Economic Evaluation of Emissions Reductions in the Transport Sector of the EU

EXECUTIVE SUMMARY

The main greenhouse gas emissions associated with transport are CO_2 emissions that are a direct result of the combustion of vehicle fuels (petrol, diesel, aviation kerosene etc). N_2O emissions from petrol cars equipped with 3-way catalytic converters are higher than from non-catalyst cars and could constitute a growing source.

Within this study, baseline projections of energy demand are taken from the Primes model baseline scenario defined for the 'Shared Analysis' project 1999. This excluded the impacts of the voluntary agreement reached with European (ACEA), Japanese (JAMA) and Korean (KAMA) car manufacturers[1] to reduce the average CO_2 emissions for all new cars. The impact of this and the agreements with the non-European producers has been included in this study. The table below shows the emissions in 1990 [Primes, 1999] for the transport sector and two baseline projections. Under the baseline, transport emissions are projected to grow by 35% by 2010, with the ACEA agreement the growth is 25% due to the smaller growth in emissions from passenger transport[2].

Baseline Trends in CO_2 Emissions from Transport in the EU in 1990-2010

	1990 emissions	2010 baseline	2010 baseline with ACEA agreement	Change 1990-2010	Change 1990-2010 with ACEA agreement
	Mt CO_2	Mt CO_2	Mt CO_2	% change	% change
Total (passenger)	524	718	608	37%	22%
Total (freight)	245	412	310	33%	33%
Total (all)	**769**	**993**	**918**	**35%**	**25%**

Note: Air passenger transport also includes air freight. See footnote 2 for an update.
Source: PRIMES

There are three main ways in which CO_2 emissions from transport can be reduced:

- **Operational** - reducing energy use and emissions per vehicle km (vkm) driven.
- **Strategic** - optimisation of the vehicle use, reducing total vehicle km per passenger km (pkm) or per tonne km (tkm).
- **Demand** - reducing the overall demand (pkm or tkm) for travel.

In this 'bottom up' study of available options we have focused on 'operational' solutions to reduce energy use and emissions per vehicle kilometre driven. For these options, quantitative data on costs and reductions are available allowing the assessment of cost-effectiveness in terms of €/tonne CO_2. The table below

[1] As American car manufacturers are all present in the EU, the ACEA agreement covers the emissions from these cars. For simplicity, in this report the ACEA/JAMA/KAMA agreement is referred to as the "ACEA agreement".

[2] However, in the most recent baseline (see the Green Paper of the European Commission *"Towards a European strategy for the security of energy supply"*, COM(2000) 769, November 2000), the projections of transport emissions have increased by 184 Mt of CO_2 implying that the growth of CO_2 from transport would be 41% instead of 25% by 2010. This increase is due to higher projected growth in truck transport as well as in aviation. These latest numbers have not been included in this analysis.

summarises the costs and savings from different options, assuming no interaction between measures.

Cost of different options to reduce greenhouse gas emissions from transport sector in the EU

Name measure	Subsector	EU15 Emission reduction potential	Specific costs
		kt CO2	Euro/tCO2
Rolling Resistance	Freight	10882	-72
Engine improvement	Freight	3733	-64
Aerodynamics - Cab Roof Fairing	Freight	2682	-51
Aerodynamics - Cab Roof Deflector	Freight	1739	-47
Mobile air conditioning: leakage red.	Mob Airci	6627	6
Lightweight Interior components - Petrol cars	Passenger carsPetrol	1128	8
Variable Valve Lift Timing + Cylinder Deactivation	Passenger carsPetrol	22768	19
Driver Training - Heavy Goods Vehicles (HGV) Drivers	Freight	10871	19
Transport refrigeration: leak reduction	Refrigeration	2787	29
Mobile air conditioning: recovery	Mob Airci	3534	31
Basic package - Diesel cars	Passenger cars Diesel	1603	41
Lightweight Interior components - Diesel cars	Passenger cars Diesel	198	81
Petrol to Diesel shift	Passenger carsPetrol	7803	82
Advanced Gasoline Direct Injection (advanced: "DISC")	Passenger carsPetrol	19025	92
Basic package - Petrol cars	Passenger carsPetrol	9119	122
Lightweight structure - Petrol cars	Passenger carsPetrol	9906	217
Lightweight structure - Diesel cars	Passenger cars Diesel	1736	327
Total technical emission reduction potential (Mt of CO2-eq.)	**116**		

'Strategic' and 'Demand' based solutions generally rely on influencing behaviour, and can use a wide variety of methods to do so. Data are becoming available on the impact of these 'non-technical' type measures, but are often not complete enough to allow the estimation of the cost-effectiveness of options. Thus extrapolation of costs and impacts across the EU cannot be done with any accuracy.

In this bottom-up study, we have identified 73 $MtCO_2$ eq. of savings in passenger cars, 30 $MtCO_2$ eq. in freight and 13 $MtCO_2$ eq. from improvements in mobile air conditioning. The top-down projections (from the Primes model) for the baseline already include some reductions from improved fuel efficiency. For cars, the reductions from the ACEA agreement are larger than the savings identified in this study. It is therefore assumed that the identified measures, together with others not identified, will be implemented as part of the agreement. The 'with measures' projection for cars is therefore taken to be the baseline with the ACEA agreement. For freight, the reductions included in the baseline are smaller than the measures identified in the study and the 'with measures' projection includes the additional reductions from this study.

Baseline and 'With Measures' Trends in CO_2 Emissions from Transport in the EU, 1990-2010

	1990 emissions	2010 baseline	2010 baseline with ACEA agreement	2010 'with measures'	Change 1990-2010 with measures
	CO_2 (Mt)	CO_2 (Mt)	CO_2 (Mt)	CO_2 (Mt)	% change
Total (passenger)	500	683	608	608	22%
Total (freight)	233	310	310	280	20%
Total (all)	**734**	**993**	**918**	**888**	**21%**

An analysis of air conditioning and catalytic converters estimates that they could increase greenhouse gas emissions by some 25 g/km (CO_2 equivalent) per vehicle. It seems that mobile air conditioning could increase the nitrous oxide emissions further. Fortunately it seems that lower sulphur content of fuels would reduce nitrous oxide emissions to some extent.

Due to data constraints, this study focuses on road transport. Some preliminary analysis is undertaken for air transport. As greenhouse gas emissions from railways and inland navigation are fairly small, they have not been analysed as part of this study, except