be procured as award criteria, in addition to the vehicle price. Inclusion of life-time costs in the procurement decision process would increase the awareness for running costs. This would give a competitive advantage to the cleanest and most energy efficient vehicles. The public sector could thereby set an example for “sustainable economics”. Additionally, public procurement could give preference to new Euro standards.

4.6 **Behavioural Programmes**

4.6.1 *Freight Best Practice Programme – Department for Transport, England*

The Freight Best Practice (FBP) Programme (formerly known as TransportEnergy Best Practice) is one of a number of worldwide freight industry behavioural change programmes, which aims to reduce GHG emissions. While FBP and other similar programmes have been in existence for some time, in recent years they have gained increasing popularity as a relatively low cost approach to dealing with climate change obligations. In particular, this has been evident in the passenger transport market, where travel demand reduction programmes such as ‘TravelSmart’ have been being increasingly applied in the US, UK and Australia, and are seen as a low cost and effective alternatives to building new infrastructure to meet supply. Essentially behaviour change is one of a number of ‘soft’ non regulatory changes aimed at managing travel demand.

FBP is targeted at the freight industry in England, providing free advice to encourage operational efficiency within freight businesses to help reduce operating costs, and at the same time reducing CO₂ emissions to satisfy objectives of the Kyoto agreement. Information is provided free to industry in the form of guides, DVDs, case studies and research papers. The fundamental aims of the programme are to encourage road freight operators to use less fuel and use vehicles more efficiently, thus reducing GHG emissions.

The FBP programme is targeted at all those involved in the freight industry in England, making it inclusive and accessible to all, although the programme is principally aimed at small and medium sized hauliers who often may not have the means or resources to access useful information for decision making. This includes a wide range of companies from major 3rd party logistics providers to small own-account operators, where freight movement is a secondary activity in support of their main business. The primary focus is targeted at management as it plays a role in promoting efficiency measures upwards to directors and downwards to drivers and other operational staff.

The benefits of a behavioural change programme like FBP is that it is non regulatory in nature, however this also means that industry may not always be compelled to uptake best practice, even with sustained marketing activity. With this issue aside, there are a number of positive reasons that elements of Freight Best Practice could be adopted by EC. Demand management and behaviour change is favoured by current thinking in the logistics action plan, and represents a low cost option compared to regulation. Specific elements and information (particularly the SAFED driving standard) would be portable to the EU level, though some degree of tailoring would be no doubt required. One issue to consider is the degree to which the environmental ‘message’ resonates with operators across different countries. Marketing for FBP is almost entirely based on the premise that operational improvements can reduce costs, however many EU member states view environmental issues as being much more compatible with business interests.

4.6.2

SmartWay Transport Partnership – US Environmental Protection Agency (US EPA)

The SmartWay Transport Partnership is another important behaviour change programme. It is a voluntary collaboration between US Environmental Protection Agency (US EPA) and the freight industry and is designed to increase energy efficiency while significantly reducing greenhouse gases and air pollution. Smartway provides free information along similar lines to FBP and FleetSmart (discussed in next section), however a slightly narrower range of areas are covered. In general awareness of fuel efficiency is lower than in Europe, which to a large degree would be attributable to lower fuel prices. For instance, SmartWay anti idling campaign focuses on encouraging investment in better in-cab heaters to encourage vehicles to turn off engines while drivers take overnight rest.

A unique feature of the programme is the operator efficiency accreditation programme. Under this system, hauliers use a prescribed fleet tool provided by the US EPA to calculate an efficiency score for their fleet. Hauliers input their operational information into the tool, which then illustrates the savings associated with measures they currently use. This score can then be used by shippers when choosing hauliers to hire. Depending on the hauliers that the shippers pick, they then also gain a score. Therefore, accountability is devolved throughout the supply chain. In association with the scheme, the US EPA also provides information on how to reduce fuel use, idling and how to improve efficiency. What is most interesting about this programme is that it is voluntary, but at the same time supplier led (by major retailers) which means there is a powerful incentive for participation.

By 2012, this initiative aims to reduce between 33-66 million metric tonnes of carbon dioxide emissions and up to 200,000 tonnes of nitrogen oxide emissions per year. At the same time, the initiative is expected to result in fuel savings of up to 150 million barrels of oil annually. There are three primary components of the programme, which are creating partnerships, reducing all unnecessary engine idling and increasing the efficiency and use of rail and intermodal operations. During 2004-2005 the SmartWay projects are reported as having eliminated more than 3.2 million tonnes of CO₂, reduced diesel fuel consumption by nearly 300 million gallons and have saved participating partners \$850 million in annual fuel costs.

The EC could choose elements from this programme to form part of a pan European freight behavioural change programme. Industry feedback will help determine the usefulness of this; however the haulier - shipper accreditation scheme is particularly worth of attention. This could potentially be very effective, particularly if a large shipping organisation (such as the TAPA group for improved security arrangements in transport) could be convinced to support the scheme

4.6.3

FleetSmart – Natural Resources Canada

Another key behavioural change programme is FleetSmart in Canada, which offers free practical advice on how energy-efficient fleets of trucks, transit vans and other commercial vehicles can reduce operating costs, improve productivity and increase competitiveness. Membership is free and is open to any company that has offices in Canada which operate fleets, or are involved within the transportation industry.

Natural Resources Canada claim that the commercial highway freight sector is responsible for 10% of Canada's GHG emissions and with the launch of the ecoENERGY for Fleets Initiative is one of the key methods being used by the government to fulfil its commitment to reduce emissions. EcoENERGY for Fleets Initiative is an information based campaign that helps fleet owners and managers access information about the efficiency benefits of new and developing technologies. This is achieved through publications (case studies, guides and newsletters), workshops, training, benchmarking and research. In this respect, the programme is similar to FBP, although the range of subject areas covered by the programme is different.

Again, if the EC were to develop its own freight behaviour change programme, there would undoubtedly be elements that could be replicated from FleetSmart and other similar schemes.

4.6.4

STEER Programme – Intelligent Energy for Europe

The STEER programme forms part of the 'Intelligent Energy for Europe (IEE)' programme which looks to promote energy efficiency and the use of alternative energy sources. STEER supports projects dealing with the energy aspects of transport, such as the diversification of fuels, the promotion of renewable fuels and energy efficiency in transport, and the preparation of legislative measures and their application.

The STEER programme ran until 2006 with a total budget of around £21 million. Projects received up to 50% of eligible costs. However, the IEE is continuing its studies until 2013 under the Competitiveness and Innovation Programme

The main two areas covered by the STEER group were strengthening the knowledge of local management agencies and policy measures for more energy efficient transport. Under the “strengthening the knowledge of local management agencies” sector the programme undertook the following studies:

- COMPETENCE – Strengthening the knowledge of local management agencies in the transport field (2005);
- TREATISE – Training programme for local energy agencies and actors in transport and sustainable energy (2005);
- E-ATOMIUM – Energy Agencies Training on Mobility in Union Member States; and
- E-TREAM – E-learning for training Energy Agencies in mobility management and alternative fuels (2006).

Under the programme examining policy measures for more energy efficient transport, the following projects were conducted:

- ASTUTE – Advance Sustainable Transport in Urban areas to Promote Energy Efficiency (2006);
- ECODDRIVEN – European Campaign On Improving Driving Behaviour, Energy Efficiency and Traffic Safety (2006);
- MIDAS – Measures to Influence Transport Demand to Achieve Sustainability (2006);
- SNOWBALL – Demonstration, take-up and further dissemination of sustainable integrated planning methods in European Cities (2006);
- START – Short Term Actions to Reorganise Transport of Goods (2006); and
- Green Labels Purchase – Making a greener procurement with energy labels (2006).

A number of the projects appear to have significant relevance to the project and are detailed further below.

4.6.5

ECODRIVEN (STEER Programme)

ECODRIVEN is a synchronised European-wide ecodriving campaign aimed at drivers of passenger cars, delivery vans, lorries and buses in 8 EU-countries: *UK, Finland, Austria, Greece, Belgium, Poland, Czech Republic and France*. The consortium will be assisted by an Implementing Expert Committee, consisting of representatives of Ford, BP, the FIA, Profile International, the German Road Safety Council DVR and ACEA, in the development and implementation of the campaigning activities and materials.

The main aims are to keep CO₂ emissions below 0.5m tonnes by 2010, through optimising driving behaviour. The project is to involve 500,000 drivers of passenger cars, delivery vans, lorries and buses across Europe and an additional 2,000,000 drivers through publicity and media attention, to establish a European-wide network of local and regional collaboration between local departments. During a one year campaigning period end-users will be regularly presented with ecodriving activities within their familiar social environment, which will stimulate them to reflect on and optimise their driving behaviour in a safe and energy-efficient manner. Country-specific campaigns will be used where appropriate to reinforce the common campaign messages.

4.6.6

START (STEER Programme)

The START project began in July 2006 running for 36 months and is being undertaken within Gothenburg, Bristol, Ravenna and Riga. These ‘START’ cities will implement consolidation schemes in new areas and with new participants. A complete programme of incentives will be implemented directed at raising awareness among freight companies about energy efficiency and to stimulate more sustainable behaviour by promoting the introduction of clean vehicles (CNG and Bio-fuels); developing “extras” for clean vehicles and trucks with a high load rate; and promoting and training drivers for eco-driving and maintenance of vehicles.

The overall goal of START is to reduce energy use by making the freight traffic within the cities more efficient, through consolidation of deliveries, improved load factors and greater use of more energy efficient vehicles. Objectives include: Reducing energy use by freight traffic within

the demonstration areas by 10%, CO₂ emissions by 7%, NO_x by 10% and PM₁₀ by 15%. The project also aims to increase awareness and acceptance from the local transport sectors about the possible ways to increase energy and economic efficiency of freight transport; Increase public private co-operation. These objectives need to be reached without hindering the economic development in the demonstration areas. Structured workshops enable the participants to exchange information, experiences and discuss progress.

4.6.7 *Green Labels Purchase (Steer Programme)*

The aim of the project is to increase the share of energy efficient procurement procedures on a European level. The national and European labeling schemes will be supported by enhancing the demand for labeled goods. The project therefore contributes to the reduction of CO₂ emissions by reducing the purchase of energy inefficient goods and services especially in the tertiary sector, where energy consumption has increased in the last years.

Within nine European countries: Germany, Austria, Finland, Italy, Slovenia, Hungary, Poland, Bulgaria and Latvia, a consortium of 12 well-experienced institutions will implement and develop dissemination strategies. The main objective of these strategies is to raise awareness and knowledge concerning Energy Labels as a simplifying instrument in public and private procurement departments; Develop and disseminate standardised tools to support a wider distribution of energy related "greener" procurement procedures; identification of main barriers against the implementation of energy related "greener" procurement and target specific actions to overcome them; using of energy related "greener" procurement pilot projects as the first step for comprehensive green procurement, and, thus, support of national, regional and European wide green procurement initiatives.

4.7 **Research & Study Projects**

4.7.1 *WestStart-CALSTART*

WestStart-CALSTART is dedicated to supporting and accelerating the growth of the advanced transportation technologies industry and its related markets, with the goals of, cleaning the air and improving energy efficiency. WestStart-CALSTART is a non-profit organisation that works with the public and private sectors to develop advanced transportation technologies and foster companies that will help reduce air pollution, lessen our dependence on foreign oil and reduce global warming. It was founded in 1992 as CALSTART, but rapidly expanded to address national and broader Western needs. It now operates as WestStart-CALSTART, with CALSTART as its California operating division.

WestStart-CALSTART's key transportation programmes can be summarised as follows:

Technology Programmes – They work with teams of advanced transportation technology companies to develop the cleanest systems for medium and heavy duty vehicles. They also work with partners to focus development in reducing cost and increasing reliability. Such technologies include natural gas, hybrid, fuel cells, etc.

Clean Transportation Solutions – WestStart-CALSTART's consulting unit provides independent, clean transportation expertise to assist fleets involved in planning, developing, testing and implementing transportation and mobility programmes. They work with fleets, public agencies, ports and airports to name a few organisations. These services include assessment and analysis, funding assistance, environmental policy, implementation planning, implementation strategies, technology demonstration, communication and public outreach.

Clean Heavy Duty Vehicles Programmes – WestStart-CALSTART work with several agencies such as the US Army, Federal Transit Administration's Bus Rapid Transit Programme (BRT) to create green policy programmes.

Bus Rapid Transit – WestStart-CALSTART work with the BRT and are now a national clearinghouse and consulting centre for the BRT movement, which advocates high-capacity, clean fuel propelled buses with interactive traffic control system technology.

In addition WestStart-CALSTART is also at the fore front of the Hybrid Truck Users Forum and the Clean Heavy-Duty Vehicle Conference. The European Commission could also create a body to carryout these tasks for the European Union.

4.7.2 *Link to CO₂ from Cars: Integrated Approach*

The integrated approach to the reduction of CO₂ from cars is an approach that has been proposed by European Automobile Manufacturers Association (ACEA) and aims to achieve reduction targets via financial support from both EC and the National R&D programmes. One example of such a programme is "CO₂ operate", which is a joint R&D initiative involving European Automotive Manufacturers and their suppliers.

This programme is part of the larger and more comprehensive EUCAR project, which aims to identify, develop and demonstrate new technologies and system concepts to enable reduction of CO₂ emissions from vehicles. In particular the programme is looking at methods that can help reduce CO₂ emission objectives to no more than 120 g/km by year 2012. Solutions will be considered in terms of safety, affordability and customer acceptance.

Although the programme is mainly oriented towards the evolution of car technology, a similar integrated approach could easily be adapted to HDV by taking into account broader service objectives rather than pure leisure/business personal mobility issues that are key drivers in the car market. It is recommended that these programmes be considered further in the next stage of work.

4.7.3 *IEA 2007 Clean Energy Recommendations for G8*

At the Gleneagles Summit in July 2005 the International Energy Agency (IEA) was asked to play a key role in delivering the next Plan of Action for the G8 summit in 2008. The main areas of discussion were focussed upon:

- Alternative energy scenarios and strategies;
- Energy efficiency in buildings, appliances, transport and industry;
- Cleaner fossil fuels;
- Carbon capture and storage;
- Renewable energy; and
- Enhanced international co-operation.

The IEA aims to ensure reliable, affordable and clean energy. To achieve this objective the agency recommends that the following measures, supported by technology advancement, be adopted to help achieve fuel efficiency within the transport industry:

Advanced Fuel Cell

Fuel cells have the potential to convert fuels to electricity at very high efficiencies compared with conventional technologies. This results in reduction of vehicle emissions of greenhouse gases from the increased efficiency their use does not result in the production of the other noxious emissions that are usually associated with combustion.

Advanced Materials for Transportation

Fuel for transport accounts for 32 per cent of final energy use. Almost all of this energy is in the form of oil and transport accounts for 60 per cent of total oil usage. The use of ceramic materials in engines has the potential to allow the use of higher operating temperatures and hence improved efficiency.

Advanced Motor Fuels

As stated previously, fuel accounts for around one third of final energy use in a transport operation. Almost all of this energy is in the form of oil and transport accounts for 60 per cent of total oil usage. Of this, road transport accounts for 83 per cent. Alternative motor fuels, therefore, are important to increasing diversity of supply. In addition, many alternative motor fuels either from fossil fuels or from renewable resources offer advantages in terms of emissions of greenhouse gases and other pollutants compared with conventional fuels.

Hybrid and Electric Vehicles

Hybrid and electric vehicles offer an opportunity to reduce the dependence of transport on traditional oil imports and at the same time can offer the potential to reduce adverse environmental impacts of energy supply and use. The use of hybrid drive systems incorporating an electric motor together with another power source may be the best way to capitalise on the potential benefits of electric traction systems.

IEA recommendations are primarily focused on climate change policies, market reform, energy technology collaboration and international outreach, especially the major producers and consumers of energy like US, China, India, Russia and the OPEC countries. The policy has both financial costs and financial benefits, including the chance of achieving world leadership in a range of clean energy technologies. Example of benefits may be mentioned that EU renewable technologies already have a turnover of 20bn euros per year and employ 300,000 people. Also the EC's pledge to increase energy efficiency by 20% by 2020 is estimated to generate savings of 100 billion euros per year, but it would require considerable investment to achieve this ultimate goal. The EU has also pledged to increase the use of renewable energy by 20% and an increase in the use of biofuels of 10% in the transport industry. The EC can use these recommendations and pledges to promote broader policies to reduce greenhouse gases in heavy duty vehicles. Once again this could be achieved via regulation or through information campaigns.

Following from the Gleneagles summit, the IEA hosted the IEA/International Transport Forum Workshop on Standards and Other Policy Instruments on Fuel Efficiency for HDVs²⁴, which took place on 21-22 June 2007, at the IEA office in Paris. The purpose of the workshop was:

- To bring together policy makers, technical experts, manufacturers and other stakeholders in HDV transportation;
- To exchange the latest information on policies to improve HDV fuel efficiency, and
- To share experience with fuel efficiency standards for HDVs, including in relation to effectiveness and test procedures.

The workshop challenged the conventional wisdom that commercial operators are more conscious of fuel costs than private drivers, obviating the need for policy intervention. Participants pointed out that, potential HDV fuel efficiency improvements were not necessarily being delivered as quickly or as broadly as the conventional wisdom would suggest.

4.7.4

VTT – Fuel Savings for Heavy-Duty Vehicles “HDEnergy” – Summary Report 2003-2005²⁵

During 2003-2005, in conjunction with other research organisations, VTT carried out an extensive research programme. The project focused on reducing energy consumption of HDVs. The main goal of the project was ultimately to achieve a permanent fuel saving of 5-10%. In all, six research parties and 20 sponsors took part in the project.

The research programme included 12 technical sub-projects. The themes for the sub-projects were broken up into vehicle technology and transport system research. Such themes included the fuel consumption of different types of vehicles, modelling the fuel consumption of vehicles, technical aids for the driver, minimising the rolling resistance of tyres, the impact of the road surface on the tyres' rolling resistance, lubricants, the influence of maintenance and after-market equipment on fuel consumption, transport business monitoring systems, eco-driving and automated load detection for trucks.

The results from the research indicate that significant savings in fuel consumption can be reached by many independent technical improvements. The potential savings of different technical measures were evaluated as follows:

- Weight and Aerodynamics of the vehicle up to 30%;
- Guidance if the driver by technical aids 5-15%;
- Variation between different vehicle makes 5-15%;
- Tyres 5-15%;
- Different air deflectors 4-8%;
- Type of trailer 3-5%; and
- Lubricants 1-2%.

These findings were analysed and incorporated into the desk based research task, but were also offset with other findings from other research projects and case studies.

²⁴ http://www.iea.org/Textbase/work/workshopdetail.asp?WS_ID=306

²⁵ <http://www.motivva.fi/fi/raskaskalusto/rastu/rastuineenglish/>

4.7.5

Green Project

The main objective of the GREEN project is to perform research, leading to sub-systems for a heavy-duty engine. The objectives should be achieved with strict boundary conditions for a competitive cost base and the highest fuel conversion efficiency of the diesel cycle, to achieve near-zero, real-world, including off-cycle, pollutant emissions and significant reductions of CO₂ and other greenhouse gases. The project puts emphasis on diesel engines for trucks and rail applications, and on natural gas engines for city transport applications. The combination of innovation and durability is strongly supported. The research targets have been selected to look beyond all known legislation to date. The project will also target possible adjustments after the year 2010 with a focus on near-zero real-world emissions (illustrated below). A reduction in CO₂ emissions of 6.5% over 7 years is targeted.

Table 4.2 Targets for GREEN Project

	Target (for 2015)	Euro VI (Scen. A)	Euro V
NOx (g/kWh)	0.5	0.4	2
PM(g/kWh)	0.002	0.01	0.03
Fuel consumption (g/kWh)	204	-	[214]*
CO₂ (g/kWh)	617	-	[660]*

*not regulated in Euro V

The work in GREEN is divided into sub-project and crossover activities:

- HD gas engine for urban areas: with the objective to reach low GHG emissions and diesel-engine equivalent fuel consumption by variable valve management, cooled EGR for gas engines and close-to-valve multipoint port-gas injection, and comparing this with DI injection.
- Enhanced flexible engine: with the objective to find the best combination and concept to reach emission limits beyond Euro V, flexible engine components/sub-systems and exhaust after-treatment systems.
- Innovative control and air utilisation: with the specific objective to develop the sub-systems for a new combustion process with complete air utilisation and to develop the models for a model-based closed-loop emission control, to regard engine and after-treatment as one system in the future.
- High BMEP engine: with the specific objective to investigate the advantages and possibilities of a very high brake-mean effective pressure to reduce fuel consumption as much as possible. The crossover activities link the subprojects further: Future HD technology adaptation to rail diesel engines and to develop the rail diesel engine in 2012+ Basic investigations and comparison on fuels: diesel – biofuels – GTL Further development of a comparable injection system for gas engines – electromagnetic operated control valve (EOCV) system.

The project will provide research results and new components that will enable future emission standards, putting European HD manufacturers in a more competitive position. Essentially, the global conflict of fuel consumption and emissions will be targeted for HD diesel engines. Additionally, the introduction of valve management and electronic controls for gas engines will make the NG engine competitive for both emissions and GHG emissions. Research has shown that new technologies for improving the fuel efficiency without sacrificing fuel economy look promising and that improved high-tech engine components, such as fuel injection systems, turbine-compressors, variable compression ratio, and many others, are now being electronically controlled and equipped for future engines. GREEN also secures compatibility with future sustainable diesel fuels. The project targets improvement for both urban and long haulage applications. To date, the rapid start and positive early results look promising for the future.

4.7.6

FURORE

The Thematic network FURORE establishes a platform for stakeholders to discuss breakthrough technologies and the corresponding research demand for vehicles for the year 2020 and beyond. The network focuses predominantly upon road vehicles powered by internal combustion engines, but also analyses potential breakthrough technologies in alternative fuels and systems such as hybrids and fuel cells. In general, technological targets can be split up into research targets, engineering targets and commercial targets. FURORE focuses primarily on research targets. This means that the potential of a technology to realise intended technological objectives is examined but the aspects of feasibility and large-scale production are not investigated in detail.

It is anticipated that a smooth transition from the conventional to the new technologies will happen and no radical change is foreseen within the time period envisaged. Political and economical boundaries and technical feasibility will determine the speed gradient of the smooth transition to new technologies. Big improvement potential is still seen in further development of state of the art technologies. The immediate impact of these improvements on environment and economics is considered to be much bigger than the effect achievable by the introduction of completely new technologies which suffer from shortcomings in production, infrastructure and public acceptance.

Nevertheless the introduction of completely new technologies must be encouraged too in a sensitive manner also taking into account the intermodal situation. Any solo activity in the European Community might have a negative impact on competitiveness for the European automotive industry world markets.

A comprehensive, system-oriented view on potential new technologies is required, not only tank-to-wheel considerations but also well-to-wheel or fuel-production-to wheel analysis. For a complete understanding an approach which covers the whole life-cycle of a technology is essential.

The following targets were identified:

Table 4.3 FURORE Targets

	Car	Truck	Bus
Fuels	2020: Achieve EU target 20% substitute fuel, fuel/ combustion optimised together, significant depot-fuelled fleets (e.g. bus) using CNG and H ₂ 2030: Routemap to sustainable transport identified and enacted		
CO₂/ GHG	2020: 95g/km 2030: 80 g/km	2020: - 10% on today	2020: - 40% on today
Emissions	2020: 50% EU 4 + PM 0.1 control	2020: NOx 25% EU4, PM 50% EU4 inclusion of unregulated compounds, local control	
	2020: Understanding of the true needs of the local environment achieved		

The introduction of several new fuels is a challenge due to the costly proliferation of many different engine and emission control technologies, and a parallel proliferation of supporting fuel infrastructures. In some cases these new fuels or blends may be specific with new combustion modes, but this remains to be verified. Major concerns with all these alternative solutions are production costs, and for gaseous fuels the distribution and improvement of storage solutions; if there is no breakthrough improvement in this area, alternative fuels will remain marginal and serve niche markets only.

Vehicle propulsion system technology development is an evolutionary process, influenced by the requirements of customers, the legislative boundary conditions (emission and safety standards), the energy resources and prices influenced by production/ distribution costs and taxes. The general targets for technology trends and visions are energy consumption reduction, near zero emissions and alternative fuel-compatible power systems. A summary of the findings about powertrain technologies is highlighted below:

- IC-engines will be the powertrain backbone for the time beyond 2020;
- IC-engines with one combined combustion system will come to the market;
- Fully-variable engine concepts and their control will be state-of-the-art;
- Hybrid (IC-electric) vehicles needing advanced control and system integration will penetrate the market; and
- Fuel cell automotive applications will start from an ancillary power unit and then develop to prime mover applications.

4.8

Reflection on Task 1: Research into Policy Instruments

This desk based research exercise was essential in order to achieve the outcomes of the project and created the foundation on which to formulate our educated assumptions and conclusions. The policy research enabled the project team to decipher instruments that have the real potential to reduce GHG emissions on a European scale. On consolidating this information, the project team then took these findings onto Task 2 of the project: Reality Checks.

5 Task 2: Reality Checks

5 Task 2: Reality Checks

5.1 Introduction

Following the completion of Task 1 (desk based research), this second phase of work provides an opportunity to collect further information on relevant measures and policies to validate the information already gained from industry case studies. This phase of work was a key element to the success of the project as a whole. Research into the potential of different measures is important, but if the transport industry does not understand, nor implement these then such potential is wasted. This exercise therefore not only validates our findings, but also highlights any problems with the implementation of measures and policies to reduce GHG emissions from HDV.

5.2 Methodology

The following methodology ensured a balanced and consistent approach across the task.

5.2.1 *Preparation for Consultation with Industry Partners*

Following the finalisation of Task 1, an executive summary discussion document was prepared (see Appendix 8). This was essentially a summarised version of the report from Task 1, with a clear and concise list of measures and policies that were to be considered in this next task. This document was refined by partners and then sent to all prospective interviewees. This process allowed interviewees to better understand discussion topics prior to the interviews taking place. Additionally, Faber Maunsell also created a briefing note which outlined the process of Task 2 to all the project partners. This enabled a consistent approach to carrying out the interviews and collating the relevant information.

5.2.2 *Format of Industry Partner Consultation*

The reality check took the form of an in depth semi-structured interview, where validation of the options list provided the starting point for a wider discussion which focussed on:

- Measures previously used, currently used and those under active consideration,
- Costs and benefits of these measures including practical non-financial benefits,
- Obstacles to implementing measures and solutions and measures that promise benefits but fail to deliver in practice; and
- Awareness of policy instruments.

The operator, manufacturer and shippers' interviews were all carried out on the premises of the interviewee to maximise our understanding of the interviewee's business. Several of the Trade Association interviews were carried out over the phone, but some were carried out in person.

5.2.3 *Optimising the Sample*

Ensuring the best possible mix of industry partners was an important factor in ensuring the success of this stage of the project. We therefore ensured that a range of different sized manufacturers, vehicle operators, shippers and trade associations were visited, to gauge and understand varying levels of best practice throughout the European Union. The following sections summarise the results from these interviews. The number of visits planned was small in relative terms and does not represent the level of detail necessary for an impact assessment prior to the implementation of regulation and legislation, however it was considered appropriate for the purpose of this reality check.

5.3

Operator Site Visits

This section highlights which operators were visited (though names are not mentioned for confidentiality) together with their respective views on a range of areas and issues, including:

- Performance management;
- Fuel management systems/programmes;
- Aerodynamics;
- Vehicle specification;
- Information technology systems;
- Driver training;
- Vehicle maintenance;
- Alternative fuel;
- Improvements in propulsion technology; and
- Additional measures and policy.

For each subject, operators were presented with an extract from the options list which summarised our initial findings. Each section in this chapter begins with this quotation and then progresses to outline the overall view of the operators. This process provided a very useful method to test our ideas.

5.3.1

Operators Visited

The operator site visits were the main focus of Task 2. In total 16 operators were visited and interviewed, allowing us to ascertain vital information to update the options list.

The following table illustrates which operators were visited, but for confidentiality purposes the responses and comments discussed in this report will remain anonymous. As the table shows, a spectrum of companies were visited, encompassing freight operators, in a range of sectors including general haulage/logistics, food and drink distribution, paper distribution as well as a range of specialised own account operators. A number of different bus companies were also interviewed.

Although the interviews were confined to a relatively small number of countries, it should be noted that many were at company head office's and represented operations spread over several countries. It should also be stressed that this is a small sample of companies, and given that all were willing to speak to us about efficiency related issues, may not be representative of the views of all freight operators. Nevertheless, the information and feedback these companies provided, was extremely useful in testing the project teams findings from the first stage of work.

Table 5.1 Operators Visited to Date

Operator Name	Interview Location	Size of Fleet	Interviewing Partner	Date of Interview
Operator 1	Coventry, England	150+ at the Coventry depot	Faber Maunsell	26/06/2007
Operator 2	Warwickshire, England	30+ Vehicles	Faber Maunsell	26/06/2007
Operator 3	Wednesbury, England	70+ Vehicles	Faber Maunsell	27/07/2007
Operator 4	Nottingham, England	200+ Vehicles	Faber Maunsell	29/07/2007
Operator 5	West Bromwich, England	10 Vehicles	Faber Maunsell	20/06/2007
Operator 6	Edinburgh, Scotland	700 Buses	Newcastle University	05/07/2007
Operator 7	Leeds, England	1100+ Vehicles	Faber Maunsell	03/07/2007
Operator 8	Duiven, Netherlands	24,000 Vehicles worldwide	NEA	03/07/2007

Operator Name	Interview Location	Size of Fleet	Interviewing Partner	Date of Interview
Operator 9	Hilversum, Netherlands	3000+ Vehicles exc ships, trains, trams, taxis etc.	NEA	19/06/2007
Operator 10	s-Heerenberg, Netherlands	200+ Vehicles	NEA	02/07/2007
Operator 11	Kolham, Netherlands	360+ Vehicles	NEA	03/07/2007
Operator 12	Milan, Italy	900+ Vehicles	CSST	18/06/2007
Operator 13	Warsaw, Poland	568+ Vehicles	Faber Maunsell	27/06/2007
Operator 14	Perth, UK	7,200 Vehicles	Newcastle University	18/07/2007
Operator 15	Warsaw, Poland	56 Buses/Coaches	Faber Maunsell	28/06/2007
Operator 16	Warsaw, Poland	3,000 vehicles	Faber Maunsell	29/06/2007

5.3.2

Operator 1

Operator 1 is a European supply chain solutions provider. From single site operations to complex supply chain management, they handle operations that range from the management of single distribution sites and simple product flows through to complex supply chain solutions. They work with customers to streamline distribution networks and optimise international logistics. Their customers range from automotive sectors to utility companies. They have over 500 offices employ approximately 5000 employees of which 2000 are UK drivers. Their fleet at the Coventry depot consists of over 150 vehicles.

5.3.3

Operator 2

Operator 2 is a family business which started life in 1971. The company offers solutions in the following areas: warehousing, logistics, contract distribution, fleet maintenance and crate and pallet washing. Operator 2 has now been operating for over 30 years and has a mixed fleet of modern vehicles, both rigid and articulated, either in their livery or customer livery – all maintained to a high standard by their maintenance unit. With their fleet of in excess of 20 vehicles they offer a dedicated National and International service and all vehicles are equipped with mobile telecommunications to ensure rapid response when necessary. They have an in house government sponsored training programme to promote road safety and fuel efficient driving. (SAFED). They operate from one main office and have approximately 40 employees of which 20 are drivers. Their fleet consists of 30+ vehicles.

5.3.4

Operator 3

Operator 3 is an independent, consumer led and profitable public company, engaged in the manufacture, distribution and marketing of branded carbonated soft drinks. Their long established company produces a large range of soft drinks. They have four production sites in the UK which are supported by distribution centres covering the whole of the UK. They have a total of nine offices, 900 employees and 300 drivers and a fleet of approximately 70 vehicles.

5.3.5

Operator 4

Operator 4 operates a diverse fleet of technologically & environmentally advanced heavy goods vehicles for UK distribution. They offer a daily nationwide service for the carriage of goods with their fleet of approximately 160 heavy goods vehicles, including tippers, articulated flats and curtainsided trailers, and truck mixers. Their innovative management approach and regular investment maximises fleet flexibility and ensures an up to date and modern image, incorporating some of the most advanced technology available within the industry. They carry all types of commodity from raw products to finished manufactured goods and work for many high profile companies. They specialise in mechanical off-load apparatus and operate a large fleet of truck mounted forklifts. This allows them to off-load efficiently and deliver product down the narrowest of streets or over rough terrain. This is a particularly advantageous service for fragile goods that require extra care. Their vehicles and trailers are selected with maximum

payload in mind and they also operate specialised double deck trailers designed to accommodate a higher volume of awkward, fragile items without stacking. They operate out of four offices and have approx 300+ employees and 190 drivers.

5.3.6

Operator 5

Operator 5 is a UK national paper warehouse and distribution company with two offices, 50 employees and 10 drivers. They have 10 vehicles in total which delivery paper across the UK. This company was chosen for the interview due to their small size and proactive attitude to fuel efficiency.

5.3.7

Operator 6

Operator 6 is a public bus company that operates in the city of Edinburgh, Scotland. It has four offices and employs 1800 staff, of which 1330 are drivers. Their fleet consists of 700 buses.

5.3.8

Operator 7

Operator 7 is a large and successful grocery retailer based in the UK. It operates its own transportation for 90 – 95% of goods movements between distribution centres and stores, the remainder is mainly subcontracting on trunk journeys between distribution centres. A small amount of direct deliveries to stores also still occurs. The company employs over 5000 distribution staff including approximately 3500 drivers and 1100 of its own HDVs. It does undertake goods movements upstream of its main distribution centres; however a much greater proportion is subcontracted, in particular where upstream primary consolidation centres operate. The company also operates 1400 home delivery vans which are less than 3.5tonnes GVW which mean they can be driven with a standard B category driving licence.

5.3.9

Operator 8

Operator 8 provides businesses and consumers worldwide with an extensive range of services for their mail and express delivery needs. Basically the activities can be divided into two main activities that correspond to two company divisions: They employ over 92,000 employees and have over 600 offices of which 409 are in Europe.

5.3.10

Operator 9

Operator 9 is a large public transport bus company. Besides bus services, it also operates certain train lines, tram lines, a few ferry routes, a taxi service and touring cars. They have 23 registered offices in the Netherlands and employ approximately 13,000 people of which 10,500 are drivers. Their fleet consists of over 3000 buses and coaches.

5.3.11

Operator 10

Operator 10 is a 3PL and logistic service provider backed by a powerful European network for customer specific and preferably integrated warehousing, transport and distribution solutions. They offer European network services, world wide sea and air freight network services, innovative solutions, warehousing solutions and distribution solutions. They have 25 offices in 8 countries and employ 1800 staff of which approximately 500 are drivers. Their fleet consists of over 200 vehicles.

5.3.12

Operator 11

Operator 11 provides trucking and forwarding services throughout Europe. Operator 11 is an integrated logistics service provider and specialises in finding optimal solutions to any kind of logistic question, in close cooperation with its relations. Their expertise allows them to give optimal advice about logistic choices, leading not only to better services but often also to important savings. Their integrated core activities ensure an optimal service in transport, warehousing and intermodal activities. They have a total of five offices in the Netherlands, Germany and Budapest and employ 478 people of which 420 are drivers. Their fleet consists of 360+ vehicles.

5.3.13

Operator 12

Operator 12 is a logistics operator specialising in transportation and value added services mainly in the industries of consumer goods, plastics and automotive. Operations include the management of two platforms of multimodal transportation services. They have a total of six offices and employ 600 people of which 450 are drivers. Their fleet consist of 900+ vehicles.

- 5.3.14 *Operator 13*
Operator 13 is primarily a worldwide transport operator who also carries out warehousing. Based in Poland they have a total of 15 offices of which six are in Europe. They employ a total of 1717 employees and have 680 drivers.
- 5.3.15 *Operator 14*
Operator 14 is a large public transport group operating in the UK, UA and Canada. It operates bus, coach, rail and tram services. It operates over 7200 vehicles and employs 17,000 employees from 110 offices.
- 5.3.16 *Operator 15*
Operator 15 is a relatively small public transport operator that provides local bus services in Poland. They have a total of 56 buses and operate from a single office. They employ 96 employees of which 52 are drivers.
- 5.3.17 *Operator 16*
Operator 16 has about 5,000 employees working at 45 offices within Europe. Their resource can be used for both road and intermodal transport. The fleet of vehicles consists of more than 3,000 trucks, all equipped with satellite communication, and 10,000 loading units. Furthermore, they have 500,000 m² storage capacity at our disposal and are active within the whole of Europe with a number of large logistic silo platforms.

The following sections provide an overview of responses provided relating to each of the main measures examined in Task 1 of the research.

- 5.3.18 *Performance Management*

“The benefits of performance management can be difficult to quantify because it is an indirect driver of efficiency improvements (i.e. the act of measuring and monitoring performance does not in itself lead to efficiency improvements, but rather can act as stimulus for change). In terms of what the European Commission can do, they could adopt an information/behavioural change programme. There is also the possibility of intervention to help provide solutions not necessarily commercially viable (e.g. external benchmarking studies).”

The overall response to this statement was extremely positive with 12 out of the 13 agreeing with our initial views of the measure. What was apparent was that historically many of the operators interviewed did not have a coherent system of managing performance, but as their company evolved it became a necessity of the business to manage the simplest of Key Performance Indicators (KPIs). Therefore, it seems that a simple approach is often taken and a more sophisticated system of managing performance is then built upon these foundations over time and as the business evolves. From our discussions it seems that many large companies operate some kind of sophisticated system of managing performance, as they have the resource to research and implement such systems. Smaller operators are more likely to need assistance in understanding the real benefits of either establishing a system of monitoring or evolve their simple systems into ones which encapsulate more KPIs.

From the sample of operators that we interviewed the KPIs ranged from measuring a few to as many as 22. The main KPIs that were measured were as follows:

- Fleet Costs;
- Operational Efficiency;
- Standards of customer service;
- Compliance;
- Maintenance;
- Idling times;
- Vehicle performance;
- MPG monitoring;
- Vehicle fill;
- Fuel Usage;
- Distance; and
- Driver Performance

How did the sample operators measure these KPIs? The majority of the large companies had some form of integrated IT system which linked various different methods of measuring performance to a central database. For example, the Triscan system and other systems such as VeMIS and ISOTRAK which generate data for analysis. The smaller companies used manual methods of recording the data (i.e. driver and vehicle sheets) and then inputted the data into a database (e.g. the Freight Best Practice Small Fleet Management Tool).

After gathering and analysing the data many companies create graphs and tables which illustrate their fleet's performance. For many, these results are then used to highlight any major inefficiencies within the fleet. From this indication they can then decide if any action needed to be taken, thus enabling any money spent to be allocated to the right project. Additionally, from these results the majority of the sample then set targets and company averages which the fleet have to adhere to. These targets are also used to set bonus levels for drivers.

Other than being able to set realistic targets and benchmarks, the general benefits of those who used a system of managing performance were that they saved both fuel and distance travelled, thus equating to an improved profit on, as well as reducing greenhouse gas emissions.

The majority of the companies also found that getting their employees to interact with the new system was not overly difficult. Most carried out information campaigns and meetings whereby the employees were engaged in discussion and trained prior to implementation. This approach seemed to be a cost affective way of encouraging drivers and other employees to adopt to change.

Encouragingly, most of the operators that we visited did not encounter any real obstacles in implementing a performance management system. The simple spreadsheet based systems were obviously the easiest to implement and the main cost involved was man days rather than system set up costs. The larger integrated IT systems did attract a considerable cost but this was relative to the size of the operator. Costs ranged from €2,000 to €4 million depending on the complexity of the systems. However, from our observations it is likely that only the worldwide/multi-national operators would require a system of such sophistication that it would cost over €2 million. Additionally, 9 out of 13 companies specifically stated that more free advice and information prior to implementing a performance management system would have definitely been beneficial and saved both money and time.

Overall Comment

Our initial views which were established in Task 1 of the project seem to be valid with the majority of the operators agreeing with our statement. It has also been identified that at this point there appears to be no obvious, immediate need for intervention from the European Commission. However, the Commission could play an ancillary, simulative role in helping smaller companies who find it difficult to manage performance because of a lack of knowledge or lack of time to investigate further (For example, the Commission could produce a European wide database which could be the template for measuring performance). The majority of the operators we interviewed, big, medium or small, agreed that more information on the subject prior to implementation would have benefited them with regards to time and cost.

5.3.19

Fuel Management Systems/Programmes

“Evidence suggests that the appropriate application of a fuel management programme can lead to fuel use reductions of at least 2-5%. A fuel management programme can be a starting point for making other operational improvements. In terms of what the European Commission can do, they could adopt an information/behavioural programme to encourage a greater take up of such a system. This would highlight the fundamental aspects that need monitoring and give an operator the foundation to create a sophisticated fuel management programme.”

The overall response to this statement was also extremely positive with all the operators agreeing with the statement above. Like performance management, most of the operators do have some form of fuel management system. However, the form of these systems, differ greatly depending on the size of the operation. From our discussions it seems that smaller companies tend to have simple systems which are integrated with their performance management system

(e.g. paper base monitoring coupled with a simple spreadsheet for analysis). In addition, one company used the information supplied by Freight Best Practice to set up a fuel management system and they also employed a Fuel Champion. It is likely that the majority of larger operators also started out with a simple system that expanded and evolved over time. Indeed, one drinks manufacturer once had a Fuel Champion but as their system progressed they felt they no longer needed him as the system automatically analysed the data. This has resulted in many of the large and medium companies buying fuel management systems such as Triscan. Most of the advanced systems also integrate other IT systems within the operation to allow a comprehensive and complete analysis to take place. Other ways of measuring fuel also include fuel cards and monitoring variations in fuel prices with suppliers. The data that was analysed to form a fuel management system varied but normally consists of the following:

- Driver behaviour;
- Distance travelled; and
- Fuel used.

By measuring these criteria, operators can identify where irregularities occur and then solve the problem. For instance, if a single vehicle consistently uses 200 litres of diesel a day and then one day it uses 300 litres the transport manager can identify that there is a problem and then take measures to solve it. Other benefits highlighted included reduced theft of fuel, improved driver mpg figures, knowledge of life cycle of fuel used, complete fuel control, environmental and cost savings, improved driving techniques and the ability to create benchmarking data. In terms of substantial savings the operators recorded savings of between 2-5% in fuel usage and reduced distance. These savings obviously reduce emissions and improve overall profits for operators.

As fuel management systems/programmes are generally regarded as being the main element of performance management, the operators again stated that they had not had any real issues with getting their employees to interact. The key element that emerged from the discussions was that you must encourage drivers and engage them in a two way discussion in order to stimulate them and get them to see the reasons for monitoring fuel use. Several of the operators used driver league tables and bonuses to keep an on-going incentive for the drivers.

Again the same comment on obstructions applies for fuel management systems/programmes as for performance management systems. No real obstacles were encountered except the issue of time and money if sophisticated systems were adopted. The issue of monitoring drivers is always an obstacle at the beginning but if the right methods and communication is adopted then this can be easily overcome. The operators we visited were obviously pro-active in managing fuel performance, but all stated that more advice prior to implementation would have definitely been beneficial.

Overall Comment

Our initial views which were established in Task 1 of the project appear to be valid with the all of the operators agreeing with our statement. It has also been identified that at this point there is no obvious, immediate need for intervention from the European Commission. However, the Commission could play an ancillary, simulative role in helping smaller companies who find it difficult to manage fuel because of a lack of knowledge or lack of time to investigate further. The majority of the operators we interviewed, big, medium or small, agreed that more information on the subject prior to implementation would have benefited them with regards to time and cost.

5.3.20

Aerodynamics

“There may be little scope for increased take up of aerodynamic styling, as many operators have already purchased it. However, more information on the benefits of different kinds of aerodynamic products could lead to a further take up of additional products. The best way the European Commission can address this is to provide information on the benefits of different kinds of aerodynamic styling”.

The topic of aerodynamics and how much they actually save seems to be very debatable with nine of the operators agreeing with our statement. However, interestingly the two bus/coach companies believe more can be done in this area for buses and coaches. All the operators used some form of aerodynamics, mainly the kit that the manufacturers supply the vehicle with, including kit such as window flexes, wind deflectors, trailer side skirts, sun visor and low drag mirrors. The main point that emerged from the interviewees was that most of the operators did not know the real benefits of aerodynamics nor did they know how to research it. Only three operators had done any real research into the topic and they used aerodynamics that matched their operation (i.e. there is no point in having the full kit on a quarry haulage vehicle). The minority that understood the benefits of certain types of aerodynamics stated that they did save fuel and the payback period was approximately 12 months. Overall, most of the operators agreed that a European funded independent research project which created simple illustrative outputs of the benefits of different types of aerodynamics would be extremely beneficial.

Overall Comment

There seems to be a real lack of understanding from the operators that we interviewed. Many believed that aerodynamics were beneficial, but they did not understand what equipment would be beneficial to their operation. Overall, the majority of operators believed that there was not much more that could be developed in terms of new aerodynamic kit, but also that they normally relied on what the manufacturer stated. Unanimously, the operators stated that a comprehensive guide to aerodynamics and the individual benefits of each different types of kit would be extremely useful in understanding the real benefits of aerodynamics.

5.3.21

Vehicle Specification

“Alternative combinations/body types may use more fuel, but can ultimately improve vehicle utilisation and reduce total distance travelled. Bus and coach operators are likely to have less flexibility over design compared to freight operators. A range of mechanisms could potentially be used to encourage increased use of alternative specifications, including information/behavioural change programmes for operator based education on the need for appropriate vehicle specification or a regulatory based approach for light-weighting, longer and heavier vehicles and double deck trailers.”

The overall response to this statement was that only two operators disagreed with this statement. Interestingly, the two operators were the bus and coach operators. Their reason for disagreement was not that they thought longer/heavier vehicles would not improve efficiency but more so because they are bound to what the customer/authorities want. The discussion points varied between operators as different operations require different vehicles. Overall, there was a consensus that longer heavier vehicles could benefit the industry at large, as long as the infrastructure could accommodate them.

In terms of what the operators currently do with regard to vehicle specification, the majority of them do specify vehicles for different jobs, considering vehicle size, weight and engine size. However, the express delivery operators stated that time is more important to them than specification. Several of the UK operators also use or are considering double deck trailers. Additionally, several of the operators also used light weight materials on their trucks in order to fit more cargo, thus being more efficient in their deliveries. One operator carried out a research project to identify methods of specifying vehicles and determining what types of vehicles are best suited for specific jobs.

The benefits that were stated by the operators were numerous including:

- Increase load;
- Decrease in amount of trips;
- Reduced distance travelled;
- Reduced fuel usage;
- Reduced emissions;
- Reduced fleet; and
- Reduced taxation in the Netherlands if your vehicles weigh less

Overall Comment

Overall, vehicle specification seems to be widely adopted. However, more information on the benefits of using different kinds of vehicles for certain operations would be beneficial to all operators. Of interest to all operators was the possibility of longer and heavier vehicles as this would result in a win-win situation (i.e. less trips, reduced fuel usage, less emissions.)

5.3.22

Information Technology Systems

“Evidence suggests that appropriate application of telematics and CVRS technology suggest fuel savings of up to 10%. Telematics are appropriate to all kinds of vehicles, but CVRS is generally not useful for passenger transport vehicles. The European Commission could implement information campaigns/behavioural change programmes to promote the benefits of such measures. Additionally, the EC could support R&D to increase innovation and take-up of technology.”

This statement was validated by majority of operators interviewed. However, one bus company was adamant that information technology systems were less relevant to them. The degree of information technology systems that were used varied depending on operator size and type of operation. The following systems were identified:

- Fleet Management system;
- Security System;
- On-board computers;
- Telematics;
- Track and Trace systems;
- Data and voice communication systems;
- Computerised Vehicle and Routing Systems; and
- Mobile phones

Several of the large companies had invested a vast amount of money on IT systems (between €30,000-€300,000 a year) whilst some of the smaller operators had taken initial steps by implementing routing and scheduling systems. The more expensive systems integrated several different IT packages enabling full control over their fleet and allowing them to monitor several aspects of their business at the same time.

It was established from the interviews that information technology systems can give real benefits in two major areas:

- 1) On board the vehicle; and
- 2) Remote monitoring from the office

The benefits for operators included real time control over their operation which created efficiency and reduced usage of fuel, driver control, vast savings in fuel of up to 10%, efficient routing and planning, streamlining of procedures, improved customer satisfaction, higher load factors and reduction in empty running, improved reliability and reduced emissions. Though many of the operators were unable to give figures for the savings they had achieved, one stated that their trials of information technology in the urban environment led to savings of 17-20%. Another stated that increasing cruise control led to savings of 3% in fuel, whilst another operator saved 3-9% in fuel by reducing their velocity. A bus company also recorded savings of 5-6% in fuel by using on-board computers.

The main identified problems with information technology systems was implementing them and then getting employees to integrate with the technology. Many of the operators solved this problem by training their staff appropriately and making them understand that they were not infringing their personal space but in fact were trying to make their jobs easier. However, the majority of the operators stated that if more information was available prior to implementation then they could have avoided pitfalls and possibly chosen a better system to suit their operation

Overall Comment

From our interviews, Information Technology Systems seem to be used in all the major transport operators' businesses. With regard to the smaller companies, most have some form of IT system but do not have the means or time to make their operation fully electronic. It was specifically stated by many of the operators that advice on the real benefits of different systems would make a real difference to their choices and implementation.

5.3.23

Driver Training

“Driver training is applicable to all types of transport operations. Many driver training schemes report 3-5% fuel use reductions when applied appropriately. Evidence suggests training must be ongoing to maintain the maximum benefits. The European Commission could promote a European standard and/or an information/behavioural change programme to educate operators of the benefits of such a scheme. In addition, more vigorous regulatory mechanisms could be introduced to establish a European wide compulsory training scheme.”

Overall, all the operators agreed with the statement except one who stated that good drivers know how to drive and therefore they do not need training. However, this view was not shared by others and research and operational tests have illustrated that driver training is beneficial for safety, efficiency and plays a big part in reducing emissions. All other operators had some form of driver training and believed that it was an essential part of their business. However, it appears that driving standards varied across Europe.

One UK operator was a pioneer in driver training and as a result they set up a driving school to teach other companies as part of the SAFED programme. The smaller operators that were interviewed in England had all participated in the SAFED programme, which was available free of charge for operators with less than 50 vehicles. The Dutch operators also highlighted the existence of the “Het nieuwe rijden” programme. Several of the operators also trained drivers when they had recruited them. This allowed good driver behaviour to be adopted from the beginning. Importantly, not all operators continuously applied training to those who had already been trained, whilst other operators who did annual re-training sessions said they made a real difference as bad habits quickly return. Many operators also took the opportunity to train their drivers in basic maintenance procedures and customer care.

The cost of training varied for every operator. Many manufacturers include training in their vehicle prices and several of the operators had taken advantage of free SAFED initiative in the UK. Therefore, time was the main cost, but in the long run the training proved to be invaluable. The large operators have created their own worldwide training schemes, with one bus operator stating they had spent £3.25 million on driver training.

Despite the difference in cost, the benefits of any kind of driver training are clear to see, according to the operators. The main benefits included a reduction in fuel use (on average 3-10%), better driver retention, lower vehicle damage cost, etc.

Many of the operators said they found it difficult to influence drivers who often opposed operational changes. However, if you communicate the benefits of the training in the right way and create a two way process whereby you listen to drivers, the operators stated that the drivers then become enthusiastic about learning new skills. Many of the operators coupled the training with bonuses and league tables. Each operator had different methods of encouragement but prizes such as a holiday or a cash bonus for each driver if they meet their targets were common.

Overall Comment

It was accepted and promoted by the operators that driver training is essential and the benefits far outweigh any costs incurred. One thing that was obvious that across Europe different levels of training were adopted, thus not creating a unified approach. In this respect, the potential of a universal standard of driver training (which could even be a requisite of obtaining a HDV driving licence) is seen as positive.

5.3.24

Vehicle Maintenance

“Preventative maintenance is an overarching management strategy about ensuring efficiency above and beyond minimum road worthiness obligations. The firm benefits of this measure are unproven to date but developments are also taking place in the area of diagnostics. The European Commission could promote such a measure through an information/behavioural change programme. Additionally, money could be provided to fund research to identify what improvements could be made in terms of vehicle diagnostics.

The concept of preventative maintenance as being a positive step in improving fleet performance and efficiency was generally accepted. However, one operator did not understand the relevance of preventative maintenance. Overall, regulatory obligations have prompted the operators to carry out regular vehicle checks for compliance reasons. The degree of preventative maintenance that was implemented varied across the spectrum, size of the fleet being the most influential factor. Those with large fleets generally had their own maintenance departments and therefore explored preventative maintenance further. The smaller fleets generally outsourced their maintenance or used their manufacturer dealers.

The majority of the operators undertook daily vehicle checks, which were performed by the driver. This enables any obvious defects with the vehicle to be identified immediately and then the cost of repair is minimal rather than the problem getting worse. The regularity of maintenance checks also varied between 2-12 weeks. The more sophisticated preventative maintenance procedures checked vehicles on different timescales depending on the degree of tension and the specific operation applied to the vehicle. For instance, aggregate haulage trucks were checked every two weeks, whereas new general haulage vehicles were checked every 8 weeks. Overall, the majority of the operators had some form of preventative maintenance system, with the following elements highlighted;

- One operator testing synthetic lubricants with Shell and Daft for three years;
- Wheel pressure checks;
- Energy tyres (Michelin);
- Nitrogen in tyres (pressure remains the same all year round);
- Daily driver checks; and
- Defect reporting.

Determining the cost for preventative maintenance was difficult for many of the operators. However, most stated that it paid for itself in terms of the cost that major repairs would cost. Indeed, one company stated that they believed that preventative maintenance was one of the best measures for all round benefits for safety, the environment and fuel efficiency. Other costs stated were £150 per vehicle per month, £61,000 for the fleet per annum and €800 per month per vehicle. Though these costs vary considerably, this is because different measures were carried out.

Most of the operators did not encounter any obstacles in implementing a maintenance programme as many of the checks are already regulatory. The main obstruction identified was being able to integrate new technology to their systems. Again, operators also stated that an advice programme would be beneficial whilst highlight the benefits of certain preventative maintenance procedures.

Overall Comment

Operators seemed to be active in this area of improving efficiency. However, it seems that this is the case because of regulatory requirements. The European Commission could strengthen these requirements and make certain procedures mandatory across Europe. Additionally, whilst

the operators we visited carried out preventative maintenance, ancillary procedures such as wheel alignment were not used and it was clear that a lack of information was available for these kinds of procedures. Importantly, the operators agreed that preventative maintenance basically paid for itself and was therefore a beneficial element of their operation.

5.3.25

Improvements in Propulsion Technology

“It is difficult to make generalisations about these types of measures because they are all markedly different, but in general successful innovations improving fuel efficiency by 5% would be seen as successful. In general, the development of these types of measures takes place over medium to long term and innovations generally take longer to reach the market than other measures. Manufacturers will always have an incentive for marketing new products, but there may be actions the European Commission can take to encourage innovation, such as reviewing/continuing/improving funding for R&D programmes.

The area of improvements in propulsion technology is one whereby operators believe they have little influential scope except in their buying power as a customer. All the operators agree with the statement above and one even said that they believe the market is doing very well in bringing out new products. However, from the interviews it seemed that the information received by the operators was given to them by the manufacturers, rather than what they had experienced. The majority of the operators stated that when they buy new vehicles they will buy Euro V or IV engines. Indeed, a main operator reported that they already have 176 Euro V tractors in operation.

The operators stated that the main benefits of new Euro engines were:

- Less noise;
- Less pollutants;
- Reduced fuel usage;
- Less maintenance; and
- Reduced NOx.

The main problem that operators encounter when considering new vehicles is the difficulty of selling their old trucks. It was apparent through the interviews that the operators believe that the EC should continue to fund research and development and that hybrids should be considered in more detail.

Overall Comment

Overall, through our interviews it seems that operators buy new engines for compliance and efficiency reasons. When replacing old trucks it appears that operators are looking to buy the latest engine technology to increase efficiency. Overall operators seemed willing to take up new technology provided it was commercially feasible to do so and that the benefits are well established.

5.3.26

Policy Discussion

The discussions on policy were limited in scope. Many of the operators we spoke to simply adhered to any policy they were required to (e.g. drivers' hours regulation), and did not always have a good understanding of different policy areas. Despite this, a number of quotes illustrate a few ideas that the operators believed would help the industry:

“The limited ability of the European Union to impose taxation across all member states is a significant disadvantage as taxation is an effective tool to promote change”

“Fiscal incentives may offer a useful alternative to accelerate take up of actions to promote greater efficiency and hence reduce greenhouse gases”

“The European Commission should adopt a Freight Best Practice Programme to help smaller operators”

“The EC should continue to fund research and development”

5.4 **Manufacturers’ Site Visits**

The following section details feedback provided by the manufacturer visits, showing which manufacturers were visited and their respective views on the options list that we created as part of Task 1 of the project. A separate questionnaire was designed for the purposes of these visits. The manufacturers were asked a series of questions which were designed to stimulate discussion. The responses are summarised below and provide a very useful method to test our initial findings.

5.4.1 *Manufacturers Visits*

The manufacturer site visits were an important part of Task 2 of the project. In total five manufacturers were visited and interviewed, allowing us to ascertain vital information to update the options list. Additionally, more interviews are currently underway and will be analysed in due course, and then incorporated into the main report. The following table illustrates which manufacturers have been visited to date, but for confidentiality purposes the responses and comments discussed within this report will remain anonymous.

Table 5.2 Manufacturers Visited

Manufacturer Name	Location	Interviewee Partner	Date of Interview
Manufacturer 1	Netherlands	NEA	05/07/2007
Manufacturer 2	Italy	CSST	28/06/2007
Manufacturer 3	Italy	CSST	19/06/2007
Manufacturer 4	Italy	CSST	04/07/2007
Manufacturer 5	Netherlands	NEA	10/07/2007

5.4.2 *Manufacturer 1*

Manufacturer 1 is a major manufacturer of trucks and buses for heavy transport applications and of industrial and marine engines. They employ over 32 thousand employee, of which approximately 2,200 are dedicated to research. They have nine production sites in Europe and two in South America WITH over 1500 offices worldwide, of which 1100 are in Europe. In 2006 the following vehicles were manufactured;

- Europe: 43,226 trucks & 2,710 buses;
- Latin America: 7,957 trucks & 1,679 buses; and
- Asia: 5,546 trucks & 879 buses.

Manufacturer 1 is committed to research and approximately 4% of their annual sales figures are spent on research and development. Fuel efficiency is a key area of their research programmes.

5.4.3 *Manufacturer 2*

Manufacturer 2 manufacture engines, transmissions and axles for passenger car, LCV, trucks, industrial application, agriculture, special variants, power generation, marine and construction industries. They cater mainly for the European Union and Asia and have 16 production plants and 10 research and development centres. They employ approximately 19,000 employees, of which 650 are dedicated to research. In 2006 they produced the following:

- 2.8 million Engines; and
- 2.1 million Transmissions.

Manufacturer 2 specifically invests approximately 2% of their turnover on research and development for trucks.

5.4.4

Manufacturer 3

Manufacturer 3 is a large scale, generalist vehicle manufacturer and offers a complete product range. The range covers all types of requirements including long distance coaches, regular service and school buses, varied capacity urban and suburban transport. Manufacturer 3 also offers alternative transport systems to trams or chassis designed to meet the needs of different countries. They sell their products on a global scale and have offices in Europe, Australia, Africa, Middle East and Latin America. They employ approximately 6000 employees and are dedicated to research and development. Last year they produced the following products:

- 2,500 citybus;
- 2,500 minibus;
- 3,000 coaches;
- 700 chassis; and
- European production = 6,000 vehicles.

Manufacturer 3 is dedicated to research and development but their budget is undisclosed.

5.4.5

Manufacturer 4

Manufacturer 4 is a full range manufacturer of commercial vehicles for on road and off road applications. They are a global player and sells their products in over 100 different countries. Manufacturer 4 has 27 production plants located in 18 different countries. The sales network of Manufacturer 4 is constituted by 661 dealers located in more than 100 countries. Globally, the manufacturer's sales points are over 4,500. They employ approximately 25,000 employees and invest a lot of time and man power (approx 1700 employees) to research and development.

Manufacturer 4 designs, manufactures and markets a comprehensive range of light, medium and heavy commercial vehicles. It also produces buses, coaches and special vehicles for defence and civil protection, earth moving applications and fire engines. In 2006 the manufacturer sold globally more than 181,000 vehicles. The following illustrates the percentage split of these sales:

- Light Commercial Vehicles: 27%;
- Medium Commercial Vehicles: 12%;
- Heavy Commercial Vehicles; 37%;
- Buses: 14%; and
- Special Vehicles: 10%

In 2006, the manufacturer invested €170 million in research and development. This equates to approximately a third of their operating income.

5.4.6

Manufacturer 5

Manufacturer 5 is a large conglomerate and as a whole employs approximately 360,400 employees. The manufacturers Truck Group manufacturers and sells Heavy Duty Vehicles and other commercial vehicles. The Truck Group has 29 production facilities world wide, with nine main locations in Europe. The Truck Group also employs approximately 84,000 employees. The whole company last year generated total revenues of €151.6 billion. About €1 billion is spent each year on research and development for commercial vehicles. This equates to approximately 3% of the annual sales of the Truck Group, which is in the region of €32 billion. Therefore, the manufacturer employs approx 25,200 employees to carry out research, with 5,500 employees dedicated to the Truck Group's research and development

5.4.7

Key Considerations' in Design

Early in the interview, manufacturers were asked "what are your key considerations when designing and building a new model?". The responses were similar across the spectrum of interviewees. The main consideration was to optimise vehicle performance through listening to customer demands and improving fuel efficiency and cargo capacity. All manufacturers also stated environment impacts were of concern when generating a new product. Additionally, safety, comfort, productivity, reliability and low maintenance costs were also identified as being important to design.

5.4.8 *Customer Feedback*

Manufacturers were also asked about predominant feedback that they received from transport operators in relation to existing or new design features. Again, the responses were all very similar. Ultimately, the customer was reported as always wanting the best cost/fuel consumption ratios and overall operational efficiency. More specifically, customers required better fuel efficiency, lower vehicle purchasing cost, higher residual value of the used vehicles, low cost and short time for repair and periodical maintenance.

5.4.9 *Policy Consideration & Discussion*

This section of the interview sought to identify manufacturers' views on current policy and possible future policy, including what they believed were the main drivers of fuel efficiency, what the restrictions are and their view on the general future of mode of distribution for the freight industry. Manufacturers were also asked what they thought of the main drivers of fuel efficiency in the short, medium and long term.

Short term measures discussed included diffusion of the Adblue system for CRT Euro V engines, further development of aerodynamics, diffusion of natural gas, driver behaviour training, improved logistics, further improvement of current diesel and gasoline engines, deployment of hybrid vehicles, more sophisticated tyres and better tyre management

Medium term measures included the improvement of diesel engine technology, use of longer and heavier vehicles, carbon-neutral bio-fuels and improvements in conventional fuel types.

Long term measures included technological solutions such as fuelcell propulsion and improved infrastructure to accommodate new technology allowing improved traffic management.

The manufacturers had very similar views on what market restrictions exist for cleaner, more efficient engines. One manufacturer stated that cleaner engines will only become available by regulatory force or through financially attractive options to the operators. Indeed, it was also identified that waves of purchasing new equipment coincided with tax relief measures. Attractive tax arrangements were seen as something that could significantly accelerate the process of market diffusion.

On asking the manufacturers what policies they would recommend, again a similar stance was observed for the sample interviewed. A main point that arose from the discussions was that any policy or regulation that allow Member States to deviate in a significant way from standard regulation of the European Union single market are counter productive and extremely expensive for manufacturers and operators. For instance, any policy that leads to special requirements for vehicles and engines (e.g. individual Member State rules on longer and heavier vehicles).

Manufacturers were also in favour of any policy that would enhance the road network in Europe and encourage a smooth flow of traffic. There was also a strong belief that regulations in favour of gas should be adopted by the European Commission. However, one manufacturer strongly expressed their concern that they believe the marketplace for the Heavy Duty Vehicles is already overregulated and that they strongly supported the simplification of regulations as proposed in the CARS 21 initiative.

5.5 **Shippers Site Visits**

The following section illustrates what the shipper interviews achieved, showing which shippers were visited together with their respective views. A series of questions were asked and we have collated the answers and presented an overall opinion of shippers (based on the sample we interviewed). This process has undoubtedly enhanced the endorsement of our options list.

5.5.1 *Shippers Visited*

In total four shippers were visited and interviewed, allowing us to ascertain useful information to update the options list. More shippers are currently being interviewed and the information will be analysed and incorporated into the main report in due course. The following table illustrates which shippers were visited, but for confidentiality purposes the responses to our questions will remain anonymous:

Table 5.3 Shippers Visited to Date

Shipper Name	Interview Location	No of offices	Interviewing Partner	Date of Interview
Shipper 1	Netherlands	1000 stores	NEA	04/07/2007
Shipper 2	Italy	2	CSST	19/06/2007
Shipper 3	Italy	6	CSST	19/06/2007
Shipper 4	Italy	2	CSST	09/07/2007

5.5.2

Shipper 1

Shipper 1 is an international clothes retailer with over 1000 stores worldwide. It employs over 50,000 people with approximately 32,000 staff located in Europe. It is one of the leading fashion retailers in Europe and Latin America. It operates approx 25 vehicles in the Netherlands and contract 30% of its logistics out to 3rd parties.

They do not know the exact tonnage that they ship but there are 25 trucks, carrying approximately 1800 pieces of clothing each shipped every working day. Therefore, over 10 million articles are transported on a yearly basis.

5.5.3

Shipper 2

Shipper 2 is a tuna fish processing company located in Italy. It manufactures its own brand as well as a major Italian retailers brand. Most of their production is sold nationally in Italy. Additionally, they also make and distribute pet food. Their distribution operation covers all of Italy and is sourced from Northern Italy. The majority of volumes shipped are full loads for efficiency. An average 30,000 tonnes of finished goods are shipped to customers. Additionally, they are also active in transporting the raw materials to create the finished product. They operate approx 15 vehicles a day and they use a national distributor.

5.5.4

Shipper 3

Shipper 3 is a leading South European carton board manufacturer with five offices in Italy and one in Spain. They have a total of 1150 employees working at these offices. A significant part of the production is shipped to central Europe, mainly to Spain, France, Germany, UK, but also in East Europe and Turkey. Their production has a broad application in many industries. They use some 120-160 trucks per day and they use approx 3-7 major transport providers per plant

On average they ship 680,000 tonnes per annum. Additionally, they also manage the inbound flow of materials into the plants. Raw material basically is recycled paper from urban and industrial sources.

5.5.5

Shipper 4

Shipper 4 is a major manufacturer of biscuits and snacks with one plant in Italy and two offices. Most of the local production is sold in Italy but there are also important import/export flows as well. Their average volume shipped per annum is 45,000 tons and they distribute some 5000 full loads in Italy and 1500 full loads for import/export. They employ a total of 560 employees.

5.5.6 *Rationale for choice of transport providers*

We presented shippers with five options for choosing transport operators, and asked them to rate the importance of these in their own decision making process (using a scale of 1-5, with 5 being the most important and 1 the least). The five options were as follows:

- Price;
- Efficiency;
- Environmental Impact;
- Reliability; and
- Customer Service Levels.

Obviously with the small number of companies visited it is difficult to draw conclusions from the values provided, however the associated comments with these scores were also helpful in generating a better understanding of these issues. Reliability scored the highest as delivery times are essential to overall operation and customer satisfaction. Price also scored highly because as business is highly competitive and many margins are, low price is a decisive factor for choosing transport. Efficiency is a high priority because if you operate efficiently money is saved and the operation runs smoothly. Interestingly, environmental impact was only chosen due to regulatory requirements.

5.5.7 *Options for Improving the Efficiency of your Transport Providers*

The response to this question was limited but points were highlighted about the need for strategic partnering and close working with contractors. In particular the following issues were felt to be important:

- Interfacing;
- Shared planning;
- Share benefits; and
- Loading efficiency and scheduling.

From a European Commission point of view they could research methods of how shippers and operators can better integrate to improve efficiency and benefit both parties.

5.5.8 *Would you be Supportive of a Rating Based System?*

The idea of creating a system that rated operators on how efficient they are and shippers on the efficiency of the transport operators they hire was explored, but not welcomed by the shippers we spoke to. One stated that more cooperation between shippers would be more beneficial. However, it is our view that this lack of interest is probably an unsurprising reaction to a regulation that could place onerous requirements on shippers and transport operators.

5.6 **Trade Association Consultation**

The following section details feedback provided by the trade association consultations, illustrating which trade associations were visited and their respective views on the options list that we created as part of Task 1 of the project. A separate questionnaire was designed for the purposes of these visits. The trade associations were asked a series of questions which were designed to stimulate discussion. The responses are summarised below and provide a very useful method to test our initial findings, whilst adding to our understanding of associations' viewpoints.

5.6.1 *Trade Associations Visited*

In total 6 trade associations were consulted, though more were contacted, allowing us to ascertain useful information to update the options list. The following table illustrates which trade associations were contacted, but for confidentiality purposes the responses to our questions will remain anonymous:

Table 5.4 Trade Associations Consulted

Trade Association Name	Location of Consultation	No of offices	No of Members	Geographical Representation
ANITA	Roma, Italy	Represented in each Italian Province	2500 Road Transport Cos	Italy
ASSOLOGISTICA	Milan, Italy	Not stated	Not stated	Italy
FOCWA – CONTEC	Sassenheim	1	2100	Netherlands
Confederation of Passenger Transport UK	London	7	1200	United Kingdom
European Aluminium Association	Phone interview	N/A	N/A	European Union
European Shippers Council	Phone Interview	N/A	N/A	European Union

- 5.6.2 *Associazione Nazionale Imprese Trasporti Automobilistici (ANITA)*
ANITA is a member of CONFINDUSTRIA (the Italian Industrial Association). Therefore, the members of ANITA are “industrial companies”, not small enterprises. The total number of employees that it represents is 30,000, approximately 30% of the employees in the road freight transport sector in Italy. Their large operator membership, mainly carry out long distance freight distribution and perform their activities on an international level.
- 5.6.3 *Associazione Nazionale Logistica (ASSOLOGISTICA)*
Assologistica is the national association of logistics enterprises, general stores and refrigerators, port terminal operators, interportual and airport operators. The main purpose of the association is to promote and to protect the effectiveness and the quality of enterprises belonging to the association.
- 5.6.4 *FOCWA – CINTEC*
FOCWA represents the interests of 2100 Dutch companies who are active in the construction of bodies, trailers and maintenance and repair of HDV (both trucks and buses), vans, mobile homes, campers, etc. CINTEC is the innovation centre associated to FOCWA which operates in particular on behalf of the companies that construct bodies and trailers.
- 5.6.5 *Confederation of Passenger Transport (CPT)UK*
CPT is recognised by the UK Government as the voice of the Coach, Bus and Light rail industries and is the focus for consultation and negotiation in national and international legislation, local bus regulations, operational practices and engineering standards. CPT also represents the passenger transport industry to the government and European Commission. It represents 99% of bus operators and 66% of coach operators. The members are provided business, operational, technical and media services/advice. The association is frequently contacted by the media to give their views on the passenger transport industry.
- 5.6.6 *European Aluminium Association (EAA)*
The European Aluminium Association (EAA) represents the aluminium industry in Europe. The EAA was founded in 1981. Its members are the European primary aluminium producers, the national associations representing the manufacturers of rolled and extruded products within 18 European countries, the Organisation of European Aluminium Remelters and Refiners (OEA) and the European Aluminium Foil Association (EAFA).

The overall objective of the EAA is to secure sustainable growth of aluminium in its markets and to maintain and improve the image of the aluminium industry towards target audiences. In order to achieve these objectives the EAA is active in the fields of: Issue monitoring and issue management on topics of common interest; Generic promotion and communication on aluminium; Collection, maintenance and dissemination of European aluminium statistics; Supporting aluminium oriented education; Encouraging and initiating studies or research projects and technical co-operation in all relevant areas whether of a scientific, technological, economic, governmental, sociological, legal or any other nature.

5.6.7 *European Shippers Council (ESC)*

The European Shippers Council represents the interests of companies trading in Europe as users of freight transport services, companies who ship the vast majority of goods distributed by sea, road, rail, air and inland waterways, the 12 national transport user organisations/shippers' councils from 12 countries, a number of key European commodity trade associations, such as CEFIC - The European Chemical Industry Council and CEPI, the organisation of paper industries and European industry interests as users of freight transport services on a variety of international governmental and non-governmental organisations including: OECD, the Consultative Shipping Group, International Maritime Organisation, the United Nations, WTO and The International Chamber of Commerce.

The prime objective of ESC is to promote efficient and competitive freight transport services to enhance the competitiveness of companies conducting business in Europe. In this respect the Council has three core purposes: to encourage and persuade transport policy makers to develop open and competitive transport markets which enhance industrial competitiveness and efficiency; to promote industry best practice to encourage efficiency and improvements in transport supply chains and to add value to the day to day business activities of its members by providing up-to-date information on market developments.

5.6.8 *What are the Three Key Measures that can Enhance Efficiency within the Transport Industry?*

On asking this question several answers were given. Technological developments in propulsion technology were ranked favourably, stating that specific and strict regulations are needed to increase technological competition amongst truck manufacturers. Additionally, performance management was highlighted by several trade associations as being the main measure to improve efficiency.

Secondly, driver training programmes were identified as being a major measure to increase efficiency. Additionally, information systems were also identified as having an important role to play in the increase of efficient operations. The ESALOG system was personally named as helping to reduce the amount of empty loads in Italy.

Another measure that was strongly recommended was the continued take up of partnerships between freight operators and shippers, etc. These partnerships could help to optimise the use of vehicles.

5.6.9 *What Policies do you believe the European Commission needs to create to promote the Reduction of Greenhouse Gas Emissions?*

The trade associations had several recommendations for EC policy, not surprisingly most were beneficial to their respective members. One element related to fiscal measures, stating that transport costs should be made equitable and uniform across the EU (i.e. uniform cost of energy and fiscal weight). Tax incentives and subsidies (inc bus fare subsidies) were also identified as possible policy actions to promote efficient methods. However, these measures could prove difficult and expensive for the European Commission to implement.

Research initiatives were also identified as something the EC can continue to fund to enable a more thorough knowledge of products and technology advancements. Research into defining a common method for measuring inefficiency due to empty vehicles across Europe was one suggestion. Trials into longer and heavier vehicles were also discussed but this is out of the remit of this project.

Additionally, a coherent method of driver and transport managerial training was identified as a method of generating efficient operations. Interestingly, several of the Trade Associations also highlighted that they would like the promotion of strategic partnerships to be enhanced and possible subsidised. They believe that this would lead to less "empty" running and a more coherent transport operation.

5.6.10 *Would you be supportive of a system of rating and branding operators in terms of their efficiency and performance?*

Overall, this approach was not welcomed by the Trade Associations as an appropriate course of action against inefficient operations. This stance was predicted by the project team prior to the consultations as such an approach is seen as too intrusive by industry.

5.6.11 *Would you be supportive of a European wide Best Practice Programme?*

The majority of the Trade Associations agreed that a Best Practice Programme would be beneficial and would not be intrusive. However, it was established that the associations believed that a comprehensive dissemination programme would need to be adopted to gain the most out of such a programme.

5.7 **Reflection on the Consultations**

This exercise successfully validated the initial research. Despite the relatively small consultation sample size discussions with operators, shippers, manufacturers and trade associations have revealed different attitudes to policy recommendations. Geographical differences between companies have also revealed different attitudes to efficiency. It is clear that certain countries (UK and Netherlands for example) are more pro-active in operational efficiency. However it is important to note that the consultations, although useful, covered a broad spectrum of the European Transportation market through a small sample size. The information gathered through Task 1 and Task 2 formed the basis for compiling a long list of potential options for the European Commission to consider.

6 Development of Long List of Options

6 Development of Long List of Options

6.1 Introduction

This chapter details the creation and assessment of the long list of options. It also explains the task methodology, the long list test criteria, individual measures and indirect policies which could have the potential to reduce GHG emissions in heavy-duty vehicles.

Task 1, desk based research into options for improving fuel efficiency and Task 2, reality checks of this project, were completed and made available to internal and external stakeholders via interim reports. The role of Task 3 was to analyse policy instruments at an EU level that could contribute to the uptake of fuel saving and emission reducing measures to improve the efficiency of heavy-duty vehicles (HDV). The analysis relies on the information gained from Tasks 1 and 2, involving extensive independent desk based research along with discussions and interviews with transport manufacturers, operators, shippers and industry groups. The outcomes of these tasks have been reported as interim project deliverables and have been revised in response to client and stakeholder comments.

Analysis undertaken as part of Task 3 has, as far as possible, quantified the fuel savings and reductions in GHG which could be possible through the implementation of different measures. However, the wide scope of the project and range of areas considered has often made it difficult to generalise numeric estimates. The overall cost and usefulness of different measures has also been considered along with a range of other issues. Task 3 can be divided into two separate stages:

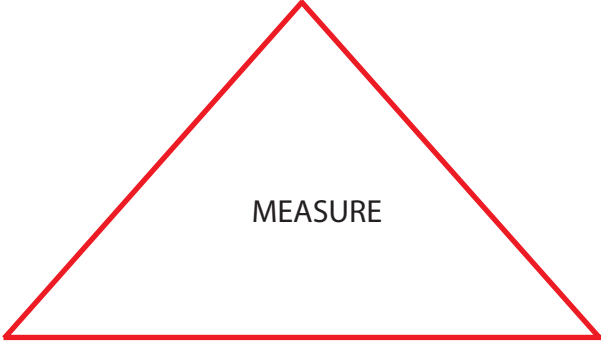
- The creation of a comprehensive policy options list (long list); and
- The creation of a short list of recommended policy instruments (chapter 7)

Essentially, the short list was to be derived from the long list, subject to feedback from the client and other internal European Commission stakeholders. Discussions with industry have been ongoing throughout the project, and in addition to work completed as part of Task 2, a meeting was held with the European Automobile Manufacturers Association (ACEA) on the 15th of October 2007 to provide feedback on work to date.

Before reporting the analysis of the long list, it is recommended that future policies should be considered in the broader context of global efforts to reduce GHG emissions from HDV. The US, Japan and other major countries are actively involved in reducing emissions in the transport sector (both driven by the Kyoto Agreement and unilateral policies) and it is recommended that as far as possible, future policy instruments should be harmonious with these efforts to create a global stance on reducing GHG Emissions. Policies in other countries have been considered as part of earlier work in this project and should be considered in moving towards a short list of options.

6.2 Methodology

Following the completion of Task 2, Faber Maunsell met with the client in Brussels on the 18th July 2007. At this meeting, the basic criteria for the long options list were agreed with the client. It was agreed that the scope of the long list assessment would need to be practical within the scope of the work, but at the same time provide sufficiently detailed information to allow for the selection of a sub set of options that could be subject to a more detailed analysis (such as considering in more detail how they could be implemented by the EC). The project team have built upon these initial criteria and have established the following framework (Figure 6.1):



Potential to Reduce CO2	HIGH/MED/LOW	
Trade off with other Pollutants		
Natural Tendency of Market (Take Up)	Small	
	Medium	
	Large	
Capital Cost	Small	
	Medium	
	Large	
Payback Period	Short	



Policy Instrument	Recommendation	Potential to Influence At EC Level	General cost of implementation to Industry	Cost to Public Authorities	Synergies/ Conflicts	Potential reduction of CO ₂ (Thousand tonnes)	Potential reduction of Nox (Thousand tonnes)
Information & Education Programmes							
Research & Development							
Legislation							
Other Recommendations							

The criteria, boundaries and ranges are explained as follows:

- 6.2.1 *Potential to Reduce GHG Emissions*
This criterion illustrates the potential of the chosen measure to reduce GHG. As each measure consists of several concepts and products, a broad range has been adopted. The wide scope of the project and the complexity of the subject area meant that it has not been possible to provide specific quantitative estimates of the effects of different measures, and hence a range of potential savings have been adopted here. These are "LOW 0-2%", "MED 2-5%" and "HIGH 5%+". These estimates are based upon results from the desk based research undertaken as part of Task 1, industry interviews undertaken within Task 2, team members expert knowledge and research currently being undertaken by the UK Freight Best Practice Programme²⁶. For practical reasons the figures in this report have been assessed 'per unit' (i.e. vehicle, driver, etc) rather than savings across the industry as a whole.
- 6.2.2 *Trade Off with Pollutants*
An important point for consideration is that of trade offs with other air quality pollutants. This section considers whether the reduction in GHG increases or decreases harmful gases such as NOx. If the measure simply reduces fuel usage then these pollutants will also be reduced by the same percentage of CO₂.
- 6.2.3 *Tendency of the Market (Take Up)*
It was also appropriate to consider the likely tendency of the market to uptake measures without intervention from the EC. As it would not be possible to accurately state this without detailed European wide market research on each measure, we have relied on a broad assessment of likely take up among different sized transport operators. Three transport operator categories were used - Small (<10 vehicles), Medium (10-50 vehicles) and Large operators (>50 vehicles). The assessment of overall take up is based on feedback from the reality checks and the project teams' specialist knowledge, and is relatively subjective, yet sufficient for the purposes of selecting a short list. This section evaluates perceived take up of industry as of now and therefore does not take account of any future possible developments (e.g. some measures that may currently be in early stages of development could in fact have high levels of take up in the future without intervention in the meantime).
- 6.2.4 *Capital Cost*
Using the same definitions for company size, we undertook a broad assessment of the cost of each of the measures. Therefore, we have estimated the following annual costs per vehicle (or, where appropriate, costs per driver, or overall business cost) (Euros); LOW (0-300), MED (300-600) and HIGH (600+). The actual cost to a company is difficult to determine due to the fact that a number of applications may exist within a single measure area, and also the fact that costs are likely to vary considerably by operational and sector type.
- 6.2.5 *Payback Period*
Another important criterion to consider, from a commercial perspective, is the predicted payback period of the measure. The following categories have been used; SHORT (0-2 years), MED (2-5 years) and LONG (5+ years). Payback estimates for HDV operators only relate to the cost of implementation, and other continuous costs have not been evaluated within the framework (i.e. re-training of drivers on an annual basis).
- 6.2.6 *Type and Recommended Policy Instrument*
This assessment considers the policy instruments reviewed during Task 1, and how they might be used to achieve take up of different fuel saving measures. Options available within 4 different categories have been considered - Information and Education programmes, Research and Development, Legislation and Other Recommendations (e.g. subsidies, etc). By understanding the possibilities within each policy category, the EC can make an informed decision on which measures to take forward and examine them in more detail in order to produce a final short list of policy actions. It is worth noting that within this section we have only considered actions that we feel are realistic for the EC to implement.

²⁶ Fuel Efficiency Research – Ready Reckoner Project, Chrysanthos Pelekanos, Freight Best Practice, 2006, Forthcoming

- 6.2.7 *Potential to Influence at EU Level*
This criterion seeks to determine the relevance that different actions have to the overall remit of the EC. These are categorised in terms of LOW, MED and HIGH. Measures which have been categorised as “HIGH” are those that appear to be closely aligned with the EC’s responsibilities.
- 6.2.8 *General Cost of Implementation to Industry*
This criterion seeks to identify the general cost that the type of policy instrument would create for the transport industry. For the purposes of developing the long list, these have been expressed in general terms rather than in monetary values (see capital cost for likely impacts that the overall measure may have on industry). In this regard, both real immediate benefits and industrial changes are considered. For example, if a driver training information and education programme were launched, then the cost of implementation would be LOW because there would be no obligation on operators to make changes to the way their business operate and they could choose to train as many drivers as they wish. A labelling strategy on the other hand may be considered to have a MED cost as it would not directly impact on the majority of the industry (operators) but would have an impact on vehicle manufacturers. The majority of regulatory options considered as part of this task generally have a MED-HIGH cost on industry, but benefits would be likely to be generated from the initial investment over a longer period of time. The implementation of policies involving research and development or education is likely to have no immediate cost implications for industry, though this would obviously have a cost for the EC, but would see benefits in the short term.
- 6.2.9 *Cost to Public Authorities*
This criterion describes the cost of the action to public authorities, (which may be the EC member states or a combination of the two). Legislative actions are generally considered HIGH-MED cost, voluntary or “soft” measures are likely to have less of a monetary burden on the Community (but may also be less effective in achieving change). These are indicative only, the client will effectively validate our assumptions for this indicator.
- 6.2.10 *Synergies/Conflicts*
This section highlights possible conflicts and synergies of policy instruments, (either already implemented or suggested in this project). Additionally, consideration is given to the possible conflicts that arise with EC principles, such as anti-competitiveness and impacts on specific industry sectors.
- 6.2.11 *Overall potential to reduce Greenhouse Gas Emissions (GHG)- Quantified where appropriate*
Ultimately, this criterion is one of the most important and summarises the overall potential benefit of the policy action to reduce both CO₂ and NO_x. Where appropriate the benefits have been quantified using the following methodology:

These potential percentage savings have been derived by the original research carried out within Task 1 in conjunction with additional supporting findings.

Table 6.1 Potential Savings of each Measure

% Saving for Implementing	IT Systems*	Driver Training*	Vehicle Specification & Aerodynamics*	Vehicle Maintenance*	Performance/Fuel Management*	Operational Modification*
Long Distance HGV	9.0 %	6.0%	13.5%	5.0%	5.0%	6.7%
Urban HGV	9.0 %	6.0%	3.0%	5.0%	5.0%	6.7%
Long Distance Bus	0.0 %	6.0%	6.7%	5.0%	5.0%	0.0%
Urban Bus	0.0 %	6.0%	1.5%	5.0%	5.0%	0.0%

* IT systems – Savings have been based on the estimate within the Impact Assessment of Freight Logistics Action Plan (SECC, 2007, 1321) and Staff Working Paper of 8 - 10%

* Driver Training – Initial research from Task 1 and recommendations from 196 Freight Best Practice site specific advice visits.

*Aerodynamics – Initial research from Task 1 and the Freight Best Practice Ready Reckoner was also used, which assumes that the savings above would be achieved if all the relevant aerodynamics were adopted. It also assumes that there is a 70:20:10 split between motorway, rural and urban applications in long distance operations (40 tonne artics) and a respective 10:20:70 split for urban applications (7.5 tonne rigids).

* Vehicle Maintenance – Average savings calculated from initial research carried out in Task 1.

* Performance/Fuel Management – Savings based on initial research from Task 1 and the UK Freight Best Practice Programme's Fuel Management Guide.

*Operational Modification – Savings based on the reductions in fuel consumption that would be seen if European countries that have below average lading factors and empty running percentages were to achieve the European average (Eurostat 2006 information used for lading factors and empty running).

Having established potential saving percentages for an indicative quantitative assessment, the report can determine the baseline methodologies for each type of policy recommendation.

6.3

Best Practice Programme

To provide an estimate of the benefits that a Best Practice Programme can create for each measure we must firstly determine the areas in which the programme influenced most and the percentage of vehicle KM influenced by such a programme. To create an estimate of the areas influenced within the programme we assumed the following proportional split between application areas:

Table 6.2 Proportional Representation of the Popularity of Freight Best Practice Guides

Proportional Representation of the Popularity of Freight Best Practice Guides	
Maintenance	2%
Driver Training	37%
Aerodynamics	8%
IT Systems	5%
Performance/Fuel Management	40%
Operational Modification	8%

Secondly, an independent impact assessment of the UK's Freight Best Programme stated that 29% of English vehicle km were influenced by the programme, which we have assumed can be split between the following headings as appropriate to the workings above:

Table 6.3 Percentage of Vehicle Kilometres influenced

	IT Systems	Driver Training	Vehicle Specification & Aerodynamics	Vehicle Maintenance	Performance/Fuel Management	Operational Modification
% of Vehicle kms influenced	1.4%	10.6%	2.2%	0.6%	11.7%	2.4%

The total benefit was then calculated by multiplying this by the estimated percentage savings for each of the vehicle groups in Table 6.1 above. This was then weighted using the Impact Assessment estimate that 0.5% of total English HGV CO₂ was saved to provide the following:

Table 6.4 Percentage Saving on Total European Vehicle Parc

% Saving on Total European Vehicle Parc	IT Systems	Driver Training	Vehicle Specification & Aerodynamics	Vehicle Maintenance	Performance/Fuel Management	Operational Modification
NOx	0.03%	0.18%	0.06%	0.01%	0.17%	0.03%
CO ₂	0.03%	0.18%	0.07%	0.01%	0.17%	0.04%

It was estimated that total EU CO₂ for HDV is approximately 206,661 thousand tonnes and total EU NOx is approximately 1,203 thousand tonnes. This estimate was calculated using total EU vehicle km (Eurostat), the age bands of vehicles (Eurostat) and an estimate of g/km for the different engine bands (UK National Atmospheric Emissions Inventory).

6.4

Legislation

When estimating the potential saving that an Act of Legislation will generate, we assume the uptake of specific measures will increase to 100%, as everyone will be required to comply with the law. It is therefore essential to determine the adoption of measures prior to legislation, in order to identify the net benefit any new legislation will create. It is important to state that due to the lack of information on this subject a professional judgement has to be adopted.

Table 6.5 Current Take Up Estimates

Measure	Current Proportions	
	Long Distance	Urban
Aerodynamics		
Cab Roof Deflector	81%	64%
Air Dam	88%	69%
Cab Side Edge Turning vanes	71%	60%
Tractor Side Panels	26%	16%
Trailer Front Fairing	8%	2%
Trailer Side Skirts	13%	10%
Driver Training	35%	28%
IT Systems	50%	30%
Performance/Fuel Management	35%	28%
Preventative Maintenance	50%	50%

The total benefit is then calculated using the assumptions and savings for each vehicle groups, detailed earlier. This provides us with the following percentage savings on the European vehicle parc:

Table 6.6 Percentage Saving on Total European Vehicle Parc

% Saving on Total European Vehicle Parc	IT Systems	Driver Training	Vehicle Specification & Aerodynamics	Vehicle Maintenance	Performance/Fuel Management
NOx	3.9%	4.0%	4.9%	2.5%	3.3%
CO₂	3.5%	4.0%	4.5%	2.5%	3.3%

Other Policy Instruments potential saving estimates will be discussed within the text of that relevant section in this chapter.

6.5

Indirect Policies that could have an Impact on the Reduction of Greenhouse Gas Emissions in HDV

Prior to discussing the identified measures below and the possible actions that could be undertaken by the EC within each of the measure categories, it is important to note that there are a number of other less direct policy actions that could achieve the aim of reducing greenhouse gas emissions in HDVs. Through discussions with the client it has been agreed that the majority of these are long term and generally beyond the direct scope of this project, however it is important that the role they could play is properly acknowledged.

Firstly, there are a variety of taxation based policies that could be used in a variety of scenarios to make certain fuel saving measures more attractive and therefore stimulate a growth in uptake. However, these have not been considered in this work on the basis that these would be likely to prove to be difficult to implement without the agreement of all member states. It is also our understanding that minimum levels of diesel excise between members states is currently under review by the EC, with the aim of raising them to a level comparable to that of petrol. Such taxation measures would need to be considered in vast detail to determine their applicability to effectively reduce GHG in HDV.

Alternatively, the EU Emissions Trading Scheme could be adapted to include GHG emissions from transport. In principle this policy could be a very effective method of encouraging take up of fuel savings in commercial transport operations. However, such an option would require consideration that is beyond the scope of this project, and hence has not been analysed in detail here.

6.6 Individual Measures Analysis

As the last section outlined the criteria used to test the measures and potential actions that the EC could implement, this section now explores the individual measures and the actions that could be taken to stimulate industry take up.

It should be stressed at the outset that all potential actions discussed in the following sections could play a positive role in reducing GHG emissions. It is also important to understand that within a measure there are a series of 'micro' measures that can be adopted (e.g. within telematics there are various different IT systems that achieve different goals). This stage of the project involves the consideration of policy actions that could be taken by the EC, and it would be appropriate to relate these to such individual measures.

Ultimately, successful policies should be seen as encouraging the take up of a number of related measures within the policy's remit. Hence each measure considered in the following section can be thought of as a 'bundle' of related fuel saving actions. There are likely to be policy actions that can stimulate the take up of a range of measures at once (e.g. information and education campaigns which could cover a wide range of areas). These synergies have been noted where applicable. It is also important to note that some high level actions could be taken which would not relate to any specific group of measures (e.g. carbon trading). These have been highlighted previously. Additionally, it should also be noted that each measure, though analysed separately for the purposes of this project, can be integrated with other measures. For example, a performance management system can be integrated with IT systems and driver training.

In the final stage of the project the short list of options will analyse measures and associated policy instruments in more depth. The following sections provide a brief description of what a measure entails and the recommended actions for the EC to consider. Please note that a more in depth analyse of each measure has been undertaken in Tasks 1 and 2 and have also been detailed in the respective interim reports.

6.6.1 *Performance Management & Fuel Management Programmes*

6.6.1.1 Overview

Performance/Fuel management is essential for making sustainable long term improvements to any HDV operation. To carry out well informed, tactical and strategic decisions about an operation, there is a need to accurately measure the resources used to deliver services. Only then is it possible to identify areas for improvement and assess how effective any operational changes have been. A performance management programme can be seen as the starting point for making operational improvements. Monitoring internal processes is paramount to understanding the effectiveness of fuel saving measures and there are a variety of systems in place that can help collect the necessary management information to do this.

Performance/fuel management programmes encompass a set of 'soft' actions that are taken by transport managers to ensure effective monitoring of performance and fuel use. When effectively adopted this can be an extremely powerful system because it focuses attention on the issue of fuel use and operational efficiency and can act as a driver for consideration of other changes to improve operational efficiency. Performance/fuel management can be implemented across the whole HDV operation in a relatively short period making this a very attractive "soft" measure. By monitoring performance, organisations then actively seek strategies to improve their performance and the information leads to key decisions about using IT, alternative fuel, etc. The magnitudes of benefits which can result from this vary and depend on which other operational changes are made as a result. Evidence from the UK suggests conservative estimates of fuel savings of around 5% are achievable if a performance/fuel management programme is applied appropriately. Opportunities for the EC to promote and encourage take up of this concept are discussed below.

6.6.1.2

Test Criteria

In overall terms, these measures appear to have a "HIGH" potential to reduce GHG as well as reducing other pollutants. Generally, it has been estimated that the tendency of the market to adopt such systems without EC intervention varies according to company size. Smaller companies are less likely to have performance management systems, but in larger companies there is a greater likelihood that formal systems will be in place. Capital costs are also likely to vary according to company size, but for most operations the pay back period would be in the SHORT-MED term.

6.6.1.3

Recommendations

a) Information & Education Programmes

The EC could implement an information campaign or software package that illustrates the benefits of the performance/fuel management systems and more importantly how to implement such a system. This could be targeted principally at small to medium sized operators. This is recommended as having an overall HIGH benefit on the basis that it will have a LOW cost to local authorities and have a LOW cost of implementation to industry. The potential to reduce CO₂ is 339,000 tonnes and NOx 1971 tonnes.

b) Research & Development

The EC could carryout/fund research to establish external benchmarks for different transport operators across Europe, thus allowing them to compare themselves to other similar operators and better understand the scope for improvements within their own business. Targeted case studies would also be a focused method of testing performance management and thus providing a solid platform to communicate the real benefits of utilising this measure. This would obviously have strong synergies with information and education programmes. Benchmarking clubs could involve some degree of mentoring between operators, although the commercial nature of transport operations means further thought may need to be given regarding how an idea could be implemented in practice. Due to the nature of the policy this would not be anticipated to have any cost impact on industry and be of a LOW/MED cost to public authorities. It also appears to have a HIGH relevance to the remit of the EC on the basis that individual Member States would be unlikely to undertake work to establish trans-European external benchmarks. It is recommended that this action would have a MED overall benefit. Possible issues include the fact that companies are often reluctant to supply data for benchmarking purposes, or that there may be difficulties in comparing operations in different regions of Europe. This work could tie in with benchmarking work currently undertaken by the EC which compares overall transport performance between different urban areas.

c) Legislation

In terms of legislative action the EC could implement a policy which could dictate a certain degree of performance/fuel management for transport operators across Europe. However, this is likely to be a costly action that would be difficult to implement in practice. It is also likely that trade associations and Member States would be against such a demanding policy. The potential to reduce CO₂ is 6,690,000 tonnes and NOx 39,000 tonnes. However, the EC's potential to influence is considered LOW.

***PLEASE SEE FIGURE 6.2 BELOW FOR THE ILLUSTRATIVE VERSION OF THE TEST**

Performance Fuel Management

Potential to Reduce CO2	HIGH	
Trade off with other Pollutants	Reduction in other pollutants	
Natural Tendency of Market (Take Up)	Small	Low
	Medium	Medium
	Large	High
Capital Cost	Small	Low
	Medium	Medium
	Large	High
Payback Period	Short/Medium	



Policy Instrument	Recommendation	Potential to Influence At EC Level	General cost of implementation to Industry	Cost to Public Authorities	Synergies/ Conflicts	Potential reduction of CO ₂ (Thousand tonnes)	Potential reduction of Nox (Thousand tonnes)
Information & Education Programmes	Information campaign/software illustrating the benefits and how to implement a performance management system.	HIGH	LOW	LOW	Drivers may be reluctant if the tool is not transparent	339	1.97
Research & Development	Research to establish external benchmarks for different transport operators across Europe	MED	N/A	LOW/MED	Companies may be unwilling to provide data	MED	MED
Legislation	Legislate to make a degree of performance/ fuel management mandatory for transport operators across Europe	LOW	HIGH	HIGH	MS and Trade Associations would probably be against such legislation	6,690	39

6.6.2 *Information Technology Systems*

6.6.2.1 Overview

The appropriate application of IT systems in HDV operations can make day-to-day tasks easier and improve efficiency, thus reducing GHG emissions. There are a range of different IT systems that can be used for commercial transport operations. Whether providing directions for drivers, developing more efficient route plans, or recording and monitoring fuel use, the important aspect of IT systems is that they exist to make tasks easier and improve efficiency. IT systems can be applied widely and can be used in a variety of different levels within HDV operations. Systems can be used to optimise planning (thus improving overall operational efficiency), monitoring and controlling individual vehicles (to ensure efficiency levels are met or to make incremental improvements), or even streaming company administration and providing general management information (that can be used to make long term improvements to businesses as a whole). When used appropriately, these applications and other forms of technology can allow vehicles and fleets to operate more productively and can have a significant impact on improving fuel efficiency and reducing harmful greenhouse gases. There is also a strong correlation between IT systems and other measures such as performance/fuel management. The benefits of IT, and in particular systems that focus on planning routes and managing overall vehicles, are well proven. However, it is important to understand that the cost of IT systems vary immensely, depending on the type of product and size of fleet. If applied widely, IT measures have the potential to drastically reduce GHG both in new vehicles and existing fleets. Opportunities for the EC to promote IT systems are explored below.

6.6.2.2 Test Criteria

On applying the test criteria the project team have concluded that IT systems have a HIGH potential to reduce GHG, whilst also reducing other harmful pollutants as well. The natural tendency of the market take up appears to be higher than that for other measures, on the basis that technology and systems are often manufacturer lead with small companies having a LOW-MED take up, whilst medium and large companies appear to have a MED-HIGH take up. This is largely down to cheaper costs as technology becomes more widespread, and the fact that larger companies often have more purchasing power. Similarly, capital costs for small and medium companies are MED-HIGH and Large companies MED-LOW. It is suggested that the payback period is SHORT/MED with efficiency increases enjoyed by most companies who use IT systems.

6.6.2.3 Recommendations

a) Information & Education Programmes

The EC could implement an information campaign to provide information on different IT systems and their applicability to certain types of operation. This appears to have considerable merit on the basis that impartial information about technology and developments is often difficult to access. General awareness of IT systems appears to have risen over the past decade, however companies are sometime unsure about actual benefits, hence the demonstration of benefits could be the focus for an information and education programme. We envisage this to be of a HIGH relevance to the remit of the EC and is recommended as having a MED/HIGH overall benefit to the EC. The general cost of implementation to industry is expected to be LOW on the basis that no action would be required, and the cost to local authorities would be minimal and would also therefore be LOW. No conflicts or major issues were identified, but there could be synergies between information and education initiatives actions within the EC STEER programmes. These apply to all such options and hence will not be repeated in subsequent discussion. The potential to reduce CO₂ is 60,000 tonnes and NO_x 314 tonnes.

b) Research & Development

It is important to note that the EC is already active in funding research and development for intelligent transport systems (ITS). Within this policy area there may be further opportunities for funding research and development into different systems, and in particular their relevance to differing types of operation. This could include pilots and trial tests, with results published within an existing or new programme undertaken by the EC. This is seen to be of a MED relevance to the EC with a LOW cost to industry and cost to local authorities. However, it is suggested that the overall benefit for this is MED-HIGH.

c) Legislation

It could be possible to make certain types of technology mandatory, but this is not seen as a realistic, viable political option and therefore is also seen as having a LOW potential for the EC to influence but if made mandatory potential savings could result in CO₂ savings of 7,818,000 tonnes and NOx 41,000 tonnes.

d) Other Recommendations

The EC could implement tax incentives for operators to adopt more IT systems. However, once again this is seen as outside of the remit of the EC and could conflict with other national laws and policies. However, we have assumed that an extra 10% of companies would take up IT systems if a tax incentive was provided. This assumption is based on a Freight Transport Association study which showed that approximately 30% of companies say that cost is the biggest factor in not purchasing IT systems. This would therefore provide a CO₂ saving of 235,000 tonnes and 1,200 tonnes of NOx.

***PLEASE SEE FIGURE 6.3 BELOW FOR THE ILLUSTRATIVE VERSION OF THE TEST**

I T Systems

Potential to Reduce CO2	HIGH	
Trade off with other Pollutants	Reduction of other pollutants	
Natural Tendency of Market (Take Up)	Small	Low/Med
	Medium	Med/High
	Large	Med/High
Capital Cost	Small	Med/High
	Medium	Med/High
	Large	Med/Low
Payback Period	Short/Med	



Policy Instrument	Recommendation	Potential to Influence At EC Level	General cost of implementation to Industry	Cost to Public Authorities	Synergies/ Conflicts	Potential reduction of CO ₂ (Thousand tonnes)	Potential reduction of Nox (Thousand tonnes)
Information & Education Programmes	Information Campaign to provide information on different IT systems and their applicability to certain types of operation	HIGH	LOW	LOW	Possible synergy with STEER Programmes	60	0.31
Research & Development	Research into Different Systems and trial tests (including mapping & routing research (Galileo))	MED	N/A	LOW	N/A	MED/HIGH	MED/HIGH
Legislation	Legislation to make certain forms of technology mandatory (i.e. telematics, route planners. Etc)	LOW	HIGH	HIGH	Industry and Trade Associations would probably protest	7,818	41
Other Recommendations	Tax Incentives for Operators to adopt IT systems	LOW	N/A	HIGH	Not in remit of the Commission and may conflict with MS regulation	235	1.2

6.6.3 *Driver Training*

6.6.3.1 Overview

In any transport operation, the driver is one of the most important factors for achieving fuel savings. Training drivers in fuel efficient driving techniques has been proven to result in significant fuel savings and can also improve safety. By implementing driver training as part of a fuel management programme, a fleet's fuel consumption can typically be reduced by around 5%, and more in some cases. Evidence examined to date suggests that one of the key benefits of driver training is that it is applicable to a wide variety of vehicles and operational settings. This measure can be applied to essentially any HDV operation and can be implemented in the short term with immediate results. An important point to note is that it has been proven that training is only beneficial for the short to medium term following implementation, and continuous refresher courses are required to maximise the benefits of this measure over time. Driver training is an attractive type of intervention, mainly because it provides benefits at a variety of levels, i.e.

- For HGV Drivers - Reduced stress levels and enhanced satisfaction of driving;
- For transport operators: Reduced fuel spend, increased productivity and vehicle utilisation, improved resale value of fleet, reduced running costs (particularly relating to maintenance and tyres), potential reductions in insurance premiums; reduced vehicle idling; and
- For organisations and the environment: - The development of a health and safety culture within an organisation, effective risk management, reduced GHG and other harmful vehicle emissions, reduced vehicle and personal injury accidents/incidents.

As part of Task 2 one stakeholder commented that compulsory driver training could act as a disincentive for people entering the profession. While this is unlikely to detract from the benefits of the measure, this issue may need to be considered in implementation of any relevant policy instruments.

Opportunities for the EC to reduce GHG emissions through this measure within the EU are explored below.

6.6.3.2 Test Criteria

It is suggested that driver training has a MED/HIGH potential to reduce GHG, whilst at the same time reducing other pollutants. The natural tendency of the market appears to be LOW for the adoption of fuel efficient driver training in small companies but MED in large companies as the larger companies often have more capital to invest in training and tend to have broader driver training programmes in which fuel efficient driver training can be a feature. The capital cost of such training is LOW/MED throughout the company ranges and the payback period is SHORT making Driver Training an attractive measure to adopt. It is important to note that driver training has been shown to be most successful when repeat/refresher training is provided to drivers as there is a tendency to revert to previous behaviour after being trained for the first time.

6.6.3.3 Recommendations

a) Information & Education Programmes

The EC could implement an information campaign to provide detailed information on driver training benefits, techniques and the necessity of re-training on a regular basis. This appears to have considerable merit on the basis that national driver training programmes have had considerable success as well as the ECODRIVEN initiative within the EU. We envisage this to be of a HIGH relevance to the remit of the EC and it is recommended as having a HIGH potential overall benefit to the EC. The cost of implementation to industry is expected to be LOW on the basis that no action would be required, and the cost to local authorities would be minimal and would therefore be LOW. No conflicts or major issues were identified; however there could be synergies between information and education initiatives actions with the EC STEER programmes, mainly ECODRIVEN. The potential reduction of CO₂ is 368,000 tonnes and NO_x 2,141 tonnes.

b) Research & Development

It has been determined that R&D is not applicable to this measure as the benefits are established and understood.

c) Legislation

The EC could amend the EU Driver Training Directive (Directive 2003/59/EC) to make fuel efficient driver training compulsory. This has a HIGH relevance to the EC and has a HIGH cost for industry and HIGH/MED cost to local authorities. In terms of synergies, such an obligation could be integrated with already established training directive, but may be opposed by sections of the transport industry. The overall potential benefit of this policy is suggested to be MED/HIGH.

Additionally, the EC could amend the EU Driver Licence Directive to make fuel efficient driver training a pre condition to entering the industry. This could be used in conjunction with the previous directive which would require fuel efficiency for maintaining their HDV driving licence. This has a HIGH relevance to the EC and has a HIGH cost of implementation to industry and HIGH/MED cost to local authorities. In terms of synergies, such an obligation could be integrated with already established training directive, but may be opposed by sections of the transport industry. This concept could be implemented in a way that would have a low impact on industry (e.g. answering some simple questions as part of a driving test, or being provided with information following the test itself) The overall potential of this action to reduce CO₂ is 8,028,000 tonnes and 47,000 tonnes of NO_x.

d) Other Recommendations

In addition, the EC could provide subsidies for providing training for a limited number of companies across Europe. This is seen as MED in relevancy to the EC and would have a MED impact on industry, with MED/HIGH associated costs to local authorities. We have assumed that the approximate savings from a state funded programme would be potentially 3.8%. The UK SAFED programme trained 5,244 drivers, representing approximately 3% of the UK annual HGV km. Therefore, a subsidised training programme could potentially create CO₂ savings of 456,000 tonnes and NO_x savings of 2,600 tonnes. It is important to state that savings would depend on how many drivers would be funded to carry out such a programme as we have assumed the same proportion would be trained as the UK. Savings could also be possibly higher as the basic level of training could be assumed in other European countries.

***PLEASE SEE FIGURE 6.4 BELOW FOR THE ILLUSTRATIVE VERSION OF THE TEST**

DRIVER TRAINING

Potential to Reduce CO2	MED/HIGH	
Trade off with other Pollutants	Reduction in other pollutants	
Natural Tendency of Market (Take Up)	Small	Low
	Medium	Med
	Large	Med
Capital Cost	Small	Low/Med
	Medium	Low/Med
	Large	Low/Med
Payback Period	Short	



Policy Instrument	Recommendation	Potential to Influence At EC Level	General cost of implementation to Industry	Cost to Public Authorities	Synergies/ Conflicts	Potential reduction of CO ₂ (Thousand tonnes)	Potential reduction of Nox (Thousand tonnes)
Information & Education Programmes	Information Campaign illustrating the benefits of driving training. (and re-training)	HIGH	LOW	LOW	Could be integrated with MS best practice training and the ECODRIVEN programme.	368	2.14
Research & Development	N/A – benefits well researched and understood	N/A	N/A	N/A	N/A	N/A	N/A
Legislation	Amend Training Directive to increase the baseline standards of training (i.e. in order to obtain a licence)	HIGH	HIGH	HIGH/MED	Could be integrated with established training directive	8,028	47
Other Recommendations	Subsidies for proving training for a limited number of companies.	MED	MED	MED/HIGH	Could be integrated with information campaign.	456	2.6

6.6.4 *Vehicle Specification and Aerodynamics*

6.6.4.1 Overview

Accurate and appropriate vehicle specification can play a significant role in reducing environmental impacts from HDV. Ensuring vehicles are closely matched to the tasks they are expected to perform improves both fuel and overall operational efficiency. This can lead to cost savings, increased profitability and reduced environmental impacts. Vehicle specification is largely the responsibility of the vehicle purchaser, although certain elements such as aerodynamic styling are often fitted to commercial vehicles as a standard feature.

Aerodynamics is the study of forces acting on objects moving through the air. When a vehicle moves, the air exerts a force on the vehicle that resists its motion. This force is the aerodynamic drag and it has a significant effect on the fuel consumption of vehicles. Drag is affected by vehicle shape, frontal area and speed. The greater the frontal area of a vehicle, the greater the aerodynamic drag will be. Similarly, the higher the vehicle speed, the greater the aerodynamic drag will be. The primary function of aerodynamic styling fitted to trucks is to reduce aerodynamic drag, thereby reducing vehicle fuel consumption and thus realising cost savings as well as reducing environmental impacts. It is important to specify a well-styled aerodynamic vehicle from new. However, there are a range of add-on features available that can significantly improve the aerodynamics of many vehicles on the road today. The EC's role in encouraging this measure is explored below.

Both vehicle specification and aero dynamics can be applied on a wide basis covering not only new vehicles but also existing vehicles within HDV operations.

6.6.4.2 Test Criteria

Vehicle specification and aerodynamics have a HIGH potential to reduce GHG and other harmful pollutants. In terms of vehicle specification, it is suggested that there is a LOW tendency for small companies to invest time and resources in initial vehicle specification, which could be a product of a lack of information and understanding of the subject, but also the fact that vehicles may be required to perform a more diverse range of tasks that might be the case in larger operations (i.e. less opportunity to match vehicles closely to work).

The benefits of aerodynamics are universally accepted and therefore there is a HIGH tendency to adopt across the spectrum of company sizes. Capital costs are LOW for vehicle specification because improved decision making could in fact reduce the vehicle purchasing costs. Capital costs for aerodynamics are also LOW across different company sizes. The payback period for both measures is SHORT.

6.6.4.3 Recommendations

a) Information & Education Programmes

The EC could implement and launch an information campaign to provide detailed information on illustrative benefits and applicability to transport operations. This appears to have considerable merit on the basis that the reality checks highlighted that even though much was known about the benefits of vehicle specification and aerodynamics, the applicability of different types of equipment was not clear for different operations. We envisage this to be of a MED relevance to the remit of the EC. The cost to industry is expected to be MED on the basis that no action would be required, and cost to local authorities would be minimal and would therefore be LOW. No conflicts or major issues were identified. The potential to reduce CO₂ is 143,000 tonnes and NO_x 760 tonnes.

b) Research & Development

Within these policy areas it is suggested that the EC could fund further research into aerodynamics by testing different applications with different operating circumstances, e.g. urban, long distance, etc. Additionally, further research into light weight materials would also be beneficial to the industry. Both are of a HIGH importance to the EC with both measures having no cost to industry due to the nature of the action. The cost to local authorities would be LOW/MED and both could be integrated with existing information. Therefore, we have suggested that these measures have a MED/HIGH priority for the EC.

c) Legislation

It is worth highlighting that legislation with the aim of modifying the weights and dimensions policy could be extremely beneficial to the efficiency of the transport sector, bearing in mind the impact these vehicles could have on rail and water freight, or the potential for increased (induced) demand as a result of lower road transport rates. A number of countries within the EU have reported environmental benefits from allowing longer and heavier vehicles. In principle, the Weights and Dimensions Policy could also be used as a mechanism for making certain types of aerodynamics features mandatory on all new HDV (not being considered within DG Tren Weights and Dimensions project). Therefore, such a recommendation would be of a HIGH relevance to the EC and would also have a MED/HIGH cost to local authorities as legislation does already exist. It would also be seen as having a MED/HIGH implementation cost to industry (but these costs would have a relatively short pay back period). Overall, such a policy would have a MED/HIGH potential to reduce GHG emissions.

***PLEASE SEE FIGURE 6.5 BELOW FOR THE ILLUSTRATIVE VERSION OF THE TEST**

Vehicle Specification & Aerodynamics

Potential to Reduce CO2	HIGH		
Trade off with other Pollutants	Reduction in other pollutants		
Split		Spec	Aero
Natural Tendency of Market (Take Up)	Small	Low	High
	Medium	Med	High
	Large	Med	High
Capital Cost	Small	Low	Low
	Medium	Low	Low
	Large	Low	Low
Payback Period	Short		



Policy Instrument	Recommendation	Potential to Influence At EC Level	General cost of implementation to Industry	Cost to Public Authorities	Synergies/ Conflicts	Potential reduction of CO ₂ (Thousand tonnes)	Potential reduction of Nox (Thousand tonnes)
Information & Education Programmes	Information Campaign illustrating the benefits and applicability to transport operations	MED	LOW	LOW	N/A	143	0.76
Research & Development	1) Further research into Aerodynamics, testing different applications with different operations. 2) Research into light weight materials.	HIGH	N/A	LOW/MED	Interate with existing information	MED/HIGH	MED/HIGH
Legislation		HIGH	MED/HIGH	MED/HIGH	N/A	MED/HIGH	MED/HIGH

6.6.5 *Operational Modifications*

6.6.5.1 Overview

There are also steps that can be taken to improve efficiency which relate to organisational characteristics. Measures such as strategic partnerships and consolidation centres are good examples of methods that can increase vehicle utilisation and reduce empty running. Operational modification relates to basic efficiency levels can always be improved no matter how large or successful a HDV operation may be. These types of measures have a fundamental effect on fuel consumption, but are often more difficult to implement compared to other measures.

Lading factors and the amount of empty running vary to a substantial degree between different EU countries. In 2005 Sweden had the highest lading factor at 18.6 tonnes and the UK was the lowest at 9.1 tonnes. In 2006 45% of Cypriot HGV kms were run empty, whereas in Latvia on 13% of kms were run empty.

EC intervention in this area may, however, be difficult. A key problem lies in the implementation of these measures as it is hard to gain collaboration within the supply chain and external factors are continuously changing. The concept of strategic partnerships and supply chain collaboration can be effective but are concepts that are difficult to implement in practice because they involve major operational changes. Estimates to the effects of operational changes need to be made on a case by case basis, and even practices such as backloading in the freight industry will have varying benefits depending on the size of an operation and number of vehicles involved. With these issues aside however, there may be certain kinds of operational modifications that can be influenced more easily by the EC than others (e.g. consolidation centres). Opportunities for encouraging/promoting such measures are explored below.

6.6.5.2 Test Criteria

Operational modification has a MED/HIGH potential to reduce GHG and also reduces other pollutants. However, the natural tendency to adopt such a measure is viewed as LOW in Small and Medium companies and MED-HIGH in Large companies. The capital cost of such measures is difficult to categories on the basis that such a wide range of measures can be adopted which have very different cost implications (e.g. reorganisation of warehousing would be very high, whereas looking to backloading opportunities would be relatively inexpensive). In recognition of this the measure is classed as MED, as is the payback period. Understanding operational modifications and time constraints seem to be the main obstacles to such a measure in the natural market.

6.6.5.3 Recommendations

a) Information & Education Programmes

The EC could implement an information campaign on the benefits of partnerships and operational modifications such as backloading and freight exchanges. This could highlight that cooperation between companies could actually be beneficial to the whole sector in terms of efficiency and thus a reduction in GHG emissions. This has a MED relevance to the EC and has a LOW cost to industry. The cost to local authorities would be LOW and no synergies or conflicts could be identified. Therefore, the overall potential to reduce CO₂ is 77,000 tonnes and NOx 401 tonnes.

b) Research & Development

Within this policy area it is suggested that the EC could fund further research into supply chain efficiency and possibly fund demonstrations and pilots (e.g. for urban consolidation centres). These are of MED/LOW relevance to the EC. The cost to industry would not be applicable due to the nature of the action and the cost to the local authorities would be MED/LOW. These measures could also be integrated with existing research, but there would be a possible conflict between regions that do not gain funding. Therefore, we have estimated that these actions would have a MED/HIGH overall potential benefit to the EC.

c) Legislation

Our research has also highlighted that reduction in speed limits for HDV could also reduce GHG Emissions, and have recently been proposed by the Federation Nationale Des Transport Routiers (FNTR) in France. Although speed limits are determined by Member States, Directive 2002/85/EC sets restrictions for speed limiters which must be fitted to all passenger vehicles with more than 8 seats, and goods vehicles exceeding 3.5 tonnes. These limits are 100 km and 90 km respectively. It would be possible to reduce this limit and hence GHG emissions on the basis that vehicles often operate more efficiently at lower speeds. This would require legislative change, and could be opposed by significant sections of the freight industry. If motorway speed is reduced to 80kph the average European speed will drop from 86.3 kph to 80 kph. This will lead to a reduction in CO₂ of 3.3% and NO_x 3.9% for all Long Distance HGV kms. This leads to an overall vehicle parc reduction of 2.6% of CO₂ and 2.7% of NO_x or 5,307,000 tonnes CO₂ and 33,000 tonnes NO_x. This calculation is based on actual vehicle tests at different speeds for UK (and the COST 346 report which states that emissions factors for the same standard Euro engine do not differ substantially between member countries)

***PLEASE SEE FIGURE 6.6 BELOW FOR THE ILLUSTRATIVE VERSION OF THE TEST**

Operational Modification

Potential to Reduce CO2	MED/HIGH	
Trade off with other Pollutants	Reduction of other pollutants	
Natural Tendency of Market (Take Up)	Small	Low
	Medium	Low
	Large	Med/High
Capital Cost	Small	Med
	Medium	Med
	Large	Med
Payback Period	Med	



Policy Instrument	Recommendation	Potential to Influence At EC Level	General cost of implementation to Industry	Cost to Public Authorities	Synergies/ Conflicts	Potential reduction of CO ₂ (Thousand tonnes)	Potential reduction of Nox (Thousand tonnes)
Information & Education Programmes	Information Campaign on the benefits of partnerships and operation modifications such as backloading and freight exchanges.	MED	LOW	LOW	N/A	77	0.40
Research & Development	1) Continued research into supply chain efficiency research.	MED/LOW	N/A	MED/LOW	Integrate with existing research	MED/HIGH	MED/HIGH
Research & Development	2) Funding of regional/urban demonstrations and pilots (e.g. Consolidation centres)	MED/LOW	N/A	MED/LOW	Possible conflict with regions that don't gain funding	MED/HIGH	MED/HIGH
Legislation	Legislation to reduce mandatory speed limits across the EU	MED	LOW/MED	HIGH	Possible conflict from Industry and Member States	5,307	33

6.6.6 *Vehicle Maintenance*

6.6.6.1 Overview

Preventative maintenance can be thought of as a proactive management strategy, rather than a set of individual actions. It is a strategy that involves making sure that vehicles are always kept in good order to help minimise the chance of major defects occurring, whilst finding ways to improve vehicle efficiency above merely ensuring that basic roadworthiness is attained. In overall terms, preventative maintenance systems appear to offer potential benefits. Some practitioners who are active in this area believe that preventative maintenance pays for itself but benefits are not well proven in terms of fuel efficiency because preventative maintenance tends to be focused on reducing the cost of maintenance and component replacement rather than on reducing fuel use *per se*. Opportunities for EC intervention are discussed below.

6.6.6.2 Test Criteria

Preventative Vehicle Maintenance (i.e. above what is required for roadworthiness) has a MED potential to reduce GHG and other pollutants. However, the natural tendency to take up such a measure within transport operators is suggested as being LOW in Small and Medium companies and MED within Large companies. The cost to Small companies is suggested as HIGH, and MED within Medium and Large companies. The payback period is SHORT and normally is a valuable exercise to carry out.

6.6.6.3 Recommendations

a) Information & Education Programmes

The EC could implement an information campaign to identify best practice in preventative maintenance and illustrate the practical benefits of carrying out such a procedure. This action would have a LOW cost to industry as well as being LOW in cost to local authorities. It is recommended that this action would have the potential to reduce CO₂ by 19,000 tonnes and NO_x by 108 tonnes.

b) Research & Development

The EC could potentially fund research projects to test the GHG savings from different preventative maintenance techniques. This has a MED relevance to the EC with a LOW cost to industry and a LOW/MED cost to local authority. However, there is a risk of replication of research being carried out elsewhere. This is viewed as having a LOW overall benefit to the EC.

c) Legislation

The EC could change the maintenance requirements throughout the EU to raise the standards of compulsory maintenance. This would have a HIGH cost to industry and would be of a HIGH cost to local authority. There would also be the potential that industry would be against such a draconian measure. However, the potential to reduce CO₂ is 5,034,000 tonnes and 29,000 tonnes of NO_x.

***PLEASE SEE FIGURE 6.7 BELOW FOR THE ILLUSTRATIVE VERSION OF THE TEST**

Vehicle Maintenance

Potential to Reduce CO2	MED	
Trade off with other Pollutants	Reduction in other pollutants	
Natural Tendency of Market (Take Up)	Small	Low
	Medium	Low
	Large	Med
Capital Cost	Small	High
	Medium	Med
	Large	Med
Payback Period	Short	



Policy Instrument	Recommendation	Potential to Influence At EC Level	General cost of implementation to Industry	Cost to Public Authorities	Synergies/ Conflicts	Potential reduction of CO ₂ (Thousand tonnes)	Potential reduction of Nox (Thousand tonnes)
Information & Education Programmes	Information Campaign to identify best practice and illustrate benefits	HIGH	LOW	LOW	N/A	19	0.108
Research & Development	Research Projects that test the Co2 savings from different Preventative Maintenance Techniques	MED	LOW	LOW/MED	Risk of replication or partial replication of research being carried out elsewhere	LOW	LOW
Legislation	Change Maintenance requirements to raise the standard of compulsory preventative maintenance	HIGH	HIGH	HIGH	Industry itself would probably resist change	5,034	29

6.6.7 *Improvements in Propulsion Technology*

6.6.7.1 Overview

The potential for improvements to vehicle efficiency via 'hard' engine technology and propulsion systems may potentially offer significant reduction in emissions from HDV. Over the past decade and more vehicle manufacturers have made significant improvements in the reduction of non CO₂ greenhouse gas emissions, in particular in compliance with Euro engine specification standards. As there is a separate consultation by the European Union, this project will not explore the concepts of Euro engine standards, however it is important to take these actions into consideration when deciding on recommendations for this measure to avoid the potential for replication or conflicts with work done elsewhere. Euro engine standards do not however address fuel efficiency and therefore production of CO₂. Indeed there can be a conflict between reductions in non CO₂ emissions whilst simultaneously reducing CO₂. Outside of the commitments stemming from Euro limits, another key focus area for engine and vehicle manufacturers is the development of new solutions for available alternative fuels, especially hybrid engines. Ultra low sulphur diesel is likely to be mandatory in the EU from 2009 (and already has 100% market penetration in many member states) and hence is not recommended as an area requiring policy intervention in this project. It is important to note that unlike other measures which could generally be applied to all HDV throughout Europe, improvements in vehicle propulsion systems can mainly influence new vehicles. Potential benefits of policy actions in this area should be viewed as long term in nature, and will be influenced heavily by the natural lifespan of vehicles and their subsequent replacement.

6.6.7.2 Test Criteria

The results of the analysis carried out suggest that this improving engine fuel efficiency has a MED potential to reduce CO₂ emissions but it could increase other pollutants, i.e. NO_x and particulate matter (PM). In contrast, the new Euro VI will reduce NO_x, but has a negative effect on CO₂ reduction. This is in direct contrast to the other measures we have explored which would reduce the total amount of fuel consumed, equating to reduced GHG emissions as a whole. Improvements in vehicle propulsion systems necessitate a balancing act to maximise the reduction of pollutants like NO_x and CO₂. Additionally, it is also important to consider differences between urban and non urban environments. Decreased NO_x may be more desirable in urban deliveries and applications, whereas in other operational environments such as long distance travel, it may be more beneficial to have reductions in CO₂ which increase other more harmful emissions.

As an overall statement, the natural tendency of the market to take up improvements in propulsion technologies is suggested to be LOW in Small and Medium companies but MED in large companies. The capital costs of such measures are HIGH throughout the spectrum of company sizes. The payback period has been estimated to be LONG.

6.6.7.3 Recommendations

a) Information & Education Programmes

The EC could introduce an information and education programme to promote hybrid engines and other improvements in propulsion technology. This is seen to be of a HIGH relevance to the EC and have a LOW cost to industry. The cost to local authorities would be LOW and would therefore be seen to have a MED overall potential benefit.

b) Research & Development

The EC can continue to fund research projects into the efficiency and potential of the development of HDV engines (e.g. hybrids) or encourage their use through pilots and demonstration projects. This would highlight to the transport industry whether such options are both practically and commercially viable, and aid in their further commercial development. This has a MED/HIGH relevance to the EC, and is not applicable in terms of the cost of implementation to industry. Additionally, this action would have MED costs to local authorities. There are also possible synergies with other research projects and it is therefore predicted to have a MED overall benefit to the EC.

c) Legislation

An important area in which the EC can influence this measure is through developing a fuel efficiency standard for HDV engines. This has recently been implemented in Japan and could be developed by the EC. This could be a potentially attractive option, but if this were to be implemented then consideration on EURO Emissions Standards would be needed. Other practical issues would also need to be considered before this type of action could be taken, such as what to do when initial standards would have to be met, and the applicability of different drive cycle tests to different types of HDV operations (and the subsequent potential for inappropriate vehicles specification as a result of inappropriate standards). As a first step Legislation could also be introduced for labelling the fuel efficiency standards of HDV engines. This could then be implemented in line with a binding or non binding fuel efficiency standard.

Both of these actions could have a significant impact on manufacturers, but at the same time there are also potential synergies with standards being established for cars. However, it is essential to consider the differences in manufacturing processes between cars and HDV. When a car leaves the manufacturer it is essentially a complete product and its fuel efficiency potential is established and predictable. The development of a HDV on the other hand is very different. The truck manufacturers generally produce only a chassis and engine, and the product is then adapted by body builders. This late stage of the production process, which is determined by the vehicle specification process of the operator, can result in the chassis with the same engines having very different levels of fuel consumption, which may or may not imply differences in levels of efficiency. Therefore, careful consideration must be given to how and at what stage an efficiency standard could be applied. Therefore, there is the potential to create a three tier step labelling scheme that firstly labels the efficiency of the engine and then possibly label other components such as the naked vehicle and superstructures. One important factor to consider is that there would need to be a method of testing and certification. These actions appear to have a HIGH relevance to the EC, with a MED cost of implementation to industry (as the main responsibility is on manufacturers) and a MED cost to local authorities. Although legislation is likely to be expensive and could take longer to implement compared to other options, an efficiency standard and labelling scheme would have a direct impact on manufacturers, but could encourage long term adoption of fuel saving measures and empower consumers to make better purchasing decisions. These are therefore recommended as having a MED/HIGH overall potential to reduce GHG emissions, whilst still understanding that such measures are long term strategic actions.

***PLEASE SEE FIGURE 6.8 BELOW FOR THE FIRST ATTEMPT TO ESTIMATE POTENTIAL BENEFITS IN VEHICLE PROPULSION SYSTEMS. IT IS ALSO IMPORTANT TO NOTE THAT COSTS AND BENEFITS ARE PRESENTED IN THE CONTEXT OF A SINGLE NEW VEHICLE.**

Improvements in Propulsion Technology

Potential to Reduce CO2	MED	
Trade off with other Pollutants	Increase in other pollutants, eg NOXs	
Natural Tendency of Market (Take Up)	Small	Low
	Medium	Low
	Large	Med
Capital Cost	Small	High
	Medium	High
	Large	High
Payback Period	Long	



Policy Instrument	Recommendation	Potential to Influence At EC Level	General cost of implementation to Industry	Cost to Public Authorities	Synergies/ Conflicts	Potential reduction of CO ₂ (Thousand tonnes)	Potential reduction of Nox (Thousand tonnes)
Information & Education Programmes	Promote Hybrid Engines through education programmes.	HIGH	LOW	LOW	N/A	MED	MED
Research & Development	Continued research into the efficiency and potential of development of HDV engines (eg hybrids)	HIGH/MED	N/A	MED	Synergies with existing research	MED	MED
Legislation	1) Fuel Efficiency Standard (to be considered as element with Emissions standards)	HIGH	MED	MED	Potential opposition from manufacturers	MED/HIGH	MED/HIGH
Other Recommendations	2) Labelling legislation requiring manufacturers to label HDV engines according to fuel efficiency standards	HIGH	MED	MED	Potential opposition from manufacturers	MED/HIGH	MED/HIGH

6.7

Reflection on the Long List Options

This chapter has detailed an initial list of policy instruments that the EC could implement to reduce GHG emissions from HDV. It is worth noting that all actions/instruments considered as part of this work could play a positive role in improving environmental sustainability within commercial road transport operations. We have provided a generalised view of the potential benefit that each action may have, based on its overall potential to reduce GHG emissions, the potential of the EC to achieve change, potential cost to industry, costs to public authorities and synergies with existing policies.

Each type of action is likely to have significant trade offs in terms of overall reductions in GHG emissions, costs to society and industry. For instance, a combined information and education programme would be relatively inexpensive and may be a logical first step to encourage change, but its voluntary nature means it may not be as effective as other options in the longer term. Legislation is likely to be expensive to implement, may have a high cost to industry but could result in very significant long term reductions in emissions. Research and development is undertaken by industry irrespective of Government intervention, however the EC could play a minor but very positive role in a range of areas such as helping improve propulsion and IT systems and vehicle light weighting and aerodynamics.

It also is important to consider some of the potential conflicts that may exist between different policies. In particular trade offs between emissions of CO₂ and other pollutants must be acknowledged. Efforts to reduce non CO₂ emissions can actively work against efforts to reduce CO₂ emissions. This issue has been highlighted in recent EC consultation on the future Euro VI Emissions Standard. This is also reported to be an issue in Japan, where current emissions reduction targets mean that agreed longer term fuel efficiency targets will, in effect, need to be larger than present values, i.e. emissions targets effectively 'raise the bar' for efficiency improvements.

Added to this, the issue of the differences between urban and inter urban transport operations are also significant. In urban areas, non CO₂ emissions are generally more of a concern than for long distance corridors. Policies that reduce non CO₂ emissions at the expense of increased CO₂ emissions may well be acceptable in urban areas, provided significant efforts are made to reduce CO₂ in long distance transport. A two tiered approach to future policy making may achieve the best possible outcomes in terms of improving the local air quality, while at the same reducing the overall contribution of commercial transport operations towards global warming.

In summary, these policy instrument recommendations were ratified by the client and then a selection of them were chosen to create a short list of policy options to be subject to more detailed analysis. This is the scope of the next chapter.

7 Final Recommended Policy Instruments

7 Final Recommended Policy Instruments

The underlying aim of this research is to identify actions that the European Commission can take to reduce Greenhouse Gas Emissions from Heavy Duty Vehicles. To meet this requirement effectively the long list of potential options was reduced to a short list of policy instruments, taking into account their effectiveness, deliverability by the Commission, cost to industry and the alignment with other Commission policies and regulations.

To this end the long list of options compiled through the previous research phases were discussed with the client steering group on 30th October 2007 at a meeting held to:

- Review the methodology used to create the long list;
- Agree on the short list assessment criteria; and
- Agree on Short List options for evaluation.

The outcome of this short list analysis and recommendations acts as a point of direction for the European Commission for further research and consideration. No formal impact assessments have been carried out within the scope of this project and the recommendations are formed from the information and evidence gathered from the client, the project team and from stakeholders consulted during the course of the research.

7.1

Methodology

Although it would have been ideal to base all evaluation on a consistent and detailed information set, due to the complexity of the transport sector and the lack of consistently available and accurate data across the European Union, it was agreed with the Client that a three tiered approach would be adopted to ensure that important unquantifiable policy instruments are not overlooked nor ignored.

Therefore, the selections of short listed policy instruments, where possible, are based on quantified information. However, if such quantified information is not available, this should not prevent an instrument from being recommended if the project team's and client's expert knowledge deems it to be suitable for further investigation. The three categories are as follows:

- Policy instruments evaluated using quantified information;
- Policy instruments evaluated using professional judgement; and
- Actions that are already considered, planned or being undertaken by the Commission.

Where an evaluation has been possible a consistent set of baseline data on the European vehicle fleet has been used. In order to generate a potential CO₂ and NO_x saving we must establish a reasonable baseline for each of the following criteria as each has a valid effect on the production of GHG in HDV:

- European Vehicle kms (Buses and HGVs);
- European fleet age profile;
- Split between long distance and urban applications for HGVs and Buses;
- Estimated Split between artic and rigid vehicles for HGVs;
- Average speed for Long Distance and Urban Bus and HGV operations;
- Emissions factor (grams/km) for CO₂ and NO_x in Urban/Long Distance HGV and Bus operations; and
- Estimated Total European Production of CO₂ and NO_x from HGVs and Buses/Coaches.

The purpose of using this baseline data is to create an estimated initial picture of the impact that the recommended policy instrument can have on the transport industry in terms of reducing GHG emissions. The calculations and sources of data we have used are not assumed to be precisely accurate as there are significant variances in the quality of the European wide data available. Therefore, several assumptions and predictions have been incorporated into the calculations to give an indicative result.

7.2 Data Sources

The sources of data and assumptions used are set out in the following paragraphs.

7.2.1

European Vehicle kms (Buses and HGVs)

To create a baseline for the total European Vehicle kms for buses and HGVs we gained vital information from Eurostat (EU-27). For HGVs the data is based on 2006 figures for all countries except Norway, Italy, UK and Luxembourg, for which data is based on 2005 figures. In contrast, the data received for buses and coaches was from 2003 passenger km figures. This information was then transferred into vehicle Km figures by using the ratio of vehicle km to passenger km for Belgium, Estonia, Slovakia, Slovenia, Finland, UK and Iceland as this was the only data available. Therefore, the following table shows the total kms for HGVs and buses/coaches:

Table 7.1 Total Vehicle kms (millions) – Eurostat Database

Sector Type	Total Vehicle kms (million)
HGVs	150,753
Buses/Coaches	47,994

7.2.2

European fleet age profile

To generate a baseline age profile for HGVs, the project team used Eurostat 2006 figures to determine vehicle kms by age band (except for UK, Ireland, Norway and Luxembourg as only 2005 figures were available, therefore these statistics were factored up by the average increase in vehicle kms in known countries.) These age bands have then been translated into equivalent Euro Engine standards, assuming that our recommendations are to be adopted in 2009. Both the age bands and the Euro engine figures have been translated into percentages. The table below illustrates the age bands and relevant Euro engines for HGVs:

Table 7.2 HGV Vehicle Age Bands and Euro Engine Bands (% Distribution)

Vehicle Parc Age	% Vehicle kms
<2 Years	17%
2 Years	15%
3 Years	12%
4 Years	10%
5 Years	9%
6 Years	8%
7 Years	7%
8 Years	5%
9 Years	4%
10 - 14 Years	9%
15 Years >	5%
Euro Engine Prediction	
Euro V	9%
Euro IV	44%
Euro III	36%
Euro II	6%
Euro I	2%
Euro 0	2%
Pre Euro 0	1%

With regards to buses, the age profile is based on Eurostat 2004 statistics (though a select few countries had submitted data from earlier years). The same process was used with this data as the HGV data to produce the following table for Bus age and Euro engine profile:

Table 7.3 Bus Vehicle Age Bands and Euro Engine Bands (% Distribution)

Vehicle Parc Age	% Vehicle kms
<2 Years	12%
2 - 5 Years	17%
5 - 10 Years	26%
> 10 Years	46%
Euro Engine Prediction	
Euro V	6%
Euro IV	23%
Euro III	28%
Euro II	8%
Euro I	12%
Euro 0	6%
Pre Euro 0	17%

7.2.3

Split Between Long Distance and Urban

Eurostat data was used to determine the split between urban and long distance HGVs. In calculating the split between freight applications it is assumed that any HGV travelling under 50kms would be classed as an urban freight application. Therefore, anything over 50kms would be termed as a long distance freight application. With regards to buses the split was calculated on the UK Department for Transport's 2006 passenger km figs. Table 4 below illustrates the total urban and long distance kms in the freight and bus/coach markets:

Table 7.4 Total Urban and Long Distance kms in the Freight and Bus/Coach Markets

Sector	Type of application	Total Vehicle kms (million)
HGVs	Urban	136,131
	Long Distance	14,622
Buses/Coaches	Urban	8,378
	Long Distance	39,617
Total	HGVs	150,753
	Buses/Coaches	47,995

7.2.4

Emissions Factor (grams/km) for CO₂ and NO_x

An important factor to generate in order to predict the potential of a policy instrument to reduce GHG emissions is an emissions factor – i.e. how many grams of CO₂/NO_x are generated per km for each urban and long distance application. The project team used the National Atmospheric Emissions Inventory (UK) as the base data to create this factor due to a lack of European wide information. It should be noted that the COST 346 report into fuel consumption by Heavy Duty Vehicles produced for the European Commissions indicates that there is very little difference between the emissions from HDVs of the same Euro engine standard in different European countries.

This data provided an average speed for urban applications and motorway applications taking into account the split between different Euro standard engines. Additionally, we then calculated the percentage split between artic and rigid vehicles by using the Continuous Survey of Road Goods Transport UK Department for Transport 2006 data, which can be seen below;

Table 7.5 Split Between Urban/Long Distance Rigid and Artic Vehicles

Type of Application	Rigid	Artic
Urban	80%	20%
Long Distance	40%	60%

From the information contained in the National Atmospheric Emissions Inventory (UK) we established the following gram per km equations for HGVs:

Table 7.6 Gram per km Equations for HGV

Emission	Total Urban HGVs		Total Long Distance HGVs	
	Rigid	Artic	Rigid	Artic
CO ₂ (g/km)	633	1471	662	1550
NOx (g/km)	3.6	7.8	4.0	7.8

The artic and rigid vehicle splits were then taken into account and the grams per km were then recalculated to produce the following results:

Table 7.7 Gram per km Equation for HGV Taking into Account Artic and Rigid Vehicle Split

Emission	Total Urban HGVs	Total Long Distance HGVs
CO ₂ (g/km)	796.8	1195
NOx (g/km)	4.5	6.2

The National Atmospheric Emissions Inventory (UK) data was also used for buses/coaches. This data provided an average speed for urban bus speeds and motorway bus speeds, taking into account the split between different Euro standard engines. Therefore, the following table illustrates the gram per km for buses/coaches:

Table 7.8 Gram per km Equations for Buses

Emission	Total Urban Buses	Total Long Distance Buses
CO ₂ (g/km)	656.7	574
NOx (g/km)	6.0	5.8

7.2.5

Estimated Total Production of CO₂ and NOx from HGVs and Buses/Coaches

The CO₂ and NOx gram per km for HGV and Buses was then used to calculate the estimated total CO₂ and NOx production of the HDV industry within Europe. The following table illustrates the results:

Table 7.9 Estimated Total Production of CO₂ and NO_x from HGVs and Buses in Europe

Estimated Total Production of CO ₂ and NO _x from HGVs and Buses in Europe			
		CO ₂ (thousand tonnes)	NO _x (thousand tonnes)
HGVs	Urban	11,651	65
	Long Distance	162,718	850
Buses/Coaches	Urban	27,253	239
	Long Distance	5,038	48

This baseline data allows an estimation of the potential greenhouse gas savings for Heavy Duty Vehicles across the European Union for each short listed policy instrument where the changes to fuel usage, mileage run or emission are known.

7.3

Category 1: European HDV Operational Efficiency Programme

The first stage of the assessment of this policy instrument was qualitative and concluded that the start up time of such a policy instrument is short in nature, with a Low cost to industry and a High potential for European Union bodies to influence.

There are a series of evaluated long list options that have demonstrable benefits in reducing greenhouse gas emissions in HDV but that would be difficult for the Commission to influence independently, either through legislation or through education. However an education and behavioural change programme embracing a number of these individual components was considered as being worthy of evaluation on the shortlist and for further consideration by the Commission.

Although there are many examples of the application of the best equipment, technology, management and training on an individual company basis this option seeks to evaluate what impact on reducing GHG emissions a Commission backed education programme might have to influence an overall higher uptake in this range of efficiency improvement measures by operators of HDV.

The only comparable policy instrument that has been applied and assessed in a quantitative manner is the English Freight Best Practice (FBP) programme which is funded by the Department for Transport. This programme researches and then communicates operational efficiency measures to the operators of HGVs in England. An independent impact assessment was carried out in 2007. The results from this impact assessment have allowed the project team to project potential GHG emission savings if a Best Practice Programme was established across the European Union.

Although FBP is aimed solely at HGV operators many of the principles and measures could be applied to buses and the explanation of the quantitative assessment and methods of implementing such a programme assumes an implementation across all HDV.

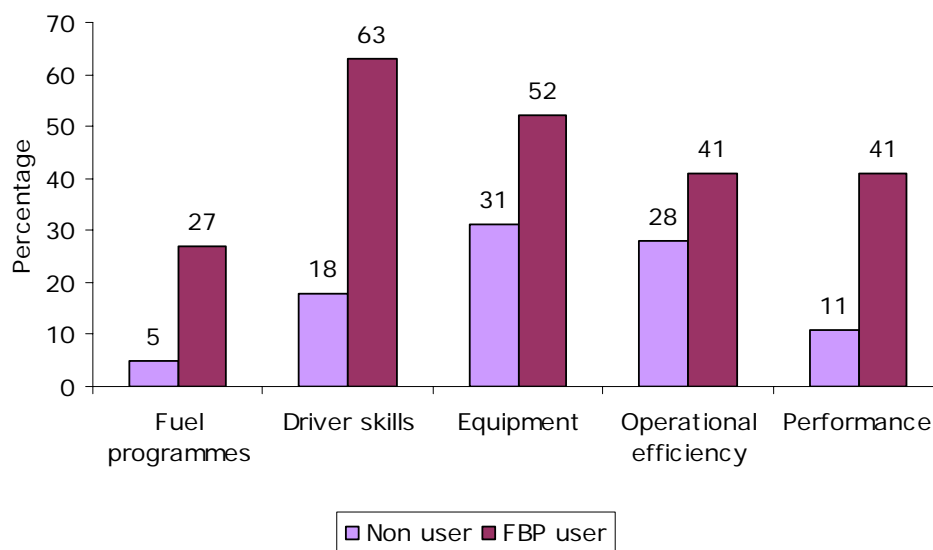
7.3.1

Methodology of Estimating Potential GHG Savings from an HDV Operational Efficiency Programme

In order to establish the actual potential GHG savings from an HDV Operational Efficiency Programme the information gained from the independent impact assessment was applied to the findings to the European Union HDV fleet as a whole. However, it is very important to understand that there can be large individual efficiency gains within a programme as overall efficiency levels vary, even in similar operations (as much as 50%). Educational Programme components, such as driver training, can save as much as 10% fuel therefore an operator who uses the programme correctly can potentially save a high percentage of fuel, thus CO₂ and NO_x. The total carbon saving from the UK Best Practice Programme for two years was 65,560 tonnes of carbon. 9% of English HGV operators had become a user of the programme, however, due to the larger size of companies who engaged in the programme this equated to 29% of HGV kms in England. The companies that participate in such a programme have reported fuel and carbon savings of approximately 4.8% per fleet. This was then compared to the total carbon per annum produced by all English HGVs, which was 7.6 million tonnes of

carbon. The two figures were divided to create a total industry saving of 0.5% in GHG emissions. On the face of it this may seem like a minute saving. However, while the number is small for the whole UK freight sector, it is not small for those who participate in such a programme who have reported fuel and carbon savings of approximately 4.8% per fleet. Therefore, with adequate European wide funding and marketing an HDV Operational Efficiency Programme could be of real benefit to achieving GHG savings throughout Europe. As illustrated in Fig XX below, those who use the FBP programme in the UK are more likely to implement or use GHG saving techniques.

Figure 7.1 Freight Best Practice Impact Assessment, Databuild Research & Solutions 2007



Having established the estimate of GHG savings in England from the Freight Best Practice Programme we could then proceed to estimate the potential GHG savings of a European wide Programme. The first step in achieving this was to establish a sound assumption of the amount of vehicle kilometres that each investigated sector (i.e. long distance freight, urban freight, etc) accounted for from the overall total European vehicle kilometres travelled. Using the total vehicle kilometre split from the baseline assumptions in Figure 7.1 above and the individual emission factors which are contained in Figure 7.1 above we can proceed to calculate the assumed potential carbon savings for long distance freight, urban freight, long distance passenger transport and urban bus. This is illustrated in the table below:

Table 7.10 Potential GHG Savings by Sector from Implementing a Best Practice Programme

Sector	Potential CO ₂ Saving (thousand tonnes)	Potential NO _x Saving (thousand tonnes)
Long Distance Freight	701	3.7
Urban Freight Distribution	50.3	0.3
Long Distance Passenger Transport	21.7	0.2
Urban Buses	117.5	1.0

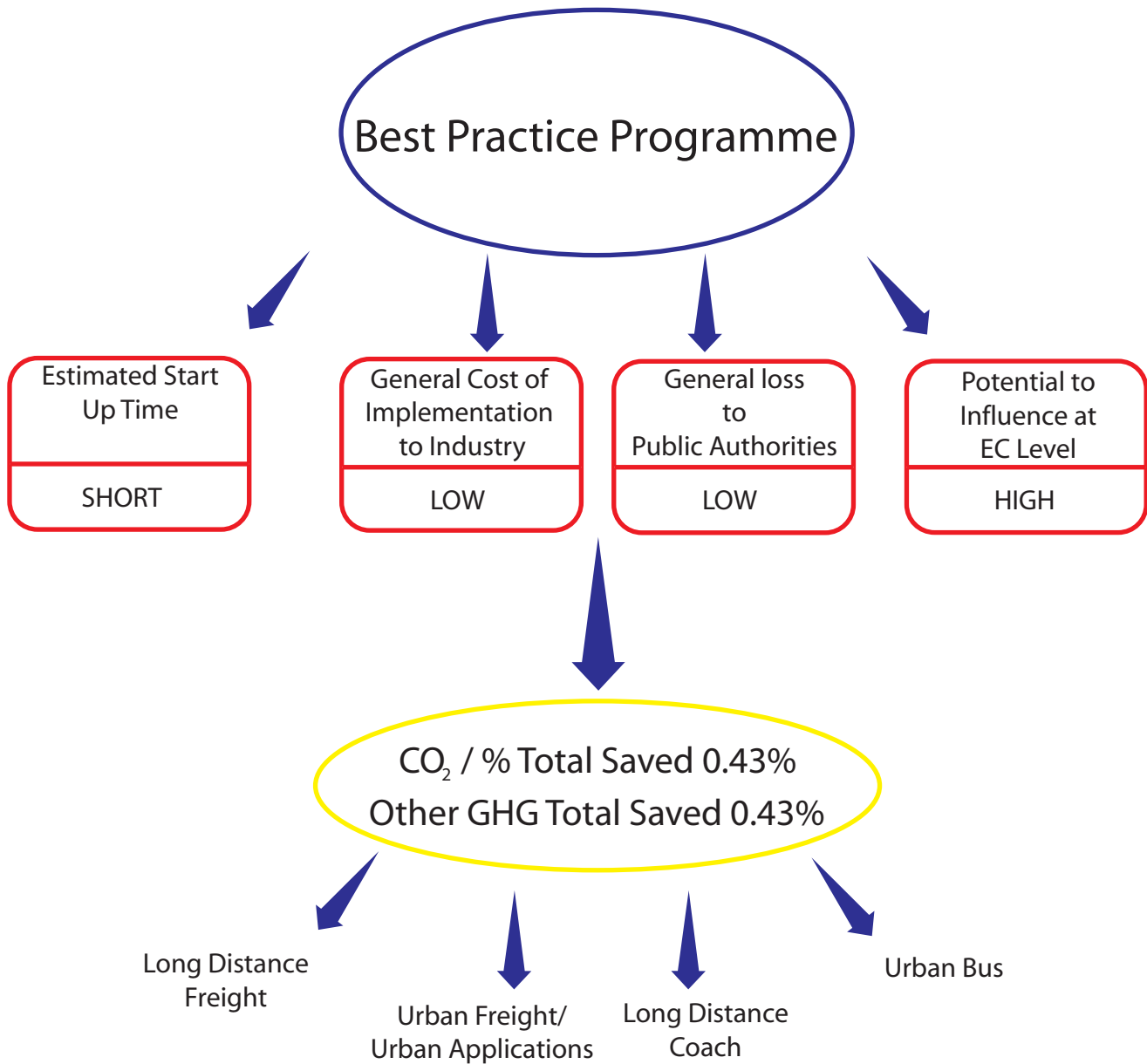
Therefore, by adding these savings together the following conservative potential savings may be achieved by a European wide Best Practice Programme:

Table 7.11 Potential total CO₂ and NO_x GHG Savings from Implementing a Best Practice Programme

Potential CO₂ GHG Savings	891,000 tonnes
Potential NO_x GHG Savings	5,200 tonnes

*It should be noted that these savings are based on the proven achievement of one example of an education programme in a single member state that could be appropriate for a wider European application. It is noteworthy that there has been no analysis of the further potential for FBP which could for example become significantly more or possibly less effective over time. Nor does this account for the relative baseline HGV efficiency in England compared to other member states. Additionally, this does not take into account increased funding, nor varying efficiency. It seems more likely that this estimate is a conservative one as the funding levels for FBP are relatively modest and it is therefore possible that a European wide programme would provide greater GHG savings.

PLEASE SEE FIGURE 7.2 FOR A DIAGRAMATIC ILLUSTRATION OF THE POTENTIAL IMPACT OF A EUROPEAN BEST PRACTICE PROGRAMME



Section	Long Distance Freight	Urban Freight/Urban Applications	Long Distance Coach	Urban Bus
Est total EV Kms (million)	14,622	136,131	39,617	8,378
Est Emmission factors (gram per vehicle km CO ₂)	1195	796.8	574	656.7
Est Emmission factors (gram per vehicle km NoX)	6.2	4.5	5.8	6.0
Est Total CO ₂ Production (thousand tonnes)	162,718	11,651	5,038	27,253
Est Total NoX Production (thousand tonnes)	850	65	48	239
Est Total CO ₂ Saving (thousand tonnes)	701	50.3	21.7	117.5
Est Total NoX Saving (thousand tonnes)	3.7	0.3	0.2	1.0

 **Potential Total CO₂ Industry Saving - 890,500 Tonnes**
 **Potential Total NO_x Saving - 5,200 Tonnes**

7.3.2 *Context of the Evaluation*

It should be noted that these savings are based on the proven achievement of one example of an education programme in a single member state that could be appropriate for a wider European application. It is noteworthy that there has been no analysis of the further potential for FBP which could for example become significantly more effective over time. Nor does this account for the relative baseline HGV efficiency in England compared to other member states. It seems more likely that this estimate is a conservative one as the funding levels for FBP are relatively modest and it is therefore possible that a European wide programme would provide greater GHG savings. Additionally, further to this project, if a best practice programme was to be considered it would be important to carry out research into the European transport market as well as carrying out an impact assessment. The programme would benefit from such acts and would therefore, along with adequate funding, maximise the benefits of a best practice programme.

7.3.3 *Implementation Ideas*

Fundamentally, an HDV Operational Efficiency programme should focus on encouraging behavioural change amongst road and public transport operators, whilst helping them to reduce fuel consumption and environmental impacts. The programme should achieve its objectives through a variety of channels but mainly by developing and disseminating transport related best practice information covering the main areas of:

- Managing Performance;
- Equipment and Systems;
- Operational Efficiency; and
- Developing Driver Skills.

Whilst Freight Best Practice provides a template which offers a proven record of success the application across the European Union and to Bus as well as HGV operators provides considerable challenges. Initiating such a programme would follow the development of a plan taking account of issues including;

- EU level research into the most appropriate actions to reduce GHG emissions and programme structure and funding arrangements;
- Consideration of the application of a single EU wide programme or a programme delivered through individual member states;
- Understanding what behavioural change levers could be used to best effect for different company sizes, business sectors, personnel within a business and different geographies; and
- Designing a media and communications strategy to firstly raise awareness and secondly to call on operators to act in a manner that will improve efficiency and hence reduce GHG emissions, including carrying out the appropriate translations of the material.

It will also be important to understand the synergies with current or planned EU actions, for instance the STEER Programme. It would be beneficial to align requirements being put in place for the operators or drivers of HDV such as the managers and drivers Certificate of Professional Competence requirements.

Specific delivery mechanisms to successfully engage with the transport industry might include performance benchmarking projects, attending trade events, and promoting messages through the press, media and marketing activities. Another vital tool to delivering such a programme is to create and manage a website to effectively communicate publications and information. It is highly likely that the most effective strategy would evolve and be refined during a staged roll out that included early measurement of success and effectiveness.

7.4

Category 2: HDV Energy Efficiency Labelling Policy Instrument

A significant area where GHG emissions might be reduced in HDV is through a European wide engine efficiency labelling scheme. As stated above, this instrument has been selected on the basis of the likely benefits in agreement with the European Commission. As this is a measure that has not been implemented previously in a manner that allows an accurate prediction of benefit, it has not been possible to carry out a quantitative assessment. This section will explore the possibility of implementing an engine efficiency labelling scheme that would require manufacturers to report CO₂ emissions. It also discusses the various progressive steps that may follow a labelling scheme.

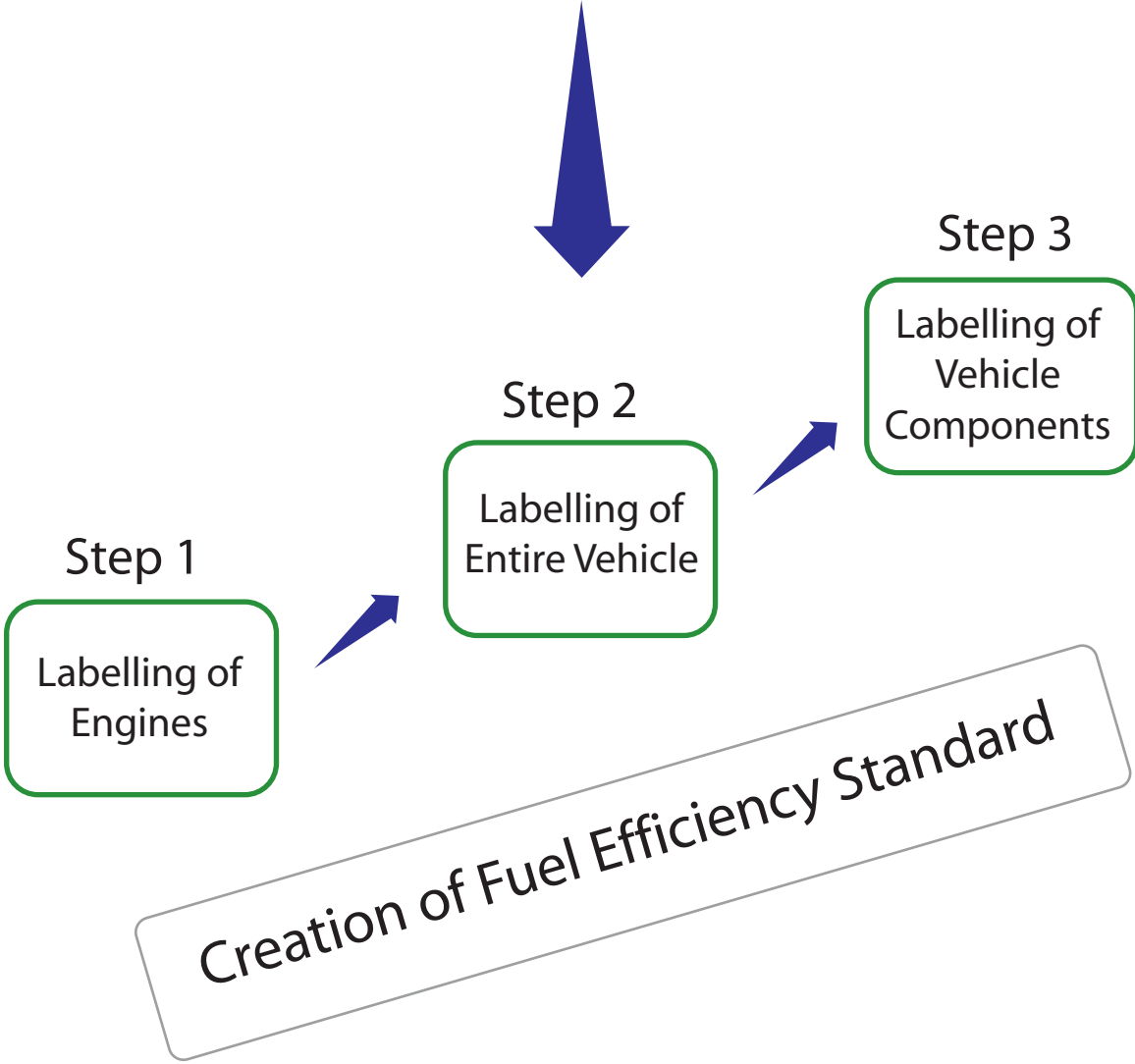
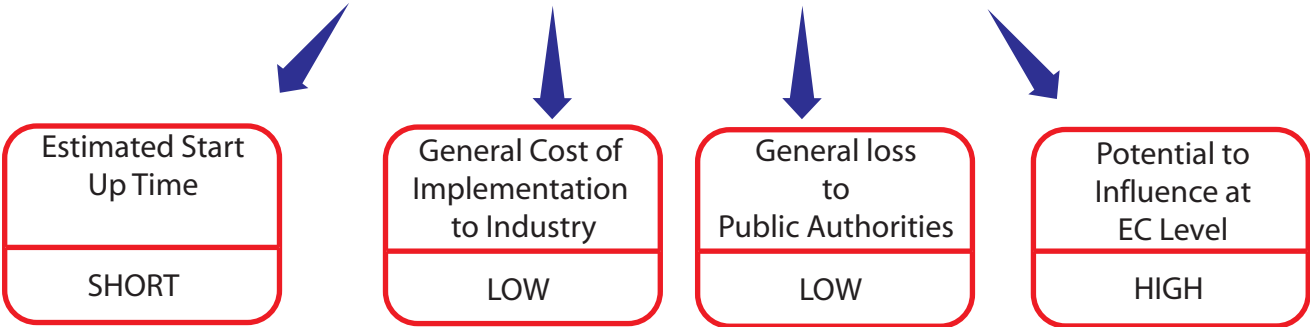
This policy instrument is based on it only being applicable to new vehicles and consequently assumes that the benefits will only be felt over an extended period of time due to the relatively long lifecycle of currently operated vehicles.

As stated above the implementation of a labelling scheme will be a progressive process which will entail the following three steps (as illustrated in Fig 3: Three Progressive Steps to Implementing a Labelling Scheme for HDV):

- **Step 1:** Labelling of the CO₂ emissions from HDV engines as recorded by a standardised test procedure;
- **Step 2:** Labelling of entire vehicles predicting the overall efficiency of a whole vehicle combination in operation; and
- **Step 3:** Labelling of vehicle components (such as superstructures, trailers and semi trailers).

There may also be the possibility of converting the labelling scheme to an efficiency standard if the evidence of success of the labelling scheme supports such a move. **Please see below for diagrammatic illustration of the three steps.**

Labelling Scheme



7.4.1

Step 1: Labelling of HDV Engines

The first step in creating a comprehensive labelling scheme is to create a labelling scheme for HDV engine efficiency. There are substantial differences between CO₂ emission standards for the car industry, as HDV are produced with many variants, with the HDV manufacturing process generally producing an engine and chassis which is then subject to a great range of additional vehicle specification decisions which can alter the performance of the engine.

However, it should also be noted that the Euro Emission Standards that are applicable to HDV engines are also subject to this manufacturing process and those standards have been judged as contributing substantially to the reduction in non CO₂ greenhouse gas emissions. It is for this reason that it is judged that, although not ideal, labelling of HDV engine efficiency is recommended for further consideration. It is unclear to what degree current HDV engines vary in their CO₂ performance, neither to what degree introducing a transparency to their performance would lead to an improvement in performance, or a consumer shift to more efficient engines. However with the reporting of CO₂ emissions from HDV likely to become a reality through the introduction of the Euro VI engine standards, step 1 of this policy instrument will be relatively easy to implement.

The impact on manufacturers should not initially be high as engine efficiency levels are currently recorded during the current test and would simply have to be reported. The benefits would be seen by customers buying a new HDV as they will be able to gain an understanding of the likely engine efficiency. Although the efficiency in operation of a particular engine may be substantially affected by the whole vehicle specification any information further assisting buyers with an increasingly refined decision would further the ultimate efficiency of new HDV.

The fact that such a scheme could be implemented through the same legislation that requires attainment of non CO₂ EURO emissions standards would allow manufacturers to deal with the negative influence this may have on CO₂ engine efficiency.

7.4.2

Step 2: Labelling of entire vehicles

The second step is to take the initial step of labelling the HDV engine further by creating a labelling standard to whole HDV and vehicle combinations. There are significant challenges to be overcome to deliver such a system including the frequent separation of the engine's manufacturer and the manufacturer of the vehicle superstructure and any trailer.

This type of labelling scheme would have to take into account the final detailed vehicle specification and as such would be exceedingly onerous to mandate through legislation as many HDV would have to undertake a single vehicle efficiency test cycle. After discussions with European Automobile Manufacturers' Association (ACEA) they have indicated that they have agreed in principle to look at the viability of creating a methodology of measuring the efficiency of the whole vehicle. We understand that this process would model the likely efficiency of any vehicle combination which would then be reported to the buyer.

Although this suggestion would not initially be backed by legislative force, if the HDV vehicle manufacturers produced an effective system of whole vehicle efficiency labelling this could have a substantial effect on consumer behaviour in purchases more efficient HDV.

7.4.3

Step 3: Labelling of Vehicle Components

It may also be possible, once a labelling scheme has been created for HDV engines, for major vehicle components, such as superstructures and trailers to be labelled with a CO₂ efficiency rating. This is a positive scenario but would take a long time to implement, but ultimately purchasers' decisions would be educated and logical when purchasing HDV vehicles and components. It is not clear if a voluntary scheme involving the manufacturers of super structures or trailers could easily become a reality. If legislative force compelled such a move it would have to be backed by a realistic and cost effective method of measuring or predicting CO₂ efficiency. If this were to be achieved then buyers would once again be influenced to specify more energy efficient major HDV components.

7.4.4

Implementation Ideas

There are essentially two options available for implementing a labelling scheme, the first being a legislative, compulsory scheme and the second being a voluntary scheme. Voluntary schemes do have significant drawbacks as stated in the Council Directive 92/75/EEC of 22 September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household applications, "a completely voluntary scheme would lead to only some appliances being labelled, or supplied with standard product information, with the risk that this might result in some confusion for some consumers".

However where the effectiveness of the measure and the difficulty of creating and implementing an effective legislative framework is balanced by an industry offer to operate a voluntary scheme this is still an option that should be given serious consideration.

Therefore it is recommended that a labelling scheme for HDV engines should be mandatory in nature to gain the maximum desirable benefit of such a scheme with the labelling of the CO₂ efficiency of whole vehicles and components being a voluntary scheme. Over time the effectiveness of such a voluntary scheme together with the success of mandatory engine efficiency labelling would guide decisions on the justification of moving to a mandatory whole vehicle or major component CO₂ efficiency labelling scheme.

7.4.5

HDV Engine Efficiency Standards

Although this recommendation suggests labelling as a practical way forward there is still merit in the consideration of extending a labelling scheme into an efficiency standard, a decision on serious consideration of this course of action would depend on the perceived benefits and costs. Over time much may be learned from the extent of success achieved by the engine efficiency standard for HDV recently introduced in Japan.

7.5

Category 3

This third category of recommended interventions for the European Commission to reduce GHG emissions from HDV are those that are currently already being considered, are planned or being undertaken. It is helpful to describe these actions as they could have a substantial complementary effect to the new policy instruments described. They can be divided into three sections:

- Market based instruments;
- Revision of the Weights and Dimensions Directive; and
- Labelling of the fuel efficiency of tyres.

7.5.1

Market Based Instruments

It should be acknowledged that Market-Based Instruments (MBIs) have and will add to the other suggested mechanisms for reducing GHG emissions. They use trading mechanisms, auctions and price signals to positively influence the behaviour of people managing natural resources and environmental assets. MBIs work in several ways but mainly by:

- Altering market prices;
- Setting a cap or altering quantities of a particular good;
- Improving the way a market works; and
- Creating a market where no market currently exists

In terms of reducing GHG emissions in the transport market, the following concepts do or will have an effect on reducing greenhouse gas emissions from HDV:

- Taxation;
- Road User Charging; and
- Emission Trading Scheme;

Below is a short summary of these concepts and their applicability to the HDV market:

7.5.1.1

Taxation

Taxation already has an important role to play in reducing GHG emissions throughout Europe. Although out of the direct scope of this project it is helpful to mention within category 3 recommendations. The Eurovignette Directive 99/62/EC, as modified by Directive 2006/38/EC sets common rules on annual taxes for heavy goods vehicles (above 12 tonnes). The Directive contributes to further development of the functioning of the internal market through the approximation of the conditions of competition in the transport sector by reducing the differences in the levels and in the systems of annual vehicle taxes applicable within Member States and has a direct link with road user charging (below)

The Directive provides minimum rates for the annual vehicle tax on heavy goods motor vehicles and vehicle combinations in accordance with the number and the configuration of axles and with the maximum permissible gross laden weight. The structure of taxes and the procedures for levying and collecting them fall under the exclusive competence of national authorities. This is the main barrier to a European wide taxation system on reducing GHG emissions.

The taxation of energy products and electricity in the Community is governed by the provisions of Council Directive 2003/96/EC restructuring the Community framework for taxation of energy products and electricity. Structures of energy taxes are also fully harmonised. The rates are also harmonised in exactly the same way as the rates in the Eurovignette: by means of setting the minima. However, Member States are free to set their own rates but the role of the EU minima is a crucial and very important factor. The Commission has also recently proposed to raise the minima (COM (2007) 52) and the environmental impacts of the proposal are very positive.

7.5.1.2

Road User Charging

The main objective of the Eurovignette Directive is to ensure road usage better reflects its true impact on society and the environment at large by introducing a "user pays" and a "polluter pays" principle. It also aims to shift freight away from roads onto other modes of transport such as rail and waterways. Road charges and tolls on heavy commercial vehicles vary widely across EU member states, regarding both the amounts charged and the systems used to calculate the levy. The Eurovignette directive was tabled in July 2003 to compensate partly for this regulatory mosaic by proposing a harmonised EU framework for charging heavy goods vehicles on European motorways. It also came as one of the Commission's major tools proposed to meet some of the objectives laid down in the 2001 Transport White Paper: "European Transport Policy for 2010: Time to decide, namely:

- To ensure national toll systems reflect the 'external costs' of transport, including environmental damage, congestion, and accidents; and
- To finance alternative modes of transport (cross-financing) to operate a 'modal shift' of freight away from roads (rail, inland waterways).

The Directive's main novelty is to introduce the possibility for individual states to integrate the 'external costs' of road transport into toll prices. It was agreed that these 'external costs' can include congestion costs, environmental pollution, noise, landscape damage, social costs such as health and indirect accident costs which are not covered by insurance.

As of 2012, Eurovignette will apply to vehicles of 3.5 tonnes or more, a significantly lower threshold compared to the previous version of the directive (1999), which only applied to vehicles of more than 12 tonnes. However, the compromise allows room for derogations under strict conditions. Member states are also given extra flexibility on how to levy tolls or charges. In particular, these can now be raised on the entire road network, not just motorways.

As a road pricing Directive is in place, extra consideration could be given to whether the cost of environmental damage is truly reflected in the current price structures. This option is out of the scope of this project but continuing research into the viability of road pricing by environmental impacts should continue.

7.5.1.3

Emission Trading Scheme

The EU Emissions Trading Scheme (ETS) is one of the key policies introduced by the European Union to help meet the EU's greenhouse gas emissions reduction target of 8% below 1990 levels under the Kyoto Protocol.

The scheme is divided into phases for which Member States must develop a National Allocation Plan (NAP) approved by the European Commission. These plans must set an overall 'cap' on the total amount of emissions allowed from all the installations covered by the scheme. This is converted to allowances (1 allowance equals 1 tonne CO₂). The allowances are then distributed by Member States to installations in the scheme.

Installations covered by the scheme are required to monitor and report their emissions. At the end of each year they are required to surrender allowances to account for their installation's actual emissions. They may use all or part of their allocation and have the flexibility to buy additional allowances or to sell any surplus allowances generated from reducing their emissions below their allocation, therefore creating a market base for trading CO₂.

The current ETS does not encapsulate the transport industry or HDV. This could be an attractive option in the future for the European Commission. However, there have been several difficulties with the ETS in its current form. One possibility is to create a ETS solely for the transport industry, but there could be problems with monitoring small transport operators.

7.5.2

Revision of the Weights and Dimensions Directive

The revision of the Weights and Dimensions Directive is a topical subject which does have the potential to reduce GHG emissions in HDV through increasing payload and volume. However, this project will not go into any detail on this matter as the "Study on the effect of adapting the rules on the weights and dimensions of heavy commercial vehicles as established within Directive 96/53/EC regarding their ability to match the needs of advanced logistics and sustainable mobility (TREN/G3/318-2007)" is doing exactly this.

There are a range of different vehicle combinations that exceed maximum dimensions established in Directive 96/53/EC, which are collectively known as Longer and Heavier Goods Vehicles (LHVs). LHVs are in use, or being considered for use, in a number of countries both within the EU and elsewhere. They offer the potential to reduce vehicle movements and congestion, the costs of goods transport and the impact of road freight on the environment. These potential benefits however must be considered against possible impacts on traffic and infrastructure, road safety and other road users, and other transport modes such as rail and water.

The maximum length of goods vehicles in the EU Member States is set by Directive 96/53/EC and is limited to 16.5 metres for articulated vehicles and 18.75 metres for drawbar combinations. The Directive does not set an absolute height or weight limit but specifies certain limits which, if met, guarantees free circulation within the EU. These limits are 4 metres and 40t. The Directive allows Member States to permit vehicle combinations that are longer and heavier than those specified above by assembling combinations of standard length vehicles together provided they do not significantly affect international competition in the transport sector. This option is sometimes referred to as the European Modular System (EMS). Variants hereof have been in use in Sweden and Finland for a number of years and uses existing vehicle and trailer components in a way that on long haul routes, two trucks and thus two drivers could do the work of three.

In addition to the physical impacts of LHVs, the economic and environmental costs and benefits also need to be assessed more closely. While European road haulage has become increasingly efficient over the past decade, with a notable reduction in goods vehicle usage, empty running remains an issue and hence operators do not always fully utilise existing limits on weights and dimensions. Further more, innovative trailer designs can provide operators with options to increase carrying capacity without the need for EMS style combinations. In the UK for instance, many operators are taking advantage of movable double deck trailers, which can be operated because there are no upper limits on vehicle heights within this member state.

However, the potential benefits of LHVs must also be measured against the potential disadvantages in the form of mode shift. The extent to which LHVs could undermine other potentially environmentally friendly and/or safer modes of transport, such as rail and inland water freight requires careful consideration.

7.5.3

*Labelling of Tyres*²⁷

The proposed approach to advanced safety features and tyres from a European level is to replace the entire separate vehicle safety-related Directives by a single Regulation. The Regulation would apply to all vehicles covered by the Framework Directive (categories M,N and O) and cover all areas of vehicle safety, including vehicle tyres. With regard to tyres, more specific requirements are proposed in order to meet safety and environmental objectives. As part of the EC's CO₂ reduction strategy, tyres have been identified as potential sources for improvements in vehicle fuel economy. In particular, the use of low rolling-resistance tyres can significantly reduce fuel consumption and the use of tyre pressure monitoring systems (TPMS) can help ensure that tyres remain inflated to the optimum pressure to maximise fuel economy. However, it is important not to trade safety aspects for efficiency measures.

Therefore, the Regulation aims to look at four requirements:

- A) Tighter noise emission requirements;
- B) New rolling resistance requirements;
- C) The introduction of TPMS to vehicles; and
- D) New wet-grip requirements.

For the purposes of reducing GHG in HDV, requirement B will be discussed below.

7.5.3.1

Rolling Resistance

Rolling resistance has a direct impact on vehicle CO₂ emissions and fuel consumption. A study by TNO²⁸ estimates that the use of low rolling resistance tyres (LRRT) could reduce fuel consumption by 3% for a given vehicle and make a contribution to the EC's CO₂ reduction targets. Additionally, Michelin have recently reported that their new 2nd generation of LRRT can save up to 9% in fuel consumption. However, this statement could differ depending on operational circumstances.

Though there has been a gradual reduction in rolling resistance over the years, the development and use of LRRT needs to be encouraged and accelerated if they are to make a significant contribution to the CO₂ reduction strategy. This could be achieved by a combination of mandatory requirements and consumer information (i.e. tyre labelling). The EC's proposed approach is to define four rolling resistance performance bands (A to D) each with a specified maximum rolling resistance value. Though these proposals are aimed at passenger cars, there is no logical reason why such a labelling scheme should not also encompass HDV tyres.

7.5.4

European Commission Logistics Action Plan

As discussed previously, the action plan establishes the importance of Freight transport within the EU and also addresses the role that the European bodies have within the industry. Our recommendations are therefore, highly relevant to the plan and should be considered within the context of it. The authorities have a clear role to play in creating the appropriate framework conditions and the action plan specifically states that in a political role, "logistics policy needs to be pursued at all levels of governance. There is a growing need for a coherent EU approach to logistic considerations that offers an opportunity for reinforced cooperation and coordination between the different dimensions of transport policy and must become an underlying factor in decision-making²⁹." Our recommendations illustrate the potential to create such a framework.

²⁷ Information gained from the Public Consultation on outline proposals for a Regulation of the European Parliament and the Council on Advanced Safety Features and Tyres

²⁸ Review and analysis of the reduction potential and costs of technological and other measures to reduce CO₂-emissions from passenger cars, Final Report – TNO Contract nr.S12.408212

²⁹ Communication from the Commission, Freight Transport Logistics Action Plan, 2007 p2

Essentially the action plan addresses the following topics:

- E-Freight and Intelligent Transport Systems (ITS);
- Sustainable Quality and Efficiency;
- Simplification of Transport Chains;
- Vehicle Dimensions and Loading Standards;
- Green Transport Corridors for Freight; and
- Urban Freight Transport Logistics.

Within the sustainable quality and efficiency section the following areas are discussed:

- Continuous bottleneck exercise;
- Freight transport logistics personnel and training;
- Improving performance;
- Benchmarking intermodal terminals;
- Promotion of best practice; and
- Statistical data.

These topics are highly relevant to our recommendations which address such ideals. Essentially, the Logistics Action Plan outlines a set of actions that are designed to help the freight transport logistics industry towards long term efficiency and growth by addressing issues such as congestion, pollution and noise, CO₂ emissions and dependence on fossil fuels that if left unchecked, would seriously threaten the industry's efficiency. Therefore, the action plan fundamentally validates our recommendations.

7.6

Conclusion

This project has followed a methodical approach in order to arrive at a logical and validated conclusion. Comprehensive global desk based research into efficient measures and relevant policies was successfully carried out through the broad spectrum and reach of the research team. This foundation of knowledge was then validated and built upon through detailed discussions with an array of interested stakeholders. The project team then collated this information and created a detailed structure for analysing the effectiveness and efficiency of potential measures and policies to reduce green house gas emissions in Heavy Duty Vehicles. Three categories emerged that justified recommendation to the client for further analysis. The next logical step to progress this research and associated recommendations would be for the Commission to consider conducting more detailed preparatory work to enact the recommended policy instruments, ultimately these will have the desired affect of reducing the European Union's HDV GHG emissions in future years.

Appendix 1: Performance/Fuel Management Examples

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UPS

UPS³⁰ operates in 200 countries, operating out of 2850 facilities using 88,000 vehicles. The fuel management system enabled strategic decision making and target setting, which lead to drastic fuel and emissions savings. The following technologies have come out of this:

- UPS was the first package delivery company to introduce a hybrid electric vehicle (HEV) into daily operations. UPS has been researching and testing HEV technology since early 1998.
- HEV technology offers significant potential to dramatically decrease emissions and fuel consumption.
- UPS deployed its first DaimlerChrysler Sprinter fuel cell vehicle in Stuttgart, Germany in October 2003, which was retired in 2004. We deployed two additional fuel cell vehicles in late 2004.
- UPS currently operates a fuel cell Sprinter in Ontario, California. and Ann Arbor, Michigan. The EPA provides a hydrogen refuelling station at its national fuel emissions laboratory in Ann Arbor, Michigan.
- Implementation of Alternative fuelled vehicles (i.e. CNG and propane), hybrid electric vehicles (near term), fuel cell vehicles (long term).
- Sophisticated route planning technologies to reduce miles and minimise emissions in delivery fleets
- Use of intermodal downshifting. This strategy utilizes the most environmentally efficient transport mode to move the product.
- Thorough preventive maintenance inspections for vehicles based on statistical data.
- Participation in partnership initiatives that result in the advancement of automotive technologies or better applications of existing technologies and strategies. Examples of this have been the EPA SmartWay Partnership, the 21st Century Truck Partnership, collaboration with automotive manufacturers and specialty manufacturers.
- Additional items of consideration to reduce fuel and emissions: driver training, speed management technologies and policies, aerodynamics, larger capacity trailer strategies, trailer gaps, wide base tires, engine upgrades, advanced lubricants, idle reduction, auxiliary power units, weight reduction, and tire inflation
- The Package Flow Technology, which features advanced geographic tools that allow UPS to analyze and edit dispatch plans to optimize delivery routes and times is expected to save the company almost 14 million gallons of fuel annually. The Package Flow Technologies is also expected to reduce mileage by more than 100 million miles annually.

Denholm Industrial Services Benefits from Site Specific Advice Scheme³¹

After the UK based firm, Denholm Industrial services Ltd took part in the Governmental site specific advisors scheme, they achieved 18% savings in fuel costs, 17% of which was generated from fuel use savings. They also reduced their annual mileage by 150,000 miles. As a result of the consultation solutions such as vehicle re-specification, speed limiters, driver training and monitoring fuel use and mileage, lead to additional cost savings. Monitoring and targeting vehicle consumption lead to £5,700 annual savings. Revised Fuel Purchasing Procedures lead to £2,000 fuel savings.

³⁰ UPS UPS Response to EPA Survey

³¹ Denholm Industrial services; Ltd Freight Best Practice; Expert advice helps cut fleet costs (Case Study)

BOC Fuel Management Programme³²

BOC is a global company based in the UK but with many manufacturing facilities in 60 countries around the world. By applying a fuel management programme they implemented a series of actions which improved their operational efficiency drastically.

Savings achieved through driver training amounted to £ 240,000, 4% of the annual fuel bill with a three to six month payback. Another £110,000 was saved by optimising the bulk storage of. Fuel Aerodynamic kits demonstrated a potential fuel saving of 4% on the selected routes with a five-month payback.

BOC feel these benefits were largely born out of the following key strategies:

- Nominating a 'Fuel Champion' to monitor and target fuel usage;
- Continuous support, involvement and commitment from top management;
- Introduction of in-house driver trainers;
- An accurate method of collecting real-time vehicle mileage and fuel data;
- Setting up fuel consumption benchmarks for specific routes and vehicles;
- On-board vehicle and driver performance monitoring;
- Trip feedback to the driver and branch manager; and
- Publication of a weekly branch performance league table.

Setz Gütertransport AG Management System³³

Setz Gütertransport AG (Switzerland) have a management system which has been certified according to ISO 9001/14001. The management handbook specifies different approaches for measuring, reducing, and improving this process. The fuel consumption of each vehicle is determined every month and analysed by a software programme. As a result of using the system, the company saved 74,225 litres in fuel. This resulted in a savings of CHF 115,280 (EUR 76,000). Fuel consumption is reduced by an average of 2.4% per year between 1995 and 2000.

Fuel Management-Urban Traffic Management³⁴

Basic Pre-requisites are:

- Proper vehicle and road maintenance as well as proper vehicle operation can improve fuel economy significantly.
- Raising fuel prices to reflect the real cost to the economy is an important consideration in stimulating fuel economy as well as in reducing non-essential trips.
- Careful differentiation of traffic segregation policies by type of road can reduce environmental impacts and accidents while increasing average speed for all traffic.

Traffic management in industrial countries has been estimated to reduce emissions by 2–5 percent overall, but by much greater proportions in specific corridors or areas. Both fuel consumption and exhaust emissions vary significantly with variability of vehicle speed. Traffic management can, in principle, reduce fuel consumption and exhaust emissions by making traffic flow more smoothly. A number of devices, such as one-way street systems, linked traffic signal systems, and traffic control systems can contribute to smoothing traffic flow.

US Example for Targets Setting

The Executive Order³⁵ (US Government) set specific targets of reduction of Energy Use Intensity starting at the baseline of 1985 of 30% by 2005 and 35% by 2010. They would also increase the use of cost-effective renewable energy and reduced reliance on petroleum-based fuels.

³² **BOC Ltd; Freight Best Practice; Fuel Champion saves equivalent of 50 trailer loads of CO₂ a year. BOC Ltd (Case Study)**

³³ **SETZ GÜTERTRANSPORT AG IRU. Report on Road Transport. Best Industry Practices (2004).** Available from: <http://www.iru.org/Publications/PDF/bip04.E.pdf>

³⁴ **The World Bank (Sponsor of the Study) Report "Reducing Air Pollution from Urban Transport"**

³⁵ **US Government Executive Order**

The Freight/Passenger HVD Transport Associations and The HVD Vehicle Manufacturing and Freight/Passenger Transport Associations could agree and define appropriate and specific best practice Energy use/GHG reduction targets to be adopted in their future business strategies.

A1 Paper uses Performance Management Tool³⁶

A1 Paper (UK) is a leading paper stockist and distributor based in the West Midlands in the UK. Prior to 2004 there were no Key Performance Indicators (KPIs) in place. In January 2004 they introduced a simple monitoring system, which had been developed in-house and maintained throughout 2004. Then in 2005 they implemented the Freight Best Practice small fleet performance tool. The tool is an Excel spreadsheet into which figures can be inputted to allow performance to be recorded and monitored for a number of freight industry KPIs. The KPIs are in 5 areas: Costs, operational, service, compliance and maintenance. Outputs can be produced in the form of charts and graphs.

Thorntons Monitors Performance³⁷

Thorntons (UK) has created an innovative incentive scheme that truly engages drivers in the fuel management programme. The 48 drivers belong to one of four teams of 12. Each team is led by its own transport leader. Each driver's performance is measured over a 12-week period. Drivers aim to achieve: An average over the 12-week period of 98% on the data logger scoring system, 100% infringement-free record from the analysis of tachograph/drivers' hours, 100% achievement of service level targets, 100% accident-free record.

Driver performance is summarised in a published driver league table and drivers meet their respective transport leaders once a week for a debriefing. This debriefing is the key to the scheme's success as it gives drivers the opportunity to explain any discrepancies that might have affected their recorded performance level, for example, heavy congestion on a motorway leading to late deliveries or an accident that was not the driver's fault. If drivers achieve the required level for each of these performance targets over the 12-week period, then they receive a financial bonus, roughly equivalent to 5% of their earnings, over the following 12-week period.

As a result they achieved 6.5% improvement in fleet fuel consumption equated to savings of around 67,500 litres per year when consumption in 2002/03 was compared with that for 2000/01. Assuming a fuel price of 65 pence per litre (excluding VAT), this reduction was worth £43,875 per year and an annual saving of some 181 tonnes of carbon dioxide.

³⁶ **A1 Paper; Freight Best Practice; Small Fleet Performance management Tool (SFMT) helps A1 paper improve efficiency (Case Study)**

³⁷ **Thorntons plc; Freight Best Practice -Fuel management for transport operators**

Appendix 2: Information Technology Systems Examples

Appendix 2: Information Technology Systems Examples

*UK Freight Transport Association (FTA) CVRS Survey*³⁸ - An e-mail survey of some 700 members of the UK Freight Transport Association (FTA) was conducted in 2002, and again in 2004. It is interesting to note that the number of members that reported using CVRS increased from 17% in 2002 to 33% in 2004. A wide range of benefits were identified during these surveys, as shown in below. Although only 38% identified reduced fuel costs as a benefit in the most recent survey, it is likely that additional fuel savings as a result of the other improvements were not reordered in this category.

Improved efficiency	75%
Reduced operating costs	58%
Improved management reports	58%
Improved customer service	54%
Reduced fuel costs	38%
Matching demand and resource	38%
Strategic reviews	33%
Reduced fleet size	29%
Reduced mileage	29%
Enhanced business development	17%
Other	17%

Source: Freight Transport Association CVRS survey.

An analysis of the extent to which newer technologies have been adopted by members showed that the growth of vehicle tracking systems has virtually doubled compared with the last survey.

*Telematics Application at C. van Heezik Ltd*³⁹ - C. van Heezik Ltd (Netherlands) a logistics service provider in the food sector, introduced telematics as part of a long-range plan in order to obtain durable logistical efficiency. The objective of the plan is to benefit from the diversity in tasks, ride classifications and delivery addresses. This resulted in a 10.5% reduction in distance travelled and fuel savings of 19.5%.

*Telematics Application at Duijghuijzen Transport*⁴⁰ - Duijghuijzen Transport (Netherlands) was founded in the 1920s and was initially active in transporting livestock. Gradually, they have moved away from livestock towards transporting bricks and ceramic products, such as tiles and bathroom equipment. In the past few years, this specialisation was expanded to include complete logistic services for ceramics and other construction materials in the Benelux region.

³⁸ **Freight Best Practice**

<http://www.freightbestpractice.org.uk/download.aspx?pid=133&action=save>

³⁹ **C. van Heezik Ltd (2000)**. *Transactie Modal Shift*. Available from: <http://www.transactie-modalshift.nl/indexdata.htm>

⁴⁰ **Duijghuijzen Transport Company; IRU; Report on Road Transport. Best Industry Practices (2004)**. Available from: <http://www.iru.org/Publications/PDF/bip04.E.pdf>

They implemented route optimisation software together with other measures to improve the fleet efficiency. Onboard computers were installed that were later equipped with GPS systems. The recording of the loading and empty kilometres using onboard computers resulted in a reduction of empty running of 5%. Over a span of three years, Duijghuijzen's entire fleet saved about 125,000 empty kilometres. The benefits for the company are higher productivity of the trucks and a reduction in empty kilometres. Duijghuijzen still sees potential for even higher efficiency in transport planning.

Use of CVRS by West Country Fine Foods⁴¹ - As a result of using CVRS, food distribution company West Country Fine Foods was able to balance deliveries much more evenly amongst vehicles, and plan routes that are far more efficient. As a result, fewer vehicles are required, fuel costs have been cut by several thousand pounds per month, and wear and tear and depreciation were also reduced. Better routes and more effective use of vehicles have enabled the fleet size to be reduced by 20% (from 25 to 20 vehicles), bringing with it reductions in running costs and revisions to contract hire arrangements.

Exel – A Storage and Logistics Contractor (UK) using Isotrak Transport Management System have seen an audited reduction in fuel use of 7.2%, achieved by the analysis and control of two key elements:

Reducing Idling

From analysis of the Isotrak standard report, Exel identified that engine idle time was abnormally high. The major portion of this was discovered to occur at the start of a driver's shift, when the vehicle's engine was used to warm up the cab. Consequently all vehicles were fitted with night-heaters. The total idle time dropped dramatically by 90% and through constant supervision has remained low.

Driver Training

Exel have always had regular driver training assessments to ensure economic, safe and effective driver operation. But as a result of Isotrak's visible and audible indication of excessive engine speed, drivers have been made more aware of their actions in controlling fuel consumption. Also, since drivers are told at their debrief following every shift how much fuel they have used, they have begun to be competitive in terms of achieving better figures than their colleagues.

Tesco – An Own Account Company Using Isotrak Transport Management System achieved fuel savings in the order of 4 to 5% which since Tesco's fleet has an annual mileage of some 120 million miles, corresponds to a saving of nearly £2 million.

The UK Freight Best Practice Telematics Guide includes 4 case studies of companies successfully using telematics including the two above and two without quantified fuel savings. Also the Freight Transport Association guide for telematics includes 12 examples of successful applications of telematics in UK companies. None of these include quantifiable fuel savings though.

⁴¹ **West Country Fine Foods; Freight Best Practice; CVRS for Efficient Logistics (Case Study)**

Appendix 3: Driver Training Examples

Appendix 3: Driver Training Examples

Drivers Training Programmes in UK⁴² - Exel (UK) saw 5% fuel savings by training 45 drivers based at Daventry. Exel's in-house driver trainer at Daventry is now trained as a SAFED instructor, which will allow the training to be rolled out to out base depots over the coming months. Turners (Soham) Ltd has put 50 drivers through the one-day course. They achieved fuel savings of between 5-10%. This has led to significant cost savings when an annual fuel bill accounts for £3 million.

Freight Best Practice in UK⁴³ - Research undertaken as part of UK Freight Best Practice revealed that a driver holding top gear for 87% of the distance and using cruise control for 89% of a journey would use 21% less fuel than a driver who was in top gear for 71% and in cruise control for 25% of the same route and driving the same vehicle. In the UK, a significant amount of work has been undertaken on the benefits of driver training via the development and implementation of the 'Safe and Fuel Efficient Driving Standard' (SAFED). MAN ERF, the truck and bus manufacturer, who are willing to participate in this project, have hundreds of heavy duty vehicles operating with their in-house telemetry system which receives and analyses comprehensive vehicle management information. This has shown around a 30% difference in driver based fuel performance with the highest users being untrained, often temporary workers.

Carl F Driver Training in Netherlands⁴⁴ - Carl F has recently introduced an eco-driving project in order to enable its drivers to drive more considerately and fuel efficiently. Although they had higher personnel costs, the drivers used 5-20% less fuel. However, it is hard to estimate the exact impact of this system on fuel consumption because many of the trucks drive in the city. The benefits will have to be evaluated on a long-term basis. The employees are enthusiastic and they enjoy the challenge of saving fuel. The best drivers plan their routes and try to anticipate the behaviour of the other drivers on the road. This also reduces repair and maintenance costs.

⁴² **Exel; Turners (Soham) Ltd; Freight Best Practice; Companies and Drivers Benefit from SAFED for HGVs. (A selection of case studies)**

⁴³ **Freight Best Practice;** <http://www.safed.org.uk/SAFEDVans/home.htm>;
<http://www.freightbestpractice.org.uk>;

⁴⁴ **Carl F; IRU; Report on Road Transport. Best Industry Practices (2004).** Available from:
<http://www.iru.org/Publications/PDF/bip04.E.pdf>

Appendix 4: Vehicle Specification and Aerodynamics Examples

Appendix 4: Vehicle Specification and Aerodynamics Examples

Examples in Use

Body Type

*Noordermeer new semi-trailer*⁴⁵ - Noordermeer (Netherlands) developed a new low bed semi-trailer design which increased deck area by creating a split loading area over the swan neck and on the low bed. This increased the loading capacity from 26 pallets in a standard 13 m semi trailer to around 30. The increase in transport capacity has resulted in a 40% kilometre reduction at five Shell branches. These savings meant the payback period for the extra costs of the semi-trailer was just one year. Noordermeer and Shell have decided to conduct follow-up studies at other transport flows as a result of this trial.

*Logipro and Van Bentum Internationaal Transport Ltd. Lighter bulktrailer*⁴⁶ - Logipro and Van Bentum Internationaal Transport Ltd. (Netherlands) developed a lighter bulktrailer to increase loading capacity for its liquid transport operation. A weight reduction of 1500 kg per trailer was obtained by omitting the chassis and using the bulktrailer as a self-supporting medium and by reducing the weight of the compressor by which the tank can be discharged. This innovation increased load capacity by 6% and reduced distance travelled by 330,000 kilometres a year. After a 6 month trial of this concept, Van Bentum ordered 20 extra ultra light bulk trailers for its operation.

Focus Ltd double deck trailer – General haulage operator Focus Ltd (UK) conducted a nine-month feasibility study⁴⁷ using a prototype 4.8m high moving double deck trailer. This was a 44 tonne box van trailer with a three-quarter length hydraulic moving double deck and a swan neck area containing a fixed double deck. The moving deck improved load turn around times. Improved access to the upper deck meant that there was no longer a need to wait for specialised loading docks and specialised equipment was eliminated. By using this trailer, 50% of journeys were reduced, which equates to a saving of 50% fuel use and emissions.

*Demountable bodies*⁴⁸: - Department store company John Lewis UK used swap body demountables (i.e. where the entire body can be removed from the trailer and put on standing legs) to circumvent a delivery problem at one of its stores outside of London where there was very little space to make deliveries. This provided the company with greater flexibility about when they could make deliveries, and reduced the number of vehicles required from six to three, saving the company £38,000 per year in vehicle rental. Additionally, the efficiency of driver deployment is increased, which provided a further saving of £35,000 per year, giving the company a total saving of £73,000 per year.

*Longer and Heavier Vehicle Combinations (LHVs) – Netherlands*⁴⁹: From 2004 until November 2006, the Ministry of Transport, Public Works and Water Management (Netherlands) conducted an experiment with Longer and Heavier Vehicle Combinations (LHV's) on urban and rural

⁴⁵ **Noordermeer Transport (2002).** *Transactie Modal Shift.* Available from: <http://www.transactie-modalshift.nl/indexdata.htm>

⁴⁶ **Logipro en Van Bentum Internationaal Transport BV (2002).** *Transactie Modal Shift.* Available from: <http://www.transactie-modalshift.nl/indexdata.htm>

⁴⁷ **Focus Ltd; Freight Best Practice; Focus on Double Decks (Case Study)** <http://www.freightbestpractice.org.uk/default.aspx?appid=1960&cid=38>

⁴⁸ **Freight Best Practice; Making the Swap to Demountables (Case Study);** <http://www.freightbestpractice.org.uk/default.aspx?appid=1960&pid=132>

⁴⁹ **Ministerie van Verkeer & Waterstaat, Directoraat Generaal Rijkswaterstaat, Adviesdienst Verkeer en Vervoer. (2006) Monitoringsonderzoek vervolgproef LZV. Resultaten van de vervolgproef met langere en/of zwaardere voertuigcombinaties op Nederlandse wegen.** Arcadis. Available from: http://www.verkeerenwaterstaat.nl/Images/br.9071.bijlage%202_tcm195-164629.pdf

roads. The policy issues surrounding LHV's are considered in more detail in the policy section, however it is considering some of the main findings of the study, notably

1. Depending on preconditions, 7 to 31% of the regular trucks with a loading capacity of over 20 tons could be replaced by LHV's.
2. The introduction of LHV's was found to cause only a limited modal shift. Transport by road increased 0.05 to 0.1%, depending on the preconditions by which LHV's were allowed. This decreases the inland navigation transport by 0.2 to 0.3% and rail transport by 1.4 to 2.7%.
3. Based on the experiment there was no reason to assume that a LHV has a higher safety risk compared with a regular vehicle combination, although it was difficult to make any firm conclusions about this because of the limited nature of the trial. Since LHV's can reduce distance travelled, road deaths and injuries can, in principle, decrease proportionally. The expected decrease in fatal accidents amounts to between 4-7 and the decrease of injuries between 13-25. Although these are only predictions, the study found that risks can be managed sufficiently by the use of certain technical applications (eg in reversing cameras).
4. The use of LHV's can reduce the number of trips and thereby the total distance travelled by inland road transport. The use of LHV's was found to reduce congestion by 0.7 to 1.4% which was lower than expected. While the cost price per mile for LHV's is 6.5% higher than for regular articulated vehicles, reduced total distance travelled means that in overall terms cost can be reduced between 1.8-3.4% depending on the preconditions.
5. The study showed that participants are able to fit in LHV's – with regard to logistics - flexibly. Big changes in logistical planning are not required. Some logistical innovations have been noted, but these did not appear to cause noticeable shifts in logistical processes.

Vehicle Light Weighting

*Institute for Energy and Environmental Research Heidelberg (IEFU) research on light weight materials*⁵⁰ - Research undertaken by IEFU in light weight materials used in articulated trucks showed fuel savings could be achieved for operations making involving both work on highways and in urban areas. Light weighting can improve efficiency in 2 ways – either reducing the absolute amount of fuel used because of lower mass, or by allowing vehicle payload to be increased thereby reducing the total number of trips required to make deliveries. IEFU research has found that that light weighted vehicles operating on uphill roads were 6% more efficient compared to conventional vehicles.

*European Aluminium Association study on light weight materials*⁵¹ – A study on light weight articulated trucks undertaken by the European Aluminium Association found light weighting could reduce unladen weight by 1000 kg. This research suggested that depending on the types of goods transport, this could effectively save between 600 and 1500 litres of fuel per 100,000 km.

*NEA Transport research*⁵² - NEA Transport conducted a research study on the economic feasibility of composite semi-trailers in the isotherm transport sector. By using modern composite materials, a weight reduction of approx. 30% can be reached over conventionally built semi-trailers. This means that more weight can be carried on vehicles, which raises productivity, although this only improves efficiency as there is a reduction in the number of trips made. The study found that even limited decreases in fuel consumption produce considerable cost savings. For example, fuel savings of 1% give an annual cost saving of £ 500 (+/- €227).

⁵⁰ Helms, H.; *Fuel saving by light-weighting for European road transport*; Institute for Energy and Environmental Research Heidelberg; Brussels, January 23, 2007

⁵¹ Gilmont, B; *Present and future contribution of aluminium to reduce CO2 emissions from cars and trucks*; European Aluminium Association

⁵² NEA Transport research and training, 1995, *Economische haalbaarheid van composietopleggers in isothermvervoer*, Rijswijk

Mems Power Case Study

Careful consideration of vehicle specification and increasing the payload of a vehicle by reducing its tare weight can maximise operational efficiency and reduce tailpipe emissions. It can mean the difference between using just one vehicle instead of two – reducing the number of lorries means lower mileage, less fuel usage and ultimately, lower CO₂ emissions.

The chassis is the fundamental platform on which the vehicle is designed and essentially has two longitudinal steel channels with a series of cross-members:



The standard chassis is made from steel making it strong and durable. A lightweight chassis is made from alternative materials such as aluminium or thinner gauge steels.

A recent UK case study on reducing vehicle tare weight features Mems Power Generation. MEMS provide diesel generators for both hire and sale, all available and ready for immediate dispatch. They run at the heavy end of their sector, these industrial generators can weigh over 10 tonnes per unit. In addition to the generator, the heavy cabling is also provided on the site where each cable set weights approximately 330 Kg. Due to the weight of the generators and additional auxiliary equipment, a number of the operations requires 2 vehicles to supply generator to the client

MEMS felt that to efficiently maximise their operations, they needed to reduce the number of trips which require 2 vehicles per delivery. Initially MEMS tried to implement multiple trips strategy for providing cables and auxiliary equipment on one truck for several sites located in the close distance. This system appeared to reduce significantly the overall number of trips, however, they encountered some disadvantages related to this solution e.g. delays with deliveries, high risk of cables being stolen that have direct impact on customers satisfaction and company costs.

Searching for a better solution than multiple trips, MEMS decided to commence a feasibility study to reduce gross weight of the truck which then can accommodate generator and auxiliary equipment at the same time. Originally MEMS looked into their lightweight crane options as a means of increasing payload capacity. Although lighter weight high tensile steel cranes are now available and the market for lorry mounting lifting gear is expanding, this was not a viable option at the time of specification which led the company to investigate the lightweight chassis option.

In 2006 MEMS invested in a lightweight Volvo F12 32 tonne rigid vehicle. The chassis design, wheels and lorry mounted crane were all specified to minimise tare weigh and maximise payload, giving an extra 1.2 tonnes of payload. 2 more 32 tonne trucks have been commissioned with Volvo providing the lightweight chassis. Logistics Manager Ian Coffey specified directly to Volvo the requirements of the company who have tailored the lightweight chassis specifically to the needs of MEMS.

The chassis is a bespoke design specific to MEMS requirements. The chassis itself is a normal grade chassis with a frame section thickness of 8 mm and a flange width of 90 mm. Its front section is bent outwards to accommodate the cab and engine, and has the same material thickness in the web and the flanges. The main weight saving gains come from the elements that are added to the chassis such as the i-shift gearbox, alloy wheels, disc brakes and the air suspension.

The chassis is more expensive than the basic design but in the long run the savings made as a result of the weight saving and payload gain outweigh these initial additional costs. For MEMS it was critical to incorporate these weight savings due to the UK restrictions of a 32 tonne vehicle load. With the heavy generator and cabling equipment, MEMS were already close to the restriction limit so every possible weight saving counts.

The lightweight vehicles have increased the Miles Per Gallon significantly from 9MPG to 11MPG. Payload has increased from 10 tonne for the standard vehicle to 11.7 tonne for the lightweight vehicle.

Euro 4 and 5 requirements have meant that additions to the chassis add weight to the overall structure. Despite this additional weight the vehicles still achieve the required carrying capacity and still cut one vehicle out of the loop per job. This goes some way to demonstrating that legislative requirements need not mean increased costs for the company if carefully considered truck specifications are adopted.

Aerodynamics

*TNT aerodynamic trials*⁵³ – Logistics and parcel carrier TNT (UK), trialled two of their trunk routes and as a result they now use aerodynamics on all their fleet (approx 380 tractor units). Two 32 tonne tractor units, coupled with 13.3m semi-trailers were trialled for a 10 month period. Aerodynamic features included a 3-dimensional cab roof fairing, cab-extension panels and mud guard panels, side skirts, air dam on tractor, semi-trailer front fairing, curved edge on trailer roof and a rear quarter panel. The trials showed a 16% saving in fuel which has resulted in 29,199 kg of CO₂ saved per annum per vehicle. In the trials 85% of the savings were attributable to the cab roof deflector.

*Somerfield aerodynamics trials*⁵⁴ – UK Supermarket chain Somerfield equipped their entire fleet of 698 tractor units with full cab aerodynamics. The equipment fitted included cab roof deflector, Cab extension panels and mud guard panels, air dam, a 3-dimensional cab roof fairing on the tractor unit, side skirts, curved edge on roof, and a rear quarter panel on the trailer. The tests revealed that they saved 13% in fuel terms which equated to 12,433 kg of CO₂ per annum per vehicle. Using these calculations the annual saving for each vehicle was £3,714 which when contrasted to the cost of modification of £4,200 results in a pay back period of 13.5 months.

*Freight Best Practice Programme research on Aerodynamics*⁵⁵ – According to research conducted by the Freight Best Practice Programme (UK), suitable aerodynamic styling features fitted to a vehicle used on long distance routes can lower fuel consumption by between 6-12% compared with a vehicle with no aerodynamic styling or badly adjusted features.

⁵³ **Freight Best Practice**; *Smoothing the Flow at TNT and Somerfield Using Truck Aerodynamic Styling (Case Study)*; Department for Transport (Faber Maunsell); www.freightbestpractice.org.uk

⁵⁴ **Freight Best Practice**; *Smoothing the Flow at TNT Express and Somerfield using Truck Aerodynamic Styling (Case Study)*; Department for Transport (Faber Maunsell); www.freightbestpractice.org.uk

⁵⁵ **Energy Efficiency Best Practice Programme**; ETSU, *The Motor Industry Research Association; Truck Aerodynamic Styling, Good Practice Guide 308; Energy Efficiency Best Practice Programme*

Appendix 5: Operational Modification Examples

Appendix 5: Operational Modification Examples

Novem Study⁵⁶

On behalf of Novem, a study has been carried out by ECN Policy Studies of the Energy research Centre of the Netherlands (ECN) to calculate the potential energy and CO₂ reduction effects of implementing policies under research in the EBIT 2001 programme.

One of the Transaction Modal Shift (TMS) measures is combining cargo flow (internal). Benefits of this measure included energy and CO₂ savings of 2%. If all the TMS measures are combined, the energy and CO₂ savings will be higher: 4% (average effect). The estimated savings are:

- km/year: 319 (million km);
- CO₂ reduction a year: 310 (kton);
- NO_x reduction a year: 3.8 (kton); and
- SO₂ reduction a year: 96 (ton).

JW Suckling Transport Ltd (UK) groupage operation⁵⁷

A groupage operation is the distribution of different products for a number of customers within a similar geographical region using a single vehicle. It optimises vehicle utilisation and makes the best use of resources through effective planning and grouping of part loads.

JW Suckling Transport Ltd is an independent haulage contractor that specialises in the provision of petroleum tanker haulage services. Tankshare, a pioneering groupage operation which was set in 2000, has helped JW Suckling to increase its geographical coverage and customer base. The scheme has helped increase annual turnover from £2 million in 2000 to £7.5 million in 2004. It reduced the distance travelled by 151 miles and fuel costs by £55 (assuming a fuel cost of 70 pence per litre excluding VAT). Maximum vehicle utilisation for groupage delivery was 63% compared with 33%, 18% and 41% for each of the single deliveries

Tilburg SURFF telematics (NL)⁵⁸

The Tilburg SURFF pilot proved that telematics applications in transport can significantly contribute to achieve effective forms of co-operations. The transport companies expect an average extra saving of about 12 kilometres per advertisement, however more kilometres are driven to companies' right through the city area (otherwise they use the main roads more). On a daily average about 60 kilometres will be economised, but around 20 kilometres more kilometres through the city area are made by the individual companies.

Lulefrakt Partnership⁵⁹

Lulefrakt (Netherlands) represents a group of 75 haulage companies as shareholders operating a limited company. A constantly updated Internet platform is used to organise the cargo for return trips. This measure has not resulted in any separate costs. The number of kilometres of return load in 1999, 979000 km, corresponds to 15468 kg of nitrogen oxide, 1,958 kg of carbon

⁵⁶ **ECN Bos, A.J.M. (ECN), Bosch, A. van den (ECN), Groot, A.T.J. (ECN), Visser, J.A. (NEA), Vrenken, H.F.M. (NEA).** (2001) *Effecten op energiebesparing en emissies van beleidsrichtingen en instrumenten binnen het EBIT-programma*. Available from: <http://www.ecn.nl/docs/library/report/2001/c01105.pdf>;

⁵⁷ **JW Suckling Transport Ltd; Freight Best Practice;** *Consolidate and Save; Department For Transport, 2006*; www.freightbestpractice.org.uk

⁵⁸ **SURFF Verhoeven, A. (Indutil), van den Bergh, F. (NEA) (1998),** *Telematics Application Programme (Transport), Validation and Evaluation Results for the Validation Site. Sustainable Urban and Regional Freight Flows. Internal Report IR 8.4. Tilburg.*

⁵⁹ **Lulefrakt AB IRU.** *Report on Road Transport. Best Industry Practices (2004)*. Available from: <http://www.iru.org/Publications/PDF/bip04.E.pdf>

monoxide, 979 kg of hydrocarbons, and 1306965 kg of CO₂. These kilometres would have been driven empty before the measure was implemented.

Consolidation Centres in UK⁶⁰

The Bristol Consolidation Centre reduced by 72% vehicle movements of the 56 participating retailers. Apart from the reduced vehicle movements, it is more likely for the deliveries to be on time. The delivery vehicles also take away plastic and cardboard for recycling, providing an extra environmental boost.

⁶⁰ **Logistics Manager March 2007** *That HORECA Moment*

Appendix 6: Vehicle Maintenance Examples

Appendix 6: Vehicle Maintenance Examples

Wheel Alignment

Steertrak (UK) Ltd supports that a 2-5% saving on fuel could be obtained by wheel alignment. Kidds Transport (UK) started a wheel alignment programme⁶¹ in 1996 and now operates such a programme over their whole fleet which consists of 26 tractor units, 80 semi trailers and 4 rigid lorries. Fuel performance improved on one vehicle from approx 6.5 miles per gallon (mpg) to approx 9 mpg. (3.8% - 18.6% on articulated lorries and 3% - 11% on rigid lorries). Steered axle tyre tread life is up from 180,000 km to 220,000 km (an increase of 22% in tyre life). Drive axle tyre tread life up from 280,000 km to 310,000 km (an actual increase of over 10% in tyre life). Super single tyre tread life up from 65,000 km to 75,000 km (an increase of 15% in tyre life) There is also added safety on aligned tyres as they are less likely to overheat and combust. Drivers also report reduced fatigue as vehicles are easier to drive.

Tyre Management

Van der Luyt Transport⁶² (Netherlands) approached Michelin 5 years ago for a tyre management solution. The resulting tyre management plan is a tailor-made strategy for the carrier, describing how a transport company can make optimum use of Michelin tyres to attain the lowest cost per mile. The description includes recommendations on pressure because the correct tyre pressure is very important for optimum mileage performance, wear and grip.

Since adopting the tyre management plan for the new type of Michelin tyre, van der Luyt has saved 5% in fuel.

EPA Pilot Programme

EPA⁶³ involved 13 heavy-duty diesel engine manufacturers in the 2005-06 model year pilot program. The complete program is expected to help ensure that the intended health and environmental benefits from recently adopted emission regulations are realised throughout the entire useful lives of heavy-duty diesel engines. A programme extension that would also cover the more advanced energy saving features of both conventional and hybrid diesel or alternative fuel HDVs could effectively help in maximising their energy efficiency as well as the identification of the most suitable recommendations concerning their likely new and appropriate life time maintenance requirements.

HDV manufacturers will test fleet or customer-owned, in-use trucks and creates new lines of communication with customers to fortify the engine development process. This will enhance the manufacturer's ability to catch any problem engines early on, and encourage future engine designs that are cleaner, more efficient and more durable.

The California Air Resources Board intends to adopt a parallel in-use testing program.

⁶¹ **Kidds Transport; Freight Best Practice; Keeping Profit on Track with Wheel Alignment (Case Study); Department For Trade (Faber Maunsell) 2005; www.freightbestpractice.org.uk**

⁶² **Van der Luyt Transport; IRU; Report on Road Transport. Best Industry Practices (2004).** Available from: <http://www.iru.org/Publications/PDF/bip04.E.pdf>

⁶³ **US EPA-Office of Transportation and Air Quality EPA420-R-05-007**

On Board Diagnostics Systems

Within the United Nations (UN), the World Forum for Harmonization of Vehicle Regulations (WP.29) administers the 1958 Geneva Agreement (1958 Agreement) to facilitate the adoption of uniform conditions of approval and reciprocal recognition of approval for motor vehicle equipment and parts. It adopted a Programme of Work, which includes the development of a Global Technical Regulation (GTR) concerning onboard diagnostic systems for heavy-duty vehicles and engines. An informal working group--the WWH-OBD working group--was established to develop the GTR.

The working group was instructed that the OBD system should detect failures from the engine itself, as well as from the exhaust after treatment systems fitted downstream of the engine, and from the package of information exchanged between the engine electronic control unit(s) and the rest of vehicle and/or powertrain. The working group was also instructed to base the OBD requirements on the technologies expected to be industrially available at the time the GTR would be enforced, and to take into account both the expected state of electronics in the years 2005-2008 and the expected newest engine and after treatment technologies.

Appendix 7: Improvements in Propulsion Technology Examples

Appendix 7: Improvements in Propulsion Technology Examples

Laboratory Research on Fuel Saving Additives

A certified U.S. Environmental Protection Agency (EPA) laboratory recently completed tests on fuel conditioners known as Ethos MAXPower Fuel Units⁶⁴, which have been designed to reduce fuel consumption and harmful emissions. These can be used on any petrol or diesel powered engine, either, to increase its m.p.g., its performance and reduce its harmful emissions whilst considerably improving its fuel consumption figures. The testing on a Toyota Exsior 1998 CC. has shown an increase of 1.54 km per litre (19.06%).

Homogenous Charge Compression Ignition

Homogenous Charge Compression Ignition (HCCI) technology⁶⁵ controls the pollutant forming processes that result from mixing and heat transfer, yielding diesel fuel economy with virtually no change in emissions for NOx and particulates. HCCI is under development by a number of manufacturers, but is unlikely to be standard feature of commercial vehicles in at least the short term.

Continuously Variable Transmission (CVT)

A Continuously Variable Transmission (CVT) is a fully automatic transmission that does not shift from one gear to another as the vehicle accelerates, but provides constant, smooth acceleration. US Company SuperDrive⁶⁶ has developed a CVT capable handling heavy torque loads and high speeds with improved fuel economy and reduced emissions. Indicative results from the first successful commercial application of system have shown significant reductions in carbon dioxide and toxic hydrocarbons, and small reductions in nitrous oxides. Particulate testing is still underway.

⁶⁴ **EthosWorld.com Ltd** (<http://www.max-power.org.uk/>)

⁶⁵ **Global Insights** *Presentation*

⁶⁶ **Superdrive Inc.** www.superdriveinc.com

Appendix 8: Summary Discussion Document

Influencing European Commission Policy to Reduce Greenhouse Gas Emissions from Heavy Duty Vehicles

Introduction

Thank you for your interest in this important piece of work we are undertaking for the European Commission (EC). Faber Maunsell, along with international research partners NEA, CSST and Newcastle University have been commissioned by the EC to undertake research to examine measures and policies that can help reduce greenhouse gas emissions in heavy-duty vehicles (Trucks and Buses).

With extreme weather occurrences seemingly on the rise, climate change remains firmly on the Policy agenda of the EU and its member states. In the Second Phase of the European Climate Change Programme (ECCP II), the EC concluded that there was reason to believe that commercial transport operators in Europe are not ALL working consistently in the best possible way to improve the fuel efficiency of their vehicles. This is despite the fact that such measures can represent a win-win situation in reducing operating costs and harmful emissions.

The object of this project will advise the Commission on what policy measures it can take to reduce greenhouse gas emissions from HDVs.

We have recently completed the first phase of work for the project and are now interested in speaking to people in or representing industry to test our initial findings and help guide future work.

The Project so Far

To date the project team has carried out an extensive research exercise looking at the ways in which industry and others are trying to reduce fuel use and greenhouse gas emissions; to specifically, we are looking at potential measures and policies that could be used to reduce greenhouse gases emissions in the road transport industry. By 'measures', we mean any physical product or system, that can have the effect of reducing fuel consumption or emissions, i.e. it is an action someone can take to reduce fuel consumption and/or emissions. These actions can supported or encouraged by education programmes, regulations, research and other policies.

As part of this first task we have collected examples of measures and assessed their costs and benefits. This information was then drawn together to make an overall (initial) assessment of the relative usefulness of the measure. The areas researched included:

- Improvements in Propulsion Technology;
- Aerodynamics & Vehicle Specification;
- Information Technology Systems;
- Changes in Fuel Type;
- Driver Training;
- Vehicle Maintenance;
- Fuel Management Systems;
- Performance Management;
- Operational Decisions; and
- Other Measures.

Our initial assessment of these areas is summarised in the table overleaf. We have colour coded them to show those measured in green represent those that appear to offer the greatest potential in helping reduce greenhouse gas emissions.

Current Activity

While the desk based research has been useful to help improve our understanding of different fuel saving measures, we now wish to speak to people in the road transport industry to understand what is happening in the real world. In particular we would like to speak to:

- Transport operators (road freight and passenger transport)
- Shippers or companies contracting out transport
- Vehicle manufacturers (truck and/or bus)
- Trade bodies representing any of the above groups.

We are interested in having a discussion with you so that we can:

- **Test the information we have found to date**
- **Understand what actions you are taking, or considering, to improve fuel efficiency**
- **Improve our understanding of the advantages and disadvantages of different fuel saving measures, as well as your views on different policy options; and**
- **Locate additional sources of information that could be utilised to refine the initial assessment of measures and quantification of their benefits;**

If we have not already done so, one of the members of our project team will be in touch with you to set a time for a telephone interview or site visit. In the week before the interview, we would like you to ask review the tables on the following pages as we will ask you some questions about this information. Reading this document should take no more than 5 or 10 minutes of your time and will help us ensure that we collect useful information for this important project.

Improvement Category	Nature of Improvement	Examples Specific measures (reported benefits if applicable)	Benefits and other comments from preliminary research	What can the commission do to encourage update of industry best practice
Improvements in propulsion technology	Physical – manufacturer led	<ul style="list-style-type: none"> • Euro engine standards (out of scope) • Advanced powertrain vehicle electronic controls • Onboard diagnostics • Fuel saving units • Homogenous Charge Compression Ignition • Continuously Variable Transmission. 	Difficult to make generalisations about these types of measures because they are all markedly different, but in general successful innovations improving fuel efficiency by 5% would be regarded as a success. In general, the development of these types of measures takes place over medium to long term, and innovations generally take a longer to reach the market.	Manufacturers will always have an incentive for marketing new products, but there may be actions the EC can take to encourage innovation, such as reviewing/continuing/ improving funding for R&D programmes
Alternative Fuels	Physical	<ul style="list-style-type: none"> • Road fuel gases • LPG (liquefied petroleum gas) • CNG (compressed natural gas) • Bio-fuels • Hydrogen fuels, including methanol, fuel cells and electric vehicles 	LNG/CNG well established in urban bus market than HGVs, however alternative fuels being considered more seriously in urban freight applications. Trade offs between alternative fuels relatively well established, however key task is to understand these from an industry point of view	Regulatory approaches may be best approach to increasing take up, though this would need to take account of the total environmental cost of production. Research based initiatives may also be favourable to help overcome barriers and problems.
Driver training	People	<ul style="list-style-type: none"> • Fuel efficient driver training programmes 	Applicable to all types of transport operations, as evidenced by extension to bus industry in UK. UK Safe and Fuel Efficient Driving Standard (SAFED) well established and proven record of 3-5% fuel use reductions when applied appropriately. ECODRIVEN programme is European equivalent but is not so much a standard as an on-going funded programme. Evidence suggests training must be ongoing to maintain benefits.	Benefits of driver training could be promoted through development of European standard and/or an information/behavioural change programme. Stronger regulatory mechanisms could also be introduced for compulsory training (e.g. CPCs)
Fuel management systems	People	<ul style="list-style-type: none"> • Fuel management system 	A fuel management programme is a structured method of managing fuel throughout its life in an organisation – from acquisition, through to storage, issue and use. Evidence suggests appropriate application can lead to fuel use reductions of at least 2-5%. A fuel management programme can be a starting point for making other operational improvements.	Information/behavioural change programme would be the most appropriate to encourage greater take-up.

Improvement Category	Nature of Improvement	Examples Specific measures (reported benefits if applicable)	Benefits and other comments from preliminary research	What can the commission do to encourage update of industry best practice
Performance management	People	<ul style="list-style-type: none"> Internal benchmarking External Benchmarking 	Like fuel management, the benefits of performance management can be difficult to quantify because it is an indirect driver of efficiency improvements – i.e., the act of measuring and monitoring performance does not in itself lead to efficiency improvements, but rather can act as stimulus for change.	Information/behavioural change programmes would be one approach, but there is also the possibility of intervention to help provide solutions not necessarily commercially viable (e.g. external benchmarking studies)
Vehicle specification and aerodynamics	Physical and people	<ul style="list-style-type: none"> Improved specification of engine and transmission Double deck trailers Swap body demountables Vehicle light weighting Longer and heavier vehicle combinations Aerodynamic styling 	Alternative combinations/body types may use more fuel, but can ultimately improve vehicle utilisation and reduce total distance travelled. Bus and coach operators are likely to have less flexibility over design compared to freight operators.	There may be little scope for increased take up of aerodynamic styling, however a range of mechanisms could potentially be used to encourage increased use of other measures: <ul style="list-style-type: none"> Information/behavioural change programmes for operator based education on the need for appropriate vehicle specification Regulatory based approaches for light-weighting, longer and heavier vehicles, double deck trailers
Information technology systems	Physical	<ul style="list-style-type: none"> Telematics systems – vehicle tracking, driver monitoring, satellite navigation, in-cab communication systems Computerised vehicle routing systems (CVRS) 	Evidence suggests that appropriate application on telematics and CVRS technology suggest fuel savings to up to 10% can be achieved. Telematics applications appropriate all types of vehicles, but CVRS generally not useful for passenger transport. Important to understand extent to which systems used across different parts of Europe.	Information campaigns/behavioural change programmes could promote benefits, advancements through R&D could also increase innovation and take-up of technology.
Vehicle maintenance	Physical and people	<ul style="list-style-type: none"> Preventative maintenance programmes Vehicle diagnostics systems 	Preventative maintenance is an overarching management strategy about ensuring efficiency above and beyond minimum road worthiness obligations. Firm benefits of this concept not well proven. Developments also taking place with vehicle diagnostics, however these may not impact on market until medium to long term.	Information/behavioural change programmes could be used to promote benefits of preventative maintenance programmes. Research based programmes could be used to see where improvements could be made in terms of vehicle diagnostics.
Operational modification	People	<ul style="list-style-type: none"> Improved physical location of facilities Strategic partnerships Supply chain collaboration Back loading 	Operational improvements can have a fundamental effect on efficiency, but can be difficult to implement in practice, at least in the short term A key difficulty lies in quantifying the benefits of these measures.	Information/behavioural change campaigns may be the most effective approach to encourage take up of other operational improvements.
Other measures	Physical	<ul style="list-style-type: none"> Energy efficient tyres Tyre management programmes Synthetic lubricants 	Benefits of energy efficient tyres and synthetic lubricants relatively well demonstrated, although not necessarily benefits for all types of operations.	Regulatory mechanisms could be introduced focusing on manufacturers (e.g. compulsory tyre pressure gauges). Information/behavioural change programmes could also be used to promote the benefits.

Policy	Type	Location	Purpose	Does policy appear to be appropriate to help reduce GHG emissions?
European Directive 2003/59/EC	Regulation	EU	Established the certificate of professional competence for HDVs. This is on a 5 yearly basis. Further requirements in efficient driving could be pursued.	Yes
Japanese fuel efficiency Standards for HDV	Research Programme /Study	National Japan	The aim is to estimate emissions, examine scenarios to improve, create intermediate scenario and to identify packages of measures to improve efficiency. This approach could be adopted.	Yes
Weights and Dimensions Directive 9653/EC, 2002/7/EC	Regulation	EU	This Directive limits the length, height and weight of HDV to move across the EU. As many countries are trailing longer and heavier vehicles, this policy should be monitored and could be possibly adapted in time.	Yes
Freight Best Practice Programme			FBP is targeted at the freight industry in the UK, offering free guides and publications on efficient operations and measures. It has been a huge success and such a programme could be adopted for a European wide programme.	Yes
SmartWay Transport Partnership – US Environmental Protection Agency	Research programme /Info campaign/ behavioural change	National United States of America	This is also a behavioural programme which establishes a voluntary collaboration between US EPA and the freight industry. Such a programme could be adopted by the EC.	Yes
FleetSmart – Natural Resources Canada	Info campaign/ behavioural change	National Canada	Again this is a similar programme to the FBP and can be adopted by the EC.	Yes
STEER Programme – Intelligent Energy for Europe	Research programme	EU	This forms part of the Intelligent Energy for Europe programme which encompasses ECODRIVEN, START, Green Label Purchase schemes. These projects can all be considered further.	Yes
WestStart-CALSTART	Research programme /Info campaign/ behavioural change	National – USA (originated in California)	They are dedicated to supporting and accelerating the growth of the advanced transportation technologies industry with the goals of cleaning the air and improving efficiency. They work with public and private sectors to develop advanced transportation technologies and foster companies willing to act. They have a technology programme, clean transportation solutions and a clean HDV programme which all aim to achieve the goals. This method can be adopted.	Yes

Policy	Type	Location	Purpose	Does policy appear to be appropriate to help reduce GHG emissions?
Public Procurement of clean vehicles	Regulation	EU	Public Procurement is based on sustainable economics and CO ₂ emissions. It will lend support to high performance technologies and could provide contributions to new the new European Energy strategy to improvements in energy efficiency in transport and to reductions of GHG. This approach could be harboured by the EC.	Yes
Regulation (EEC) No 881/92	Regulation	EU	Est a community licence which can be gained if you are operating from a MS. The objectives are to create liberalisation and harmonisation of transport markets in EU. Could only be adopted if a caveat could be used to only allow clean vehicles. Could also use a ranking system to identify those who operate efficiently.	Yes
Regulation (ECC) No 3118/93	Regulation	EU	Allows Cos who hold Community licence to carry out work in other MS. The scope to pursue this policy is extremely limited.	No
Regulation (ECC) No 484/2002	Regulation	EU	Est a uniform document for driver attestation. Used by authorities to regulate drivers. The scope for adoption is extremely limited.	No
Regulation (ECC) No 684/92	Regulation	EU	Est common rules and conditions of admission to passenger transport industry. Limited in scope but a ranking system, identifying those who are "clean" could be adopted to encourage efficiency.	Yes
Regulation (ECC) No 12/98	Regulation	EU	This policy regulates cabotage for the passenger road transport industry. It has little if no scope for adoption.	No
Recasting of Road Transport Regulations (ECC) 881/92, 3118/93, 684/92, 3118/93, 12/98 and 484/2002.	Regulation	EU	The purpose of the recasting of these regulations is to create a unified policy. The comments associated with the individual Regulations are relevant.	Yes
Recasting of Directive 96/26/EC & Directive 98/76/EC	Regulation	EU	The purpose of the recasting of these regulations is to create a unified policy. The comments associated with the individual Directives are relevant.	Yes

Policy	Type	Location	Purpose	Does policy appear to be appropriate to help reduce GHG emissions?
European Commission White Paper - European Transport Policy for 2010: Time to Decide	Policy Direction	EU	The mid term review of this White Paper est that modal shift had not occurred. As a result the EC has adopted the policy of “co-modality” which is the efficient use of transport modes operating on their own or together. This paper provides a basis to supplement and encourage our research.	Yes
Logistics Action Plan – Communication COM(2006) 336	Policy Direction	EU	The purpose of this communication is to highlight the areas which need improving to create an efficient European transport system. As such an Action Plan ids due this year and will need analysing on its creation.	Yes
Energy Efficiency Action Plan COM (2006)545	Policy Direction	EU	This action plan aims to reduce energy consumption by 20% by 2020. Although focused on the car industry these recommendations can be adopted to use in the HDV industry.	Yes
The new De minimis State Aid Rule	Regulation	EU	This regulation mainly applies to financial state aid given to small industry or business enterprises within the context of the current EU rules about competition. These are mainly used by member states address short and medium term business issues such as addressing negative impacts of unforeseeable events.	No
Environmental State Aid guidelines	Regulation	EU	These guidelines are about the enforcement of new legislation on traditional harmful emissions. They do not appear to be a useful mechanism for achieving reductions in CO ₂ emissions.	No
Link to CO ₂ from cars: Integrated approach	Research Programme	EU	This approach aims to achieve reduction targets via financial support from EC and National R&D Programmes. Although the programme is targeted at cars this approach could also be adopted by the HDV.	Yes
IEA 2007 Clean Energy Recommendations for G8	Policy Direction	International	The IEA recommends a series of measures and technological advancements to improve efficiency. These recommendations can and probably will be adopted by the EU as several countries in the EU are members of the G8. Therefore, these recommendations need to be monitored at the next G8 summit in Japan 2008.	Yes