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Climate for a transport change

TERM 2007: indicators tracking transport and environment in the European Union

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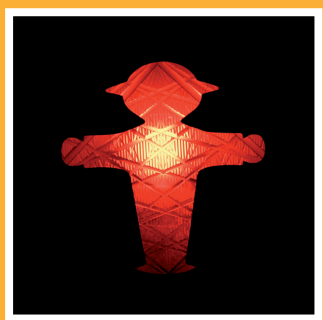

European Environment Agency

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Key messages

A process towards a post-2012 climate change agreement was started during the recent meeting of the parties to the UN Framework Convention on Climate Change in Bali. Against this background this year's TERM report aims to explore the options for climate change mitigation via transport-oriented policies.

Climate change and transport — much is needed but too little is happening

To enable the EU to meet future overall greenhouse gas emission reduction targets by 2020, the transport sector must raise its game and improve its environmental performance. Had transport sector emissions followed the same reduction trend as in society as a whole, total EU-27 greenhouse gas emissions during the period 1990–2005 would have fallen by 14 % instead of 7.9 %.

Previous and current EU policies have mainly focused on improving vehicle technology and fuel quality to reduce pressures on the environment. Trends and projections clearly show that these policies have not been enough to succeed in reducing greenhouse gas emissions from transport and that the effect of introduced mitigation measures has been more than offset by increased transport volumes. To achieve emission reductions, measures and policy instruments must therefore also address demand for transport in a serious way.

Achieving ambitious targets in line with the 'Bali roadmap' would require that transport volume growth is limited to + 4 to – 2 % over the period 2010–2020, compared to a growth of 15 % in a business-as-usual scenario. In doing so, ancillary benefits related to reduction of noise and air pollution, and protection of biodiversity will be achieved. If demand constraint is not achieved technology measures of hitherto unseen magnitude will be needed.

To address transport demand, measures and policy instruments must go beyond the transport sector itself and be introduced into sectors of the economy such as households, industry and service, within which the demand for transport actually originates.

Setting a realistic but still challenging sectoral target for limiting or reducing greenhouse gas emissions from transport would encourage stakeholders and policy-makers to develop and implement necessary measures and policy instruments. It would also facilitate the monitoring of improvements in the sector's environmental performance.

Messages from indicator-based assessments

Freight transport growth outpaces economic growth

Freight transport is growing faster than the economy. A consequence is that emissions of CO_2 from freight transport are growing quickly. Better internalisation of external costs can help reduce market distortions and emission growth.

Passenger transport continues to increase

Passenger transport continues to grow, particularly in aviation and cars. Increased car usage and a reduced number of passengers per car negate the improvements gained from improvements in vehicle efficiency.

Greenhouse gas emissions grow due to transport growth

Greenhouse gas emissions in the transport sector continue to increase steadily. Although improvements have been made in the energy efficiency of various transport modes and non-fossil fuels have been introduced, increased transport demand is outweighing these benefits.

Harmful air pollutant emissions and air quality

Transport, in particular road transport, is generally becoming less polluting due to increasingly strict air pollutant emission standards. Nevertheless, people in European cities continue to be exposed to significant health threats due to air pollution.

Biofuels in transport

Overall, EU Member States are far from meeting the current biofuels targets. Increasingly volatile and high fossil fuel prices may, however, foster faster growth.

Growing doubt about the real ability of first generation biofuels — agrofuels — to reduce overall greenhouse gas emissions and growing awareness of negative impacts of biofuel production on biodiversity, water and soil, both directly and through indirect land-use change at the global level, point to the need for great caution in promoting agrofuels further. Using available biomass to replace coal in electricity and heat production gives greater reductions in emissions of greenhouse gases at lower cost.

Second generation biofuels can lead to more substantial greenhouse gas emission reductions and reduce the adverse effects referred to above. However, more analysis is required as to whether they will be generally available in time to contribute to meeting the target of 10 % biofuels in 2020, and further analysis on other aspects of second generation biofuels and cropping of advanced feedstock on poorer soils and degraded lands is needed.

Better knowledge of life-cycle greenhouse gas emissions from all energy uses of biomass, and strong sustainability criteria (in Europe and third countries) for biomass production, addressing also knock-on effects due to indirect land-use change, are needed to fully judge the benefits and limitations of biomass use.

Messages from chapters on individual transport modes

Focus on road transport

Vehicle fleets are growing and gains in energy efficiency have been smaller than expected. Technology can deliver some of the greenhouse gas emissions reductions needed — but not all. Behavioural changes are also needed to deliver net reductions.

Focus on rail transport

Rail transport emits on average less greenhouse gas per transport unit than road transport. Passenger-kilometre and tonne-kilometre for rail increased in absolute terms. However, rail transport's share of both passenger and freight traffic decreased to 5.8 % and 10 % respectively.

Focus on air transport

Passenger air transport continues to grow significantly faster than passenger transport in general. Air freight also grew but slightly slower than overall freight transport. Because transport volumes grow much faster than energy efficiency improves, the total aviation emissions of greenhouse gases tend to grow rapidly.

Focus on waterborne transport

Transportation of people and goods by water is one of the lowest polluting modes. For freight it is also one of the most important modes. Waterborne transport is, however, by far the largest sulphur emitter in the transport sector. The tendency to employ high-speed ships for passenger transport reduces the environmental advantage because of high energy consumption and other problems such as noise.

Focus on non-motorised transport

Cycling and walking have an important role to play in sustainable transport systems. They provide access to public transport and provide alternatives to the use of the passenger car for short local trips.

Focus on land use and transport planning

The integration of land use and transport planning can be instrumental in managing the demand for transport in Europe's towns and cities. Spatial planning can facilitate walking, cycling and the use of public transport for the majority of travel purposes, thereby reducing the negative impacts on the environment of private vehicle use and provide social and economic benefits.

Focus on transport mode comparisons

The occupancy rate of different transport modes can, in many cases, be a more significant factor in the resulting relative emissions of greenhouse gases compared to the specific efficiency of modes. In addition to technological improvements, policies to ensure better capacity utilisation within each mode may result in substantial additional reductions of emissions of CO_2.

Introduction

This report represents a summary of selected issues from the European Environment Agency Transport and Environment Reporting Mechanism (EEA TERM) set of transport and environment integration indicators.

The objective of this report is to indicate some of the main challenges to reducing the environmental impacts of transport and to make suggestions to improve the environmental performance of the transport system as a whole. The report examines issues centred around transport and climate change, which need to be addressed in the coming years. These issues are derived partly from the policy questions that form the backbone of TERM and partly from other ongoing work at EEA. As with previous TERM reports, this report evaluates the indicator trends with respect to progress towards existing objectives and targets from EU policy documents and various transport and environmental directives.

The selection does not represent a full inventory of conclusions that can be extracted from TERM but rather a selection that tries to give deeper insight into the link between transport development and climate change. Readers are therefore encouraged to seek further information in the TERM fact sheets themselves (see link below), as well as in other sources referred to.

TERM: a two-layered information system

TERM reports have been published since 2000 as an official indicator-based reporting mechanism. As one of the environmental assessment tools of the Common Transport Policy, TERM offers important insights that can help the development of EU policies. With this report, the EEA aims to show the main developments over the past decade and the challenges that lie ahead, thereby also making it a comment on contemporary EU transport policy.

Currently, TERM consists of 40 indicators (see the overview on page 42) that are structured around seven policy questions (see box on page 7). It addresses various target groups, ranging from high-level policy-makers to technical policy experts. It is therefore set up as a two-layered information system, with different degrees of analytical detail.

This report summarises the key messages from the indicators. Indicator fact sheets constitute a more detailed information layer. The fact sheets provide an in-depth assessment for each indicator, including an overview of the main policy context and existing EU policy targets related to the indicator; an analysis of data quality and shortcomings; a description of metadata; and recommendations for future improvement of the indicator and data. The TERM indicator fact sheets form the reference information system of this report and can be downloaded from the EEA website at: www.eea.europa.eu/themes/transport.

Scope of the report

The report aims to cover all 32 EEA member countries. These are the 27 EU Member States, one candidate country (Turkey) and Norway, Iceland, Liechtenstein and Switzerland. Switzerland only recently became a member and has provided data in some cases. Where data are not complete, this is generally noted in the metadata section, where different country groupings are also described.

In terms of time, most indicators cover the years since 1990 subject to data availability. But there are cases where data for some Member States have only become available recently, or where the transition from a centrally planned to market economy has led to such big changes that comparisons over time become irrelevant.

Unless other sources are given, all assessments covered in this report are taken from TERM fact sheets and are based on data from Eurostat.

The underlying fact sheets used for this report have been developed by the European Topic Centre for Air and Climate Change and a consortium led by TRL from the United Kingdom.

The project was managed and the final version of the text written by Peder Jensen, EEA. Substantial input and review was also provided by Jan Karlsson, Peder Gabrielsen and Francois Dejean, all from EEA. In addition, comments were received from other EEA staff, a number of EEA member countries as well as from the European Commission.

TERM policy context, process and concept

The Amsterdam Treaty identifies integration of environmental and sectoral policies as the way forward to sustainable development. The European Council, at its summit in Cardiff in 1998, requested the Commission and transport ministers to focus their efforts on developing integrated transport and environment strategies. At the same time, and following initial work by the EEA on transport and environment indicators, the joint Transport and Environment Council invited the Commission and the EEA to set up a transport and environment reporting mechanism (TERM), which should enable policy-makers to gauge the progress of their integration policies. The Sixth Environment Action Programme (EC, 2001b) and the EU Strategy for Sustainable Development (EC, 2001c) re-emphasise the need for integration strategies and for monitoring environmental themes as well as sectoral integration.

The main aim of TERM is to monitor the progress and effectiveness of transport and environment integration strategies on the basis of a core set of indicators. The TERM indicators were selected and grouped to address seven key questions:

1 Is the environmental performance of the transport sector improving?

2 Are we getting better at managing transport demand and at improving the modal split?

3 Are spatial and transport planning becoming better coordinated so as to match transport demand to the need for access?

4 Are we optimising the use of existing transport infrastructure capacity and moving towards a better-balanced intermodal transport system?

5 Are we moving towards a fairer and more efficient pricing system, which ensures that external costs are internalised?

6 How rapidly are cleaner technologies being implemented and how efficiently are vehicles being used?

7 How effectively are environmental management and monitoring tools being used to support policy- and decision-making?

The TERM indicator list covers the most important aspects of the transport and environment system (driving forces, pressures, state of the environment, impacts and societal responses — the so-called DPSIR framework). It represents a long-term vision of the indicators that are ideally needed to answer the above questions.

The TERM process is steered jointly by the European Commission (Directorate General for Environment, Directorate General for Energy and Transport, Eurostat) and the EEA. The EEA member countries and other international organisations provide input and are consulted on a regular basis.

1 Climate change and transport — much is needed but too little is happening

To enable the EU to meet future overall greenhouse gas emission reduction targets by 2020, the transport sector must raise its game and improve its environmental performance. Had transport sector emissions followed the same reduction trend as in society as a whole, total EU-27 greenhouse gas emissions during the period 1990–2005 would have fallen by 14 % instead of 7.9 %.

Previous and current EU policies have mainly focused on improving vehicle technology and fuel quality to reduce pressures on the environment. Trends and projections clearly show that these policies have not been enough to succeed in reducing greenhouse gas emissions from transport and that the effect of introduced mitigation measures has been more than offset by increased transport volumes. To achieve emission reductions, measures and policy instruments must therefore also address demand for transport in a serious way.

Achieving ambitious targets in line with the 'Bali roadmap' would require that transport volume growth is limited to + 4 to – 2 % over the period 2010–2020, compared to a growth of 15 % in a business-as-usual scenario. In doing so, ancillary benefits related to reduction of noise and air pollution, and protection of biodiversity will be achieved. If demand constraint is not achieved technology measures of hitherto unseen magnitude will be needed.

To address transport demand, measures and policy instruments must go beyond the transport sector itself and be introduced into sectors of the economy such as households, industry and service, within which the demand for transport actually originates.

Setting a realistic but still challenging sectoral target for limiting or reducing greenhouse gas emissions from transport would encourage stakeholders and policy-makers to develop and implement necessary measures and policy instruments, and facilitate the monitoring of improvements in the sector's environmental performance.

The EU has stated that to keep the impacts of climate change at a manageable level, meaning that we will be able to adapt to them, the global temperature should not exceed the pre-industrial level by more than 2 °C. To achieve this target, developed countries and regions, including the EU, should reduce their emissions by 60–80 % over the period 1990–2050.

During the period 1990–2004, **global** emissions of CO_2 increased by 27 %, from 20 463 to 26 079 million tonnes CO_2 (Mt CO_2). Energy demand from the transport sector — an indicator of global transport emissions — increased by 37 % over the same period. The two largest greenhouse gas emitters world-wide are USA and China. In the same period, CO_2 emissions in the **USA** increased by 19 % whilst the energy demand from the transport sector increased by 28 %. **China** saw the fastest increase in emissions with CO_2 emissions and energy demand growing by 108 % and 168 % respectively. Total emissions per capita (2004) show China (3.7 t/capita) being far below the USA (19.6 t/capita) and EU-27 (8.7 t/capita). In the **EU-27**, total greenhouse gas emissions in 1990 were 5 621 Mt CO_2-equivalent, falling to 5 177 Mt CO_2-equivalent in 2005 (a decrease of 7.9 %). In the same period, emissions from the transport sector increased by 26 %. In 2005 they represented 22 % of total EU-27 greenhouse gas emissions ([1]).

Had transport sector emissions followed the same reduction trend as in society as a whole, total EU-27 greenhouse gas emissions during the period 1990–2005 would have fallen by 14 % instead of 7.9 %.

([1]) The transport sector presented here consists of road transportation, domestic civil aviation, railways, national navigation and other transportation. It excludes emissions from international aviation and maritime transport (which are not covered by the Kyoto Protocol or current EU policies and measures). Road transport is by far the biggest transport emission source.

These trends demonstrate clearly that developments in the transport sector, in the EU-27 and world-wide, are not compatible with the need to reduce overall greenhouse gas emissions.

Short-term projections reported by EU Member States (EU-27), indicate that greenhouse gas emissions from the transport sector in 2010 will be the same as in 2005 — 26 % above 1990 levels. If additional measures are implemented fully and on time, these emissions could be reduced by 7 %, to 19 % above 1990 levels. This projected decrease is, however, mainly due to the expected effects of measures in Germany, while transport emissions are projected to increase in almost all other EU Member States. All in all, therefore, it is too early to say if Europe is beginning to break the growth trend in greenhouse gas emissions from transport. It should also be noted that these projections do not reflect the expected further increase of international aviation and maritime transport because these activities are outside the Kyoto Protocol.

Within the framework of the United Nations Framework Convention on Climate Change (UNFCCC), the global community is now looking to find a global post-2012 climate change agreement to limit emissions, and address other issues such as adaptation to climate change, after the end of the Kyoto Protocol commitment period (2008–2012).

At the UNFCCC meeting in Bali in December 2007, all countries agreed on a 'Bali roadmap' with the aim to achieve such a global agreement by the end of 2009. An agreement should include both developed and developing countries, but with the largest emission reduction effort expected by the developed countries (indicatively in the range of 25 to 40 % emission reductions by 2020 from 1990 levels).

In Europe the European Council agreed in March 2007 on an integrated energy and climate change strategy (EU, 2007a), with the dual goals of tackling climate change and ensuring security of energy supply. The main element of the strategy is a commitment by the EU to reduce its emissions by 30 % by 2020 compared to 1990 levels, provided an international agreement can be reached with other industrialised countries. Without such an agreement, the EU pledged to reduce its emissions by 20 % during the same period (EU, 2007a). To implement the strategy, the European Commission presented in January 2008 a package of legislative proposals on climate change and energy, including proposals for how the overall EU greenhouse gas target will be shared between Member States (EC, 2008)

The Commission proposes to split the overall emissions reduction target into two — one for the sectors covered by the European Emissions Trading Scheme (ETS) and one for the non trading sectors in which transport is included. Emissions from non-trading sectors will be subject to binding targets at Member State level. Also relevant for the transport sector within this package is a mandatory target requiring the use of 10 % biofuels by 2020, including a clause that the biomass be produced in a sustainable way and conditional on second-generation biofuels being available. The package also includes proposals on how to ensure sustainability which includes a proposed minimum target of 35 % life-cycle greenhouse gas emission reduction compared to fossil fuel (see also information about the amendment of Directive 98/70/EC of the European Parliament later in this chapter). The climate change and energy package furthermore includes an action plan for energy efficiency, but the plan does not include specific details about how this will be achieved. The most concrete statement is that the Commission, if necessary by legislation, will ensure that a 120 g CO_2/km target for passenger cars is achieved by 2012 (see also later in this chapter).

So far, EU transport policy has mainly focused on the supply side and little has been done to tackle the growing demand for transport. Furthermore, a number of actions designed to reduce greenhouse gas emissions within the transport sector have also led to more efficient and consequently cheaper transport; a rebound effect that has contributed to growing demand within the sector.

The mid-term review in 2006, Keep Europe moving — Sustainable mobility for our continent (EC, 2006a), of the 2001 transport policy White Paper recognised that the measures proposed in the White Paper were insufficient and pointed to the need for a broader, more flexible, transport policy toolbox. When discussing what might be the contents of such a toolbox, a central question is:

Could a sector-specific target for limiting or reducing greenhouse gas emissions act as driver for a more efficient climate change strategy in the transport sector? And if so, what should the target be?

Such a target might mainly be used to assess the progress within the sector rather than being a legally binding target. Even so, it would put pressure on different stakeholders and highlight the need to analyse a wide range of measures, including a discussion on transport demand when formulating action plans to limit greenhouse gas emissions in the transport sector.

To illustrate the issue, three different 'targets' for the transport sector for 2020 are therefore investigated in the table below. The targets are linked to the unilateral EU target of a 20 % reduction and to the target band in the Bali roadmap (25–40 %) in 2020, which brackets the position taken by the European Council that developed countries should reduce emissions by 30 % in 2020.

In all the 'transport target' cases the transport measures agreed or in the pipeline fall short of delivering sufficient emission reductions. There is therefore a need for additional transport measures to meet the 20 % target for all sectors and even more to prepare for more strict reductions in line with the Bali roadmap. Depending on the target chosen, the shortfall is between 50 and 165 Mt CO_2-equivalent.

Possible additional measures — to be implemented on an EU-wide basis or nationally — include:

- Coordination and optimal use of different modes of transport. So far there are few examples of such measures generating measurable reductions.
- Ensuring a shift from less to more energy efficient transport modes. So far policy has been unable to reverse the decline in market shares of rail and bus transport, albeit there are indications that the rate of decline is slowing down.
- Improvements within each mode of transport, including behavioural changes. There are examples of measures like eco-driving campaigns in local areas that have generated measurable benefits in the range of a few percentage points, but it needs to be seen if such measures can maintain their efficiency over time and can be scaled up from the local level to regional, national and EU level.
- Technological advances until 2012 in passenger cars are already taken into account in the above calculations. Further improvements in efficiencies towards 120 g CO_2 per km by 2012, as suggested by the Commission, would generate further emission reductions of around 42 Mt CO_2-equivalent and thereby almost fulfil the 'energy package requirements'. Judging by recent lack of progress in vehicle efficiency however it is doubtful if this is a realistic scenario. Further technological advances after 2012 would take

EU-27 greenhouse gas emission from transport (excl. air and maritime transport)		
1990 emissions	767 Mt CO_2-eq.	Reported emissions.
2010 projections	949 Mt CO_2-eq.	Projections made by EU Member States, taking the effect of existing and additional measures into account (EEA, 2007b).
2020 projections	1091 Mt CO_2-eq.	Assuming a 15 % growth in transport volume between 2010 and 2020 and no further reduction measures. This growth corresponds roughly to the annual growth rate in the period 1990–2005.
Reduction measures agreed or under negotiation		
Amendment to Fuels Directive 98/70/EC	– 95 Mt CO_2-eq.	The proposed amendment foresees a reduction of life-cycle greenhouse gas emissions of about 10 % (compared to 2010) from gasoline and diesel production and use (92 % of total transport energy use). It does not cover vehicle efficiency. Achievement of the 10 % biofuels target should deliver more than one third of the reduction.
Passenger vehicle efficiency legislation	– 125 Mt CO_2 eq	Assuming the proposed target of 130 g CO_2 per km in 2012 is met and that cars are replaced at the same rate as today, there will be an efficiency gain of 30 g CO_2 per km from current levels for the whole passenger vehicle fleet in.
Additional emission reductions needed from supplementary measures to achieve indicative 2020 targets		
2020 greenhouse gas emissions to meet 'energy package requirements' (825 Mt CO_2-equivalent)	– 50 Mt CO_2-eq.	A target of 825 Mt CO_2-equivalent is roughly equivalent to the target proposed in the energy and climate change package of an overall reduction in greenhouse gas emissions of 10 % from 2005 to 2020 for sectors outside the emission trading scheme, assuming an equal effort is made in all these sectors. Aviation is excluded from these calculations as it is assumed that aviation will be part of the emission trading system.
2020 greenhouse gas emissions to meet 'Bali roadmap lower end requirements' (767 Mt CO_2-equivalent)	– 105 Mt CO_2-eq.	A target of 767 Mt CO_2-equivalent is roughly equivalent to 25 to 30 % reduction in emission of greenhouse gases, depending on the allocation of reduction targets between sectors. This is the lower end of the target in the Bali roadmap. Aviation is excluded from these calculations as it is assumed that aviation will be part of the emission trading system.
2020 greenhouse gas emissions to meet 'Bali roadmap higher end requirements' (709 Mt CO_2-equivalent)	– 165 Mt CO_2-eq.	A target of 709 Mt CO_2-equivalent is roughly equivalent to 35 to 40 % reduction in emission of greenhouse gases, depending on the allocation of reduction targets between sectors. This is the higher end of the target in the Bali roadmap. Aviation is excluded from these calculations as it is assumed that aviation will be part of the emission trading system.

some time to filter through the vehicle park, and therefore their impact on 2020 emissions would in all probability be rather limited. Possible future technologies such as battery-driven or hydrogen-driven vehicles are unlikely to play a significant role in the 2020 timeframe. The potential in other segments of the transport fleet is deemed to be relatively small. Trucks have long been optimised for low energy consumption and trains represent a small share of overall CO_2 emission.

- Construction and maintenance of infrastructure. This can contribute to changing the attractiveness of different modes, but if construction mainly caters for the growing number of cars it will further support the present growth trend. Changes will anyhow take a long time to materialise.

- Reduction of total transport demand (passenger and freight). This can be through pricing measures or other types of demand management tools. On present knowledge, this is the only measure that can generate substantial limitations on emissions.

Present knowledge indicates that it will not be possible to achieve ambitious targets comparable to the Bali roadmap without limiting transport demand.

Growth in transport demand would have to be limited to 4 % (lower end) or transport demand would have to be reduced by 2 % (upper end) over the period 2010–2020, if we were to meet the Bali roadmap targets only through existing and planned measures in the field of vehicle technology and fuel requirements, and measures regulating transport demand. These being the only measures that so far have demonstrated any potential to deliver real limitations in greenhouse gas emissions.

In addition to stricter CO_2 emission limits for new vehicles than those already proposed, active promotion of modal shift, and influence on user behaviour may reduce the need for demand constraints. It is however, unlikely that these measures will completely remove the need for demand side measures.

An alternative would be to require even greater reductions from other sectors outside the ETS (agriculture, housing, small industries, etc.). In the longer run (beyond 2020), however, there are limitations as to how much other sectors can continue to compensate for growing emissions from the transport sector by reducing elsewhere.

The analysis above aims to quantify the role that transport demand management needs to play in achieving greenhouse gas emission reduction targets. The analysis focuses on climate change as perhaps the most serious environmental problem today. Nevertheless, other serious environmental problems also result from transport activities. Even if we have managed to reduce to a large extent some air pollution problems, air quality, especially in cities, must still be further improved to meet health needs. Noise from road transport is also a major problem in many cities. In implementing measures to reduce climate change, it is important to choose measures that can also address these additional environmental problems and offer ancillary benefits. An overall reduction of transport volumes is such a measure.

A push for such a reduction may come from high oil prices. In fact, in January 2008 crude oil passed the USD 100 per barrel figure for the first time, although it is difficult to forecast how high the price will go and how long it will remain high. However, a rapid change in demand seems unlikely as consumption patterns are to a considerable extent fixed by the location of dwellings, places of work, institutions and shops. Overall, it is difficult to predict the long-term effect on transport demand of high fuel prices.

It is important to remember that serious analysis of how to address the problem of transport growth must to a large extent focus on other sectors such as housing, agriculture and industry rather than the transport sector itself, as it is decisions in these sectors that create transport demand.

The tentative targets used for the analyses in this section are not based on analysis of cost-efficiency across sectors, but the main messages are clear:

- Implementation of non-technical measures, including behavioural change on an EU level as well as on national and local levels, must continue and if possible be intensified;

- If the increase in transport volumes is not limited, implementation of other measures will not be enough to achieve an environmentally sustainable transport system and give the necessary contribution to limiting climate change;

- Transport demand measures and policy instruments must be implemented in sectors other than transport and thus must be addressed by policies other than transport policy. This will be facilitated by analysing the development of the sector towards a challenging but still achievable sectoral target.

2 Freight transport growth outpaces economic growth

Freight transport is growing faster than the economy. A consequence is that emissions of CO_2 from freight transport are growing quickly. Better internalisation of external costs can help reduce market distortions and emission growth.

Energy use and the associated carbon emissions from freight transport grew faster than in almost any other sector between 1995 and 2005. Inland freight transport (road, rail and inland waterways) in EEA member countries increased by 30 % (2.7 % per annum), with the road freight segment witnessing the greatest percentage increase (38 %). Freight carried by rail and inland waterways also increased, by 8 % and 9 % respectively (EU, 2007b). Road freight transport continued to dominate the total EU-25 freight market (including intra-EU air and maritime transport) with a share (in tonne-kilometre) of 44 % in 2005, closely followed by sea freight at 39 %. Between 1995 and 2005, air freight increased by 31 %, but still only represented around 0.1 % of the total volume (EU, 2007b).

Growth in freight transport volume is strongly coupled to growth in gross domestic product (GDP), but there are significant regional differences. Between 1995 and 2005, transport grew faster than GDP in EU-15 Member States (freight increased by 30 %, GDP increased by 24.5 %) as a reflection of the implementation of the internal market, but slower than GDP in EU-10 Member States (freight increased by 35 %, GDP increased by 50 %). Economic restructuring in the 10 new EU Member States away from traditional bulk/heavy industries towards a larger service sector is a main factor explaining this difference.

The Commission (EC, 2006b) has predicted that increases in freight activity will continue to drive emissions of CO_2 upwards, despite expected efficiency improvements within the sector.

Policies to reduce the environmental impact of freight transport tend to focus on technical measures or the encouragement of mode shift from road to other modes. Demand reduction measures have not been used much. The mid-term review of the transport White Paper (EC, 2006a) identifies a range of interlinked policy issues to be addressed in order to increase the efficiency and sustainability of freight transport:

- reducing congestion, which would reduce costs and time of transport and reduce fuel consumption in some parts of Europe's transport system;
- reducing greenhouse gas emissions from freight transport, which would also help to reduce air pollutant emissions and noise;
- reducing dependency on mostly imported fossil fuels, which would improve energy security.

Where appropriate, modal shift could help to address these issues, particularly where longer distances are involved, or when vehicles are used within urban areas or congested corridors.

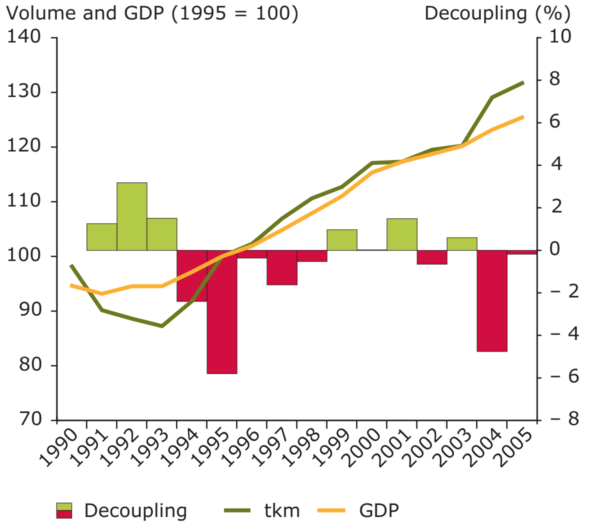
In addition, measures can be undertaken within the road freight sector to improve efficiency, such as increasing the utilisation of vehicle capacities, employing improved freight distribution practices and the design/provision of better infrastructure.

Freight transport demand is largely driven by economic considerations in the private sector. Present growth patterns reflect an optimisation where transporting freight is cheaper than producing goods locally. Including environmental costs in the charges paid will reduce the market distortion caused by uncovered costs and will go some way towards reducing growth. In June 2008, the Commission is expected to launch a proposal for better integration of uncovered environmental costs into infrastructure charging.

Figure 2.1 Freight transport volumes grow along with GDP

The growth in transport volume in EEA member countries as a whole has closely followed growth in GDP and there have been no clear signs of decoupling of transport volume growth from economic growth.

Disaggregated by region, the EU-15 Member States show an increase in freight intensity, whereas the EU-10 Member States show decreasing levels. This means that older Member States need more transport to do today what they did yesterday with less transport.



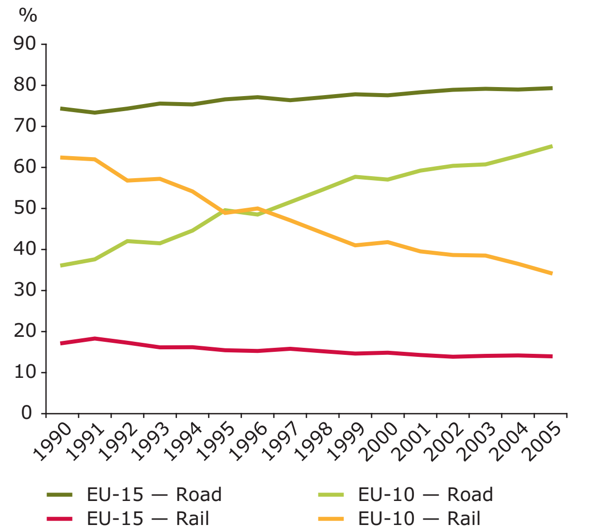
Note: The decoupling columns displayed in the chart represent annual decoupling. A positive value (green column) indicates decoupling (percentage decline in transport intensity since the previous year). The transport demand growth between 2003 and 2004 may partly be caused by a change in methodology, but no correction figure exists.

Source: Eurostat.

Figure 2.2 Road transport's share increases strongly in EU-10

With a 78 % market share, road transport dominates the inland freight transport market in EEA member countries. Furthermore, the road transport share has grown steadily over the past decade at the expense of rail and inland waterway transport.

In the EU-10, road and rail exchanged positions in the mid 1990s, with road transport's share increasing strongly and reaching 65 % in 2005 at the expense of rail transport. This can be explained primarily by historical preference for rail transport in the centrally-led economies in the EU-10. Liberalisation of markets led to the decrease in heavy industry in those economies alongside an increasing demand for more flexible road transport. The share of inland shipping is limited to approximately 5 % in EEA member countries.



Note: Road freight transport is assigned to the country of origin of the transport vehicle in EU statistics rather than to where the vehicles drive. Because a significant number of vehicles from EU-10 Member States perform transport services in EU-15 Member States the numbers for EU-10 Member States in particular are uncertain, albeit the trend is expected to be correct.

Source: Eurostat.

Addressing road freight through heavy vehicle fees

Since 2001, Switzerland has levied a distance-related heavy vehicle fee (HVF) with the key aims of restricting the increase in heavy freight traffic on the roads, promoting the transfer of goods traffic to rail and relieving the strain on the environment. The size of the fee is based on tonne-kilometres travelled on Swiss territory. Monitoring during the first five years of operation has shown that the upward trend prior to implementation has been reversed. By the end of 2005, the total number of kilometres travelled was 6.5 % lower than in 2000 (DETEC, 2007).

3 Passenger transport continues to increase

Passenger transport continues to grow, particularly in aviation and cars. Increased car usage and a reduced number of passengers per car negate the improvements gained from improvements in vehicle efficiency.

The number of passenger kilometres (pkm) travelled grew every year between 1990 and 2004 at a rate slightly slower than economic growth. Growth has occurred for all transport modes almost every year, with the exception of sea transport.

The largest increase was in air passenger travel, which grew by 49 % between 1995 and 2004 (EU-25). Aviation's share in the total pkm travelled increased to around 8 % in 2004, up from 6 % in 1995 (data refer to domestic and intra EU-25 aviation only). Higher incomes and cheaper airline tickets have led to a significant increase in holiday air traffic. The European Commission has proposed to include the aviation sector in the European Emissions Trading Scheme (ETS), with the aim of stabilising emissions at 2004–2006 levels. This proposal is currently being discussed in the Council and in the Parliament.

Passenger car use grew by 18 % between 1995 and 2004 and was responsible for 74 % of all passenger transport in 2004 (EU-25). Rail transported more passengers, but growth was slower than for road transport (9 %). There are, however, substantial regional differences. In EU-15, rail transport volume grew by 17 %, while it decreased by 49 % in the new Member States (1995 to 2005). A similar trend was observed for bus transport where EU-15 Member States saw a growth of 10 %, whereas EU-12 (only 10 of them were EU members in 2004) saw a decrease of 11 % between 1994 and 2004.

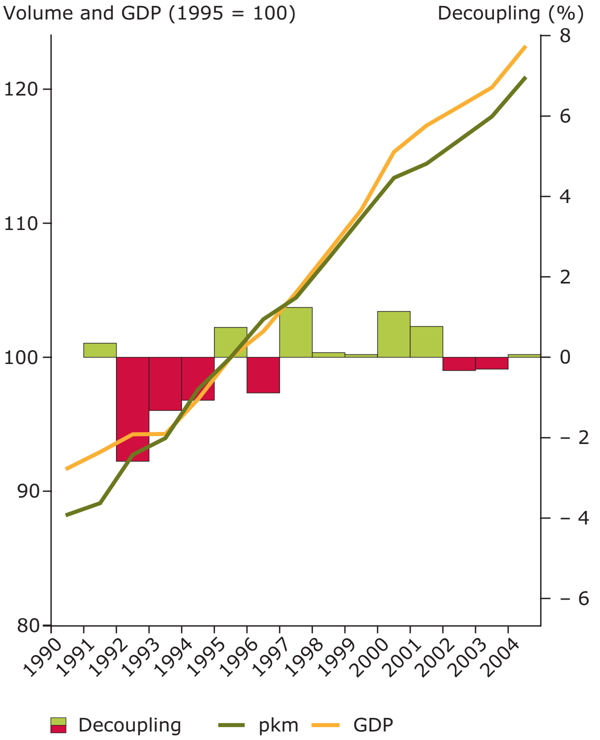
Encouraging the use of more sustainable passenger transport modes is one way of tackling greenhouse gas emissions from transport. With present average occupancy rates, there is a lot to be gained by shifting from cars to buses and trains. Increasing car ownership rates, however, have a tendency to foster a move away from trains and buses and at the same time reduce the average number of passengers per car. Growing car ownership is therefore unfortunate from the point of view of reducing greenhouse gas emissions.

A key obstacle to achieving a mode shift from private to public transport is the sometimes poor availability, slowness and unreliability of public transport services (EC, 2007a). The quality of urban transport infrastructure, including roads, trains, buses, public spaces, bus stops, terminals and footpaths, plays a large role in this. Low quality has a tendency to discourage users who have an alternative option (mostly a private car). It may be easier to deter people from using public transport via low quality than to attract them back via improved quality. Non-users are often not aware of quality improvement initiatives and are therefore less likely to be influenced. Thus insufficient attention to improving the quality of public transport and raising awareness about these improvements could restrict the use of public transport to only those users who do not have a choice due to factors such as age or economic status.

The role of non-motorised modes, such as walking and cycling, is particularly important in terms of enabling access to urban public transport and interchanges. Rail stations in countries such as the Netherlands, Germany and Denmark often have parking for bicycles, which encourages integration between modes. Other initiatives include allowing bicycles to be carried on public transport vehicles, and providing comfortable and safe waiting areas for passengers (see also Chapter 11).

Figure 3.1 Economy grows slightly faster than passenger transport volumes

Passenger transport growth has been slower on average than growth in the economy since the mid 1990s. The decoupling indicator is expressed as the change in transport intensity (passenger-kilometre/euro of GDP) compared to the previous year. The decoupling shown in the chart is relative, i.e. it is below the level of economic growth. In other words, passenger transport is still growing, but more slowly than the economy.

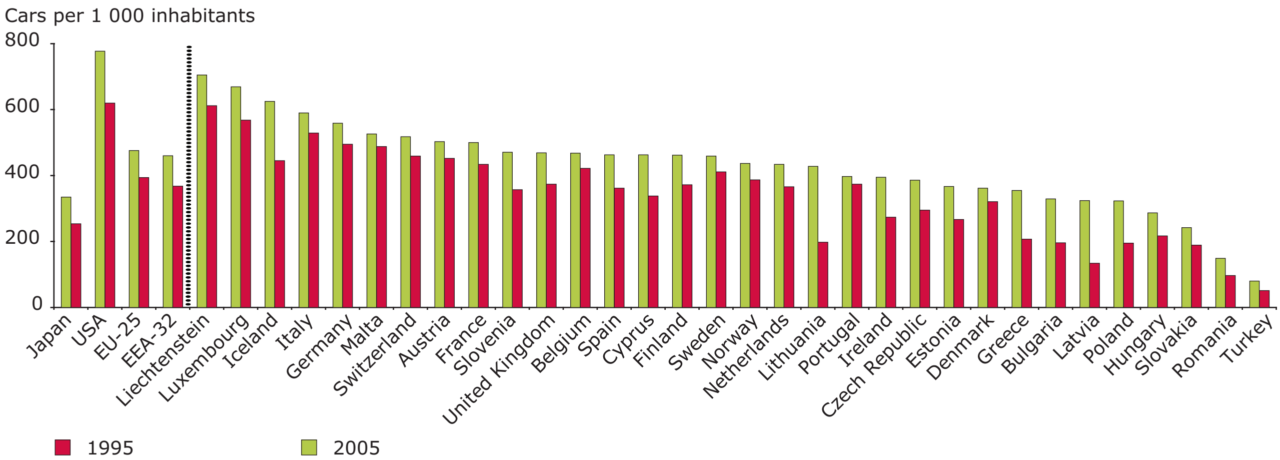


Note: The decoupling columns displayed in the chart represent annual decoupling. A positive value (green column) indicates decoupling (percentage decline in transport intensity since the previous year).

Source: Eurostat.

Figure 3.2 Car ownership increases

In 2005, the average car ownership level in the 32 EEA member countries reached 460 cars per 1 000 inhabitants, compared with 335 in Japan and 777 in the USA. Turkey has the lowest ownership rate (80 per 1 000 inhabitants), Liechtenstein the highest (705 per 1 000 inhabitants). The largest growth was observed in the new Member States and Turkey, with Lithuania topping the growth charts, up from 198 cars per 1 000 inhabitants in 1995 to 428 in 2005 (an increase of 116 %).



Source: Eurostat.

Attitudes towards public transport in the EU

'Better schedule, regularity and operating hours' (29 %) and 'better connections to regular destinations' (28 %) were cited as the top two key improvements to public transport that would encourage EU citizens to drive less often. Only 22 % of respondents stated that they would not consider reducing their car usage under any circumstances whilst 49 % believe that 'better public transport' could significantly improve the traffic situation in their (closest) city. Studies have identified that urban transport is the service with which consumers in the European Union are least satisfied. Around 13 % of EU-25 consumers have difficulty accessing public transport whilst 4 % have no access at all. With regard to public attitudes towards paying more for using a less polluting mode (including energy-efficient private and public vehicles, clean fuels, etc.), 41 % of respondents were not prepared to pay any more. However, 45 % were prepared to pay up to 10 % more, and a further 9 % were prepared to pay in excess of 10 % more (Eurobarometer, 2007).

4 Greenhouse gas emissions grow due to transport growth

Greenhouse gas emissions in the transport sector continue to increase steadily. Although improvements have been made in the energy efficiency of various transport modes and non-fossil fuels have been introduced, increased transport demand is outweighing these benefits.

Greenhouse gas emissions from transport (excluding international air travel and maritime transport) increased by 27 % between 1990 and 2005 in EEA member countries as a whole. By region, growth in emissions is higher in the 12 new EU Member States (30 %) than in the older ones (26 %) and the EFTA countries (17 %). The high growth in the new Member States does however cover large differences, with four countries having lower emissions in 2005 than in 1990.

CO_2 emissions from aviation have grown faster than emissions from other transport modes. In EU-15 Member States, domestic aviation showed an increase of 44 % between 1990 and 2005. In addition to emissions of CO_2, aircraft emit oxides of nitrogen (NO_X) as well as particles and water vapour, and contribute to the formation of contrails and cirrus clouds. Some of these additional factors add to global warming whereas others counteract it. The size of the net effect is uncertain, but it is agreed that the radiative forcing effect of aviation is higher when all other factors are taken into account compared to the impact of CO_2 emissions alone.

Maritime transport is currently responsible for approximately 13 % of the world's total transport greenhouse gas emissions (Eyring *et al.*, 2005). Projections foresee a growth of 35–45 % in absolute levels between 2001 and 2020, based on expectations of continued growth in world trade and providing that no actions are taken to limit emissions per tonne-kilometre. Aviation and maritime transport activities are not included in the commitments in the Kyoto Protocol because of the difficulty in agreeing how to allocate emissions to any specific country.

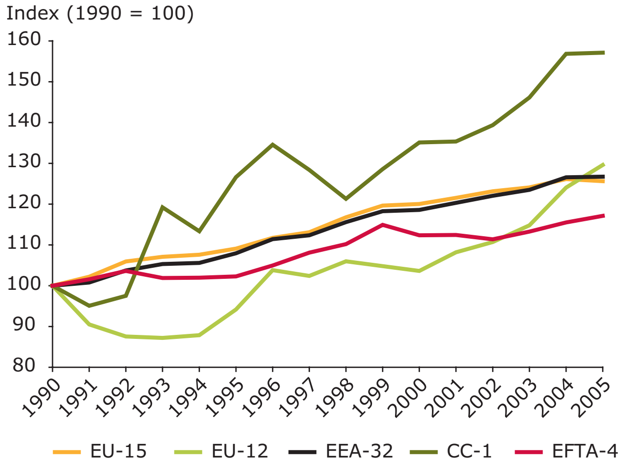
The growth in greenhouse gas emissions and energy use in the transport sector over recent decades is the consequence of factors such as longer journeys (for both freight and passengers), increases in the number of vehicles and the rapid increase in air travel. Even with all planned reduction measures affecting transport, greenhouse gas emissions are projected to grow in all EU Member States except in Germany and Luxembourg according to reports from Member States (EEA, 2007b).

The average European passenger car is gradually becoming more efficient, due to technological improvements and a growing share of diesel-driven vehicles. If future energy efficiency progress matches current ambitions and growth in car transport is only moderate, the total energy demand from passenger cars is expected to decrease slightly over the coming decade. Therefore, to substantially reverse the current trend of growth in greenhouse gas emissions, further measures are required. For a further discussion of this topic, see Chapter 1.

Consideration could be given to the cost of fuel and transport as this generally influences the intentions or actions of individuals in promoting energy efficiency. In a recent survey, responses from EU citizens indicated that 54 % would be willing to pay more for using less-polluting transport (Eurobarometer, 2007). However, evidence also suggests that only a minority actually take action to reduce private transport energy consumption and fewer may intend to take action in the future (Stead, 2007). This may therefore lead to problems in developing policy to tackle the environmental problems associated with transport.

Figure 4.1 Greenhouse gas emissions rise as transport volume increases

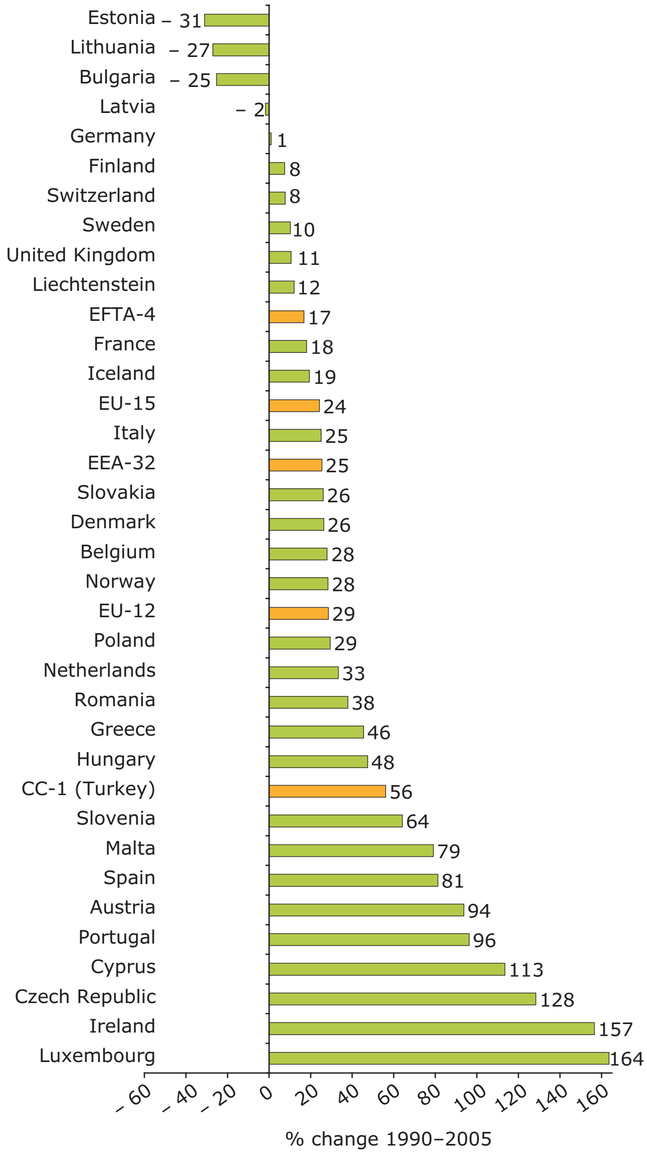
Greenhouse gas emissions from transport increased by more than 27 % between 1990 and 2005 in EEA member countries. EU-15 Member States are responsible for 83 % of the total (not including international aviation and maritime transport). This increase in emissions has occurred even though vehicle fleets are becoming more efficient. Thus the increased volume of transport has caused the increase in emissions.



Source: European Topic Centre/Air and Climate Change.

Figure 4.2 Trends in transport greenhouse gas emission, by country (1990–2005)

The majority of EEA member countries saw an increase in greenhouse gas emissions from transport due to increases in transport movements. Four of the new EU Member States (Estonia, Latvia, Lithuania and Bulgaria) saw decreasing emissions for the period as a whole. This was the case for most of the new EU Member States in the first part of the 1990s, but since the mid 1990s transport and emission growth have been greater than in the old EU Member States and in the EFTA countries. Turkey, which is the only candidate country in the figure, also saw significant growth, albeit slower than nine other countries.



Source: European Topic Centre/Air and Climate Change.

5 Harmful air pollutant emissions and air quality

Transport, in particular road transport, is generally becoming less polluting due to increasingly strict air pollutant emission standards. Nevertheless, people in European cities continue to be exposed to significant health threats due to air pollution.

Transport emissions of air pollutants show a decreasing trend in EEA member countries. Between 1990 and 2005, emissions of acidifying substances decreased by 36 %, ozone precursors by 45 % and particulates by 33 % (EEA, 2008). The largest decreases in emissions were in EU-15 Member States.

These reductions can largely be attributed to advances in exhaust gas after-treatment devices together with improved fuel quality introduced since the early 1990s (EARPA, 2007). Developments include advanced three-way catalytic converters and particulate filters. These technologies are steadily improving both in terms of their performance and cost. Selective Catalytic Reduction (SCR), a system that uses urea to reduce NO_X emissions, is more commonly fitted to heavy road vehicles. The implementation of these technologies is being driven by stepwise tightening of on- and off-road vehicle emission standards. These emission standards, the so-called EURO standards, have been the most powerful tool for reducing transport emissions.

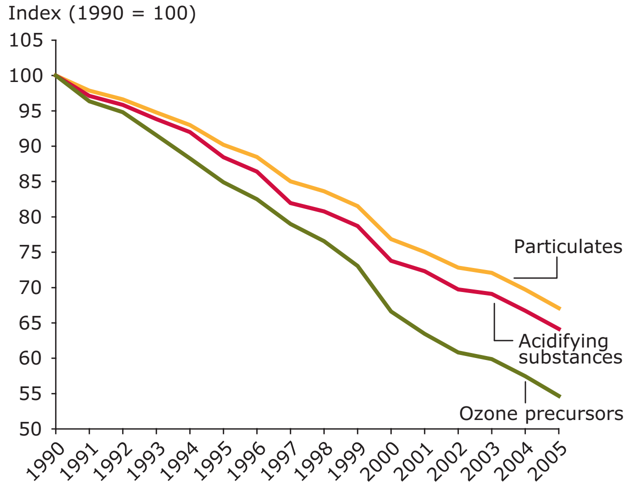
Every year approximately 4 million life-years are lost due to high pollution levels (EC, 2005a). There is therefore a continued need for attention to air quality in urban areas. Similarly, concerns are raised over air quality in alpine valleys, which in many respects can be compared to urban areas because the topography of the landscape traps emissions in the valleys, in some cases leading to air pollution comparable to that on major urban streets.

Measures aimed at improving local air quality may sometimes result in the production of additional greenhouse gases. For example, the use of SCR to reduce emissions of NO_X could lead to increased emissions of nitrous oxide (N_2O), potentially more than offsetting the global warming mitigation of reduced CO_2 emissions resulting from improved engine efficiency. However, reductions in pollutant emissions are often key ancillary benefits associated with measures targeted at reducing emissions of greenhouse gases. Typical examples are measures that reduce fuel consumption or transport demand.

There is increasing awareness across Europe of the contribution of shipping to acidifying pollutant emissions. In 2000, emissions from international shipping in the seas surrounding the territory of the European Union (i.e. the Baltic Sea, the North Sea, the northeast Atlantic and the Mediterranean Sea) amounted to 20–30 % of land-based sulphur dioxide (SO_2) and NO_X emissions in the EU (EC, 2007b). SO_2 emissions from shipping, as a percentage of all transport sources in the EEA member countries, have increased from 50 % in the early 1990s to 78 % in 2004. The reason for the rapid growth is partly that land-based emissions are decreasing and partly that shipping emissions are increasing. With increasingly tight emission standards being applied to land-based sources, marine transport's share will increase further in the coming years.

Figure 5.1 Transport emissions of air pollutants in EEA member countries

Transport emissions of acidifying substances, ozone precursors and particulates decreased by 36 %, 45 % and 33 % respectively between 1990 and 2005 in the 32 EEA member countries. This was mainly due to emission reductions realised in road transport, which in turn were due to fleet renewal with vehicles equipped with catalytic converters and particulate traps and to reduced sulphur content in fuels.

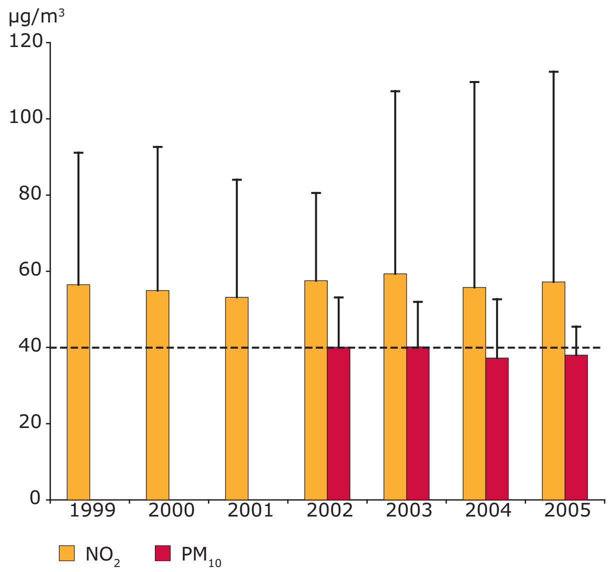


Source: European Topic Centre/Air and Climate Change.

Figure 5.2 Annual average mean NO_2 and PM_{10} concentrations at traffic monitoring stations

Data from selected measuring stations in urban agglomerations close to major traffic arteries indicate that the concentration of nitrogen dioxide (NO_2) (2010 limit) and PM_{10} (2005 limit) are at or above the European air quality limits at these sites. Between 2000 and 2005, mean traffic concentrations have remained relatively stable at the selected measuring stations. The decrease in emissions shown in Figure 5.1 does not appear to have had a statistically significant influence on air quality.

Two factors may help to explain why improvements still fail to appear: the increased use of diesel in urban areas and, since 2000, an increase of the fraction of NO_X emitted as NO_2. Oxidation catalysts and regenerative traps in modern diesel vehicles have been found to lead to such increases (AQEG, 2006).



Note: Columns indicate mean values while error bars indicate maximum values.

Source: European Topic Centre/Air and Climate Change.

Speed control measures to improve local air quality — Rotterdam

Speed control measures were implemented in 2002 in Rotterdam on the A13 motorway, which cuts through the suburban area of Overschie. The measure was implemented primarily in response to concerns related to health and poor air quality for residents living in close proximity to the road. Speed limits were reduced from 120 km/h to 80 km/h along a 3.5 km stretch of the motorway and are tightly enforced through a series of cameras that monitor average vehicle speed within the controlled zone.

The speed control measures subsequently led to an improvement in local air quality. Monitoring revealed that emissions of NO_x fell by 15–20 %, PM_{10} by 25–30 % and carbon monoxide (CO) by 21 %. In terms of ancillary benefits, it was estimated that emissions of CO_2 fell by 15 %; the number of accidents decreased by 60 % and casualties by 90 % and noise was reduced by approximately 50 %.

Source: Olde Kalter *et al.*,2005; and Wesseling *et al.*, 2003 in Kroon, 2005.

6 Biofuels in transport

Overall, EU Member States are far from meeting the current biofuels targets. Increasingly volatile and high fossil fuel prices may, however, foster faster growth.

Growing doubt about the real ability of first generation biofuels — agrofuels — to reduce overall greenhouse gas emissions and growing awareness of negative impacts of biofuel production on biodiversity, water and soil, both directly and through indirect land-use change at the global level, point to the need for great caution in promoting agrofuels further. Using available biomass to replace coal in electricity and heat production gives greater reductions in emissions of greenhouse gases at lower cost.

Second generation biofuels can lead to more substantial greenhouse gas emission reductions and reduce the adverse effects referred to above, However, more analysis is required as to whether they will be generally available in time to contribute to meeting the target of 10 % biofuels in 2020, and further analysis on other aspects of second generation biofuels and cropping of advanced feedstock on poorer soils and degraded lands is needed.

Better knowledge of life-cycle greenhouse gas emissions from all energy uses of biomass, and strong sustainability criteria (in Europe and third countries) for biomass production, addressing also knock-on effects due to indirect land-use change, are needed to fully judge the benefits and limitations of biomass use.

Many EU Member States are presently increasing their production and consumption of biofuels. However, they far from met the 2005 indicative target of 2 % of fuel coming from biofuels, and there is some way to go to meet the overall indicative target of 5.75 % in 2010 (EU, 2003). Over the EU as a whole, only about 1.2 % of fuel in 2005 was biofuel, the majority (78 %) of this being biodiesel. Studies indicate (JRC/Concawe/Eucar, 2006) that the net emission reduction over the life-cycle of the fuel is typically less than half of what it replaces. Thus, the corresponding reduction in greenhouse gas emissions from transport was probably less than 0.6 %, or 0.1 % of total emissions.

Biofuels today mainly consist of first-generation fuels. They are based on vegetable oils and starch from crops that can also be used for food. The remaining parts of the plants cannot currently be used directly for biofuels. Second-generation technologies, where energy stored in other parts of the plants are released by enzymes or gasification processes, could reduce competing land-use claims (food versus fuel).

Recently, doubts have been raised about the real CO_2 benefit of these fuels because of the energy consumption tied to fuel production and because of releases of greenhouse gases linked to changes in land use to accommodate the growing of crops for biofuels (e.g. destruction of rain forest). Together with rising demand for food and feed due to growing affluence in e.g. China and India, biofuels production is putting pressure on land, biodiversity, water resources and soil in developing countries, and rising global food prices have also been seen. Common EU-wide and even globally agreed greenhouse gas life-cycle emission methodologies and certification schemes are therefore needed to understand and avoid these impacts.

This is not only true for biofuels, but for all uses of biomass for energy. In line with earlier conclusions from the European Council (EU, 2007a), the energy and climate change package adopted by the Commission in January 2008 (EC, 2008) proposes a binding target of 20 % final energy demand to be provided from renewable sources by 2020. The most cost-effective way of achieving this target would be to use biomass to replace coal in electricity and heat production.

The proposed amendment to the fuel quality Directive (Directive 98/70 EC) in the energy and energy package aims for a reduction in life-cycle emissions of all fuels by 10 % between 2010 and 2020, In the same package the Commission proposes a minimum reduction from biofuels compared to traditional fuels of 35 %, which means that up to 65 % of the overall reduction of 10 % has to come from improvements in the production chain.

Figure 6.1 Biofuel production in EU Member States

Today's biofuels are mainly produced as biodiesel and bioethanol. Overall, slightly less than 5.1 million tonnes of biofuels were produced in the European Union in 2006, marking a 31 % growth in production from the year before. Biodiesel accounted for 85 % of the total production.

The red line in Figure 6.1 (119 PJ) represents 1 % of the road transport energy consumption in 2005. It thus represents half of the indicative target of 2 % proposed by the Commission.

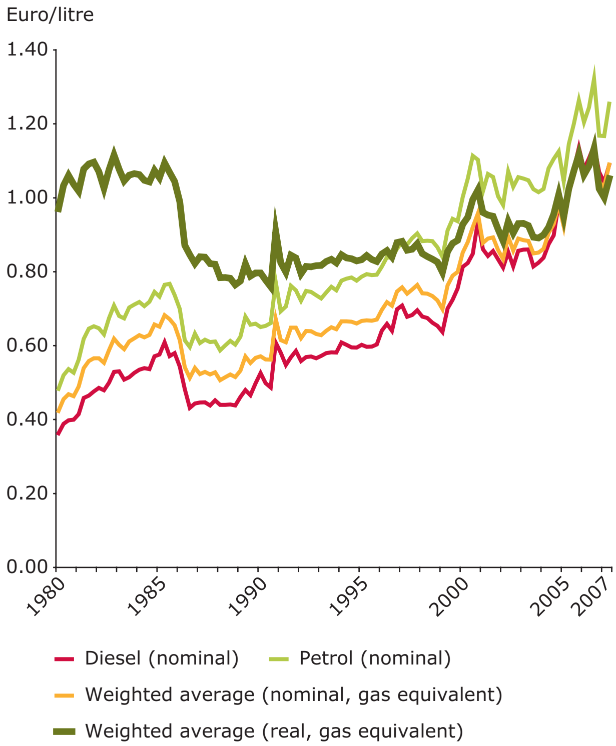
Source: EurObservER.

Figure 6.2 Road transport fuel prices (including taxes) in EU Member States

While nominal prices of transport fuels have increased considerably, the real (inflation-corrected) average price of road fuel in the EU has only increased slightly during recent decades, apart from short periods of price increases caused by political and market instabilities.

In the EU-15 Member States, the level of fuel prices and taxes is about 20 % below the level in the EU-10 Member States. The accession of the EU-10 in 2004 has not led to a reduction of the average fuel price in those countries, due to high crude oil prices and the limited fuel consumption in the EU-10 region.

An important factor for biofuel development is the price of fossil fuel. With oil prices close to USD 100 per barrel, biofuel production is increasingly becoming self sustaining as 'just another product' from the agricultural sector. High oil prices therefore support a shift away from fossil fuel and at present biofuel is the most obvious alternative.



Source: DG TREN.

Europe bioenergy production potential

A recent EEA report on bioenergy in Europe considered how much could be produced without harming the environment. Sectors considered include agriculture, forestry and waste. In the short term, the largest potential for bioenergy comes from the waste sector — about 100 million tonnes of oil equivalent (MtOE). Longer-term potential comes from bioenergy crops from agriculture, driven by increases in additional productivity, further liberalisation of agricultural markets and introduction of high-yield bioenergy crops (up to 142 MtOE by 2030). This is based on the assumption that farmland area is available for bioenergy crop production and the yield of the assumed bioenergy crops improves. Environmental considerations may restrict the amount of biomass technically available from waste, agriculture and forestry, although there may also be co-benefits between biomass production and nature conservation. Increasing the demand for bioenergy can potentially create new uses for currently uneconomic outputs of extensive agriculture or forest residues. Cropping systems may also add diversity and require less pesticide and fertiliser than other intensive agriculture systems, and crop diversification can be promoted (EEA, 2006).

7 Focus on road transport

Vehicle fleets are growing and gains in energy efficiency have been smaller than expected. Technology can deliver some of the greenhouse gas emissions reductions needed — but not all. Behavioural changes are also needed to deliver net reductions.

Both freight and passenger sectors choose road transport more often than any other transport mode. Road transport accounted for 44 % of total freight transport in 2005 and 84 % of passenger transport in 2004.

Car ownership continues to grow in EEA member countries. Between 1995 and 2005 it grew by 25 % (DG TREN, 2007a), reaching 460 cars per 1 000 inhabitants in 2005, and ranging from 705 in Liechtenstein to 80 in Turkey. Increasing ownership goes hand in hand with a shift away from more energy-efficient buses and trains and towards less-efficient cars. It is therefore a symptom of a failure to provide adequate mobility options via public transport coupled with an affluence that allows citizens wider choice.

In 2004, there were approximately 28.3 million motorbikes and mopeds in the EEA member countries. Almost a third (32 %) of this fleet was registered in Italy. The fleet grew by 33 % between 1995 and 2004, in particular in countries like Denmark (64 %), Estonia (63 %) and Portugal (48 %). It is not completely clear why there is greater growth in the two-wheeler segment compared to cars, but it is possible that increasing congestion in urban areas plays a part. On average, two wheelers are more energy efficient than cars but tend to carry fewer passengers. Furthermore, two wheelers tend to emit a greater quantity of harmful pollutants and make more noise. The environmental consequences of the growing two-wheeler share are therefore not clear.

In line with the rise in road freight, the number of goods vehicles in EEA member countries has risen significantly from 23.5 million in 1995 to 35.0 million in 2004, a 49 % increase (DG TREN, 2007a). The highest growth rates were observed in Turkey (165 %), the Czech Republic (95 %), Ireland (89 %) and Poland (77 %). About a sixth (17 %) of the goods vehicles in the EEA member countries were registered in France, with Spain (13 %), Italy (11 %) and the United Kingdom (10 %) as other countries with a large fleet.

The total vehicle stock of buses and coaches in the EEA member countries increased from 1.1 million to 1.3 million between 1995 and 2004, a 23 % increase (Eurostat, 2007). Much of the growth came from the candidate country Turkey (79 %), which has the largest bus and coach fleet (about 35 %). EU-15

Car sharing in the United Kingdom — catching up with green Europe

Car sharing may be a successful way of reducing vehicle usage and ownership amongst those who join, and has been effective in several countries, including Switzerland, Germany, Austria and the Netherlands. The UK market is small but growing, with a total membership of car sharing clubs of 23 000 — a figure that increased by 60 % in 2006 (UKERC, 2007). Reduced car ownership, increased public transport usage and the use of more-efficient cars means carbon savings per car sharing club member are significant. Research in Switzerland (Haefeli *et al.*, 2006) suggests that those who gave up their car as a result of joining a car-share scheme reduced their car travel by around 6 700 km (approximately 72 %) a year. The evidence in Switzerland further suggests that car club membership helps bring about behavioural change, including increased use of public transport. However, some members were previously non-car owners and car usage can therefore actually rise for these people as a result of joining a car club. The net result therefore depends on who is attracted to the clubs.

Member States observed an increase of only 9.4 % between 1995 and 2004, while the 12 new Member States saw a decrease in bus fleets of 8.2 %. Thus growth occurs in the car segment rather than in public transport.

Improving energy efficiency of vehicles and reducing the CO_2 emissions tied to production, distribution and consumption of fuel are the two main supply-side measures to reduce greenhouse gas emissions from road transport.

The key element of the energy-efficiency policy is the voluntary commitment made by the vehicle manufacturer organisations (Europe: ACEA; Japan: JAMA; and Korea: KAMA). Under this they should achieve an average emission target of 140 g CO_2 per km by 2008/2009. At present it is highly unlikely that industry will meet this target (see Table 7.1). On 19 December 2007, the Commission adopted a proposal forcing manufacturers to meet an average emission of 130 g/km by 2012 — an even more challenging task for the manufacturers. At the same time, the Commission stated that it will present further measures to cover the remaining 10 g/km in order to meet the target set by the Environment Council of 120 g/km by 2012. The production of vehicles with low emissions is not the problem, in fact manufacturers are offering an ever larger range of low-emitting vehicles producing less than 120 g/km, but too few of them are being sold to balance the sale of high-emitting cars. Tax differentiations that factor in CO_2 emissions are an option to address this issue (EEA, 2007a).

In the freight transport sector, progress is more limited. Over the past decade, light duty vehicles have improved by only 4 % and large trucks by 10 % in terms of emissions. Of greater importance is the split between small and large trucks, as large trucks are up to 2.5 times more efficient per tonne transported goods. Between 1990 and 2005 all vehicle sectors grew, but the number of small trucks grew faster than the number of large trucks. Market conditions have therefore dictated a fleet development that is less favourable from an environmental point of view.

Table 7.1 Too little progress towards targets for passenger car energy efficiency

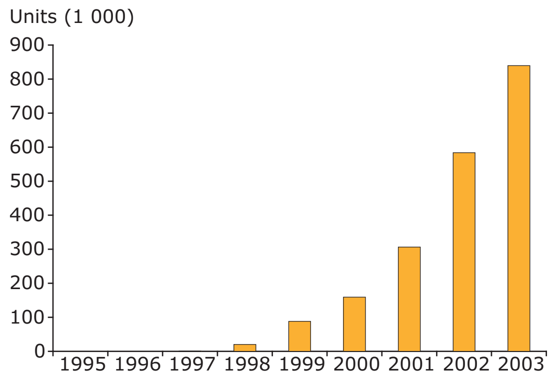
Year	g CO_2/km			
	ACEA	JAMA	KAMA	Total
1995	185	196	197	186
2000	169	183	191	172
2004	161	170	168	162
2005	160	166	167	161
2006	160	161	164	160
Target	140 g/km by 2008 and 2009			

Source: T&E, 2007; EC, 2002.

Technology still has a lot to offer to make road transport more efficient, but consumer preference is presently pulling in the opposite direction. Initiatives such as car labelling have not induced large-scale changes. Nevertheless, influencing users via eco-driving campaigns holds the potential for significant savings, as does tele-commuting or ride-sharing. Such schemes are more effective, however, if backed up via adjustments in the fiscal treatment of transport so that the incentive to behave in a more environmentally friendly manner is stronger.

Car size is also an important consideration. The present trend is towards heavier vehicles, which require more engine power. This in turn leads to increasing emissions or to a reduction that is smaller than it would otherwise have been.

Figure 7.1 ACEA registrations of cars with CO_2 emissions of 120 g/km or lower



Source: DG ENV.

Air conditioning in vehicles

Air conditioning systems can significantly increase overall fuel consumption. According to the German automobile club ADAC, the use of an air conditioning system raises fuel consumption by up to 2 litres/100 km. During initial cooling of a car that has been left in the sun, the extra energy consumption can be twice as high (ADAC, 2007).

8 Focus on rail transport

In 2005, rail transport's share of both passenger and freight traffic decreased to 5.8 % and 10 % respectively, even though passenger-kilometre and tonne-kilometre for rail increased in absolute terms. Rail transport emits on average less greenhouse gas per transport unit than road transport and therefore this represents a development in the wrong direction.

Between 1995 and 2005, rail freight grew by 8 % and passenger rail by 7 % in EEA member countries. This growth is lower than the growth in transport in general and therefore still represents a loss of market share. The largest increases in passenger rail have been witnessed in the United Kingdom (41 %), Ireland (38 %) and France (38 %), and the largest decreases have been in Lithuania (62 %), Romania (57 %) and Bulgaria (49 %). Preliminary data for 2006 and 2007 indicate that the market share may have stabilised, but it is too early to say if this represents a trend change.

Rail freight has a number of advantages over road freight, including lower emissions of regulated pollutants and greenhouse gases and higher carrying capacities (EC, 2007d). Rail has thus the potential to reduce emissions of greenhouse gases from freight movements if a shift from road systems can be achieved. However, the use of rail freight may not always be practical due to insufficient or inadequate infrastructure, inflexibility of rail systems when dealing with inter-urban markets and the greater suitability of certain goods for road transport.

Rail had a 10 % share in the movement of freight in 2005. Challenges facing rail freight include the fragmented nature of European rail networks (ECMT, 2003), low reliability in comparison with other modes and the greater competitiveness of road haulage. Reliability issues relate to reduced availability of track paths for freight during the day due to the prioritisation of high-speed movement of passengers. In addition, rail freight stops en route are more frequent, and border procedures may be complicated, contributing to the decline in modal share (EC, 2007d).

Rail freight providers have been unable to retain clients even within their core market. In order to capture a greater share of the freight market, rail freight must address its high overhead costs and respond to the inherent flexibility offered by road transport vehicles (ECMT, 2003). However, sometimes rail cannot compete with road, for example due to physical capacity constraints and limited inter-urban capacity. In addition, new rail infrastructure faces public opposition and environmental constraints.

The types of goods transported also tend to determine which mode is used. In 2004, the largest proportion of goods transported by rail were machinery, transport equipment, manufactured and miscellaneous articles (21 %), followed by metal products (18 %). The largest proportion of goods transported by road were crude and manufactured minerals and building materials (48 %), followed by machinery, transport equipment, manufactured and miscellaneous articles (19 %) (data refer to Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, the Netherlands and Spain).

During the last 15 years, high-speed rail for passenger transport has increased rapidly from 15.2 billion pkm in 1990 to 76.3 billion pkm in 2004. Countries investing in high-speed rail include Belgium, Germany, Spain, France, Italy, the Netherlands, Finland, Sweden and the United Kingdom. Speed and reliability are often key factors in encouraging the use of rail compared to other passenger modes such as road, or aviation for longer distances. The expansion of high-speed rail for passenger purposes can therefore increase rail's competitiveness for a higher mode share and will also work towards interoperability within the EU. Although rail emissions are reduced through the use of new lines that decrease the need for acceleration and braking, it is still the case that rail transport fuel consumption increases exponentially at high speeds. An increase in speed from 225 km/h to 350 km/h on a high-speed rail line between London and Edinburgh can reduce journey time by 45 minutes but can nearly double energy consumption (Kemp, 2004).

New European Community directives (rail packages) promote open access and attempt to level the playing field with respect to rail charges. It remains to be seen how effective these instruments will be in delivering change.

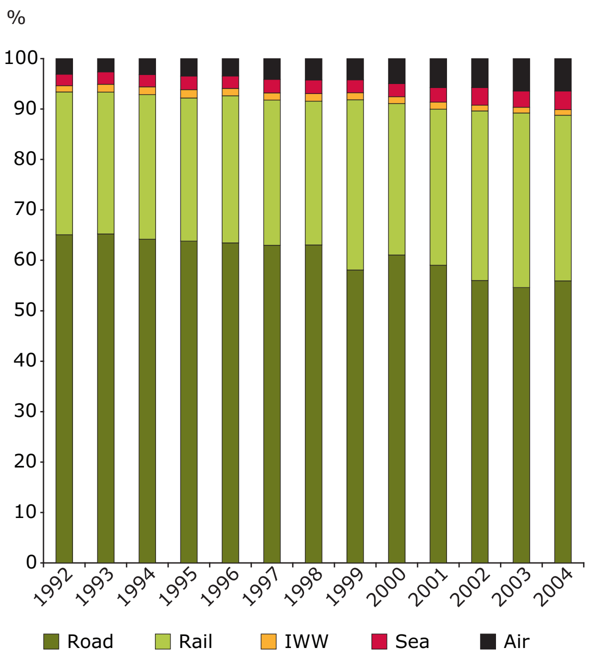
Sections of the rail industry have begun to embrace environmentally sustainable transport, addressing the environmental consequences of rail infrastructure and equipment. The Ecotransit database allows comparisons of carbon emissions between rail and other modes with respect to specific destinations (see www.ecotransit.org/).

The Environmental Noise Directive (2002/49/EC) requires that Member States produce strategic noise maps for transport sources with sufficiently high traffic volumes in order to assess the exposure of noise on the population. Member States are then required to publish noise action plans to reduce noise levels where limits are exceeded.

Improving the environmental performance of rail travel

Rail is increasingly turning to electrical power instead of diesel power units, raising the possibility of using a range of primary energy. The carbon footprint of rail is thus dependent upon how the electricity is generated. Train operators are also able to influence the energy efficiency of rolling stock. For example, new intercity double-deck cars offer 40 % more seats than a traditional intercity car for the same level of energy consumption. Additionally, the use of regenerative braking allows some energy to be fed back to the grid. In noise-sensitive areas, traffic management and operational measures can reduce the problems.

Figure 8.1 Investment in EEA member country rail infrastructure



Note: IWW = Inland Water Way.

Source: EEA, 2008 (based on data from International Transport Forum — formerly known as ECMT).

Rail viability is closely linked to investment in infrastructure. The length of railway lines in EU-25 Member States has remained the same or decreased since the early 1990s. In 2004, there was a total of 197 937 km of railway lines (EU, 2007b). One of the key barriers to expanding the rail infrastructure network to optimise the mode as an alternative to road transport is the high level of investment required. When considering the level of investment in infrastructure in EEA member countries, rail's share is still relatively low compared to road transport but high compared to its share of traffic.

Rail increased from a 29 % share of investment in 1994 to 33 % in 2004, compared to 56 % in road infrastructure in 2004 Similar trends are observed in EU-15 Member States (from 30 % to 36 % share), whereas the share of investment in rail infrastructure in EU-10 Member States is much lower and declining (from 20 % to 13 % share over the same period) (ECMT, 2007).

9 Focus on air transport

Passenger air transport continues to grow faster than passenger transport in general. Air freight grew slightly slower than overall freight transport. Because transport volumes grow much faster than energy efficiency improves, the total emissions of greenhouse gases tend to grow rapidly.

Use of air transport has increased rapidly since 1995, both within Europe and in the rest of the world. Intra-EU air passenger transport grew by 49 % between 1995 and 2004 while air freight transport grew by 31 % between 1995 and 2005 (EU-25) (DG TREN, 2007a). Moreover, air transport continues to grow faster than increases in efficiency, meaning that it is responsible for an increasing amount of greenhouse gas emissions. The bulk of these emissions increases are due to international aviation, which is excluded from consideration under the Kyoto Protocol and, for the time being, is also outside the scope of agreed EU emission-reduction targets.

The growth in air passenger transport far exceeded growth by any other mode. Between 1990 and 2005, total CO_2 emissions from EU aviation grew by 73 % (ETC, 2006). Air transport to destinations outside the EU-25 accounted for 60 % of these emissions. In 2005, CO_2 emissions from all flights leaving the EU-25 totalled 142 Mt CO_2 (ETC, 2006) compared to total weighted greenhouse gas emissions of 4 980 Mt CO_2-equivalent in the same year (DG TREN, 2007a). The contribution from Intra-EU-25 aviation to greenhouse gas emissions continues to rise and reached 12 % of total EU-25 transport greenhouse gas emissions in 2005. Table 9.1 shows the split between domestic, intra-EU and extra-EU passenger and freight air transport for 2005.

Table 9.1 2005 passenger and freight air transport

	Total air passengers (1 000)	Total air freight (tonnes)
Domestic	161 957	675 758
International intra EU-25	298 597	1 518 996
International extra EU-25	245 266	8 758 907

Source: DG TREN, 2007a.

In addition to CO_2, aircraft engines also emit oxides of sulphur and nitrogen, carbon monoxide, particulates, water and unburnt hydrocarbons, resulting in additional impacts. The majority of these pollutants, as well as aircraft noise, affect the local environment but also have impact on the climate. The CO_2 figures alone do not take into account the additional radiative forcing impacts associated with aviation due to these other emissions. There continues to be scientific uncertainty about the scale of these additional effects and how to account for them in assessments, in part because of the difference in lifetime of the different emitted compounds in the atmosphere.

Projections indicate that intra-EU passenger air transport will continue to rise at approximately 4.5 % annually and will double in the period 2000 to 2020 (De Ceuster, 2005). International air passenger projections are for an annual average growth rate of 5.6 % in the period 2005–2009; for international air freight the figure is higher at an annual 6.3 % to 2009 (IATA, 2005). Based on a conservative overall annual projected increase of 5 % in EU aviation (both intra EU-25 and extra EU-25) and current aircraft efficiencies, the projected CO_2 emissions associated with all air transport departing from EU-25 airports by 2020 will be in the region of 284 Mt CO_2. This could threaten the ability of the EU to meet increasingly ambitious emission reduction targets.

In December 2006, the Commission adopted a proposal for legislation modifying the Emissions Trading Directive 2003/87/EC that will include aviation in the ETS. The proposed legislation would cover emissions from all intra-EU flights from 2011 and all international flights from 2012. The expected effect of this would be to cap aviation emissions at 2004–2006 levels, providing a 46 % reduction in emissions by 2020 compared to the 2004–2006 baseline. In November 2007, the European Parliament voted to adopt the first-reading of a report that

Reducing the impacts of aviation on climate change

In September 2005, the Commission published a communication (EU, 2005) considering policies to reduce the climate change impacts of aviation. In terms of research, the EU plans to place more emphasis on 'greening' air transport and a greater focus on its impacts on climate change. A key element of the strategy was the incorporation of aviation into the European Emission Trading Scheme (ETS). Apart from emission trading, the 2005 strategy also proposed to continue and strengthen a number of existing efforts, including efficiency improvements in air traffic management and more focus on research and development in 'green' air transport.

went further, capping aviation emissions at 90 % of the 2004–2006 level and including all flights between the EU and the rest of the world by 2011. On 20 December 2007, the Council reached a political agreement on its first-reading position, and the co-decision process is expected to be finalised at the end of 2008.

The most fuel-efficient jets use 3.5 litres of fuel per 100 pkm. This is about 60 % less than their 1970 equivalents (Peeters *et al.*, 2005); an improvement due to developments in airframe and engine efficiency. Manufacturers expect the next generation of jets (A380, B787) will use less than 3 litres of fuel per 100 pkm and expect further annual efficiency gains of 1.2 %. Significant improvements in overall fuel efficiency, up to 56 %, may be possible, but only with lower aircraft speed (Akerman, 2005). This highlights the fact that fuel efficiency is only one of a number of factors in the design of new aircraft and engines, alongside speed, comfort, safety and regulations.

Alternatives to fossil aircraft fuels are being sought and discussed. The International Air Transport Association (IATA) has called for 10 % of aircraft fuel to be from alternative sources by 2017. Hydrogen has been put forward as a long-term low-emission solution to aircraft power and unmanned hydrogen fuel cell-powered trial craft have flown (Bradley *et al.*, 2007).

Passenger load factor (PLF) is clearly a determinant of per-passenger aviation fuel/emission efficiency and has risen in recent years. The Association of European Airlines reported a record average PLF of 82.2 % in July 2007 following steady increases since 1994. Overall aircraft load factors result from a range of considerations, including aircraft design, seat type and configuration, pricing etc. and while it can contribute to reduced emissions, it is an indirect route to this end. PLF is about 12 % lower for short-haul flights than for long-haul flights (AEA, 2007).

Carbon offsetting

A number of airlines promote carbon offsetting as part of their flight package or as a product available that can be bought in-flight. Such voluntary offsetting involves paying a sum additional to the cost of the flight ticket to the airline, or direct to a carbon offsetting company. The sum paid depends on distance and in some cases flight class. Carbon offsetting companies acquire carbon credits through investment in projects around the world that reduce carbon dioxide emissions such as renewable energy projects, energy-efficiency projects and tree planting. Best practice as set out in the carbon offsetting Gold Standard (www.cdmgoldstandard.org) allows only renewable energy and energy-efficiency projects to be supported.

Greater air traffic management efficiency

Inefficiencies in Europe's air traffic management (ATM) systems caused flights in Europe (37 states) to travel on average nearly 50 km of 'route extension' to reach their destinations in 2006, resulting in extra costs and additional emissions of 4.7 Mt CO_2 (Eurocontrol, 2007). This problem affects international flights more than it affects domestic flights. The Single European Sky (SES) initiative, as the logical solution to ATM inefficiency, has not yet overcome it. It is commonly quoted that greater ATM efficiency in Europe could achieve emissions savings of 6–12 % but with increasing flight-hours (4.9 % increase 2005–2006), the pressure on ATM systems continues to rise. It may be that until the technological solutions promised by the SES ATM research (SESAR) project are in place, flight inefficiencies will continue to cause additional greenhouse gas emissions. Some research has concluded that the hub-and-spoke system favoured by large carriers is less efficient in emissions terms than hub bypass, or direct links to often smaller airports used by low-cost carriers, partly due to congestion at large airport hubs (Morell and Lu, 2007).

10 Focus on waterborne transport

Transportation of people and goods by water is one of the lowest polluting modes. For freight it is also one of the most important modes. Waterborne transport is, however, by far the largest sulphur emitter in the transport sector. The tendency to employ high-speed ships for passenger transport reduces the environmental advantage because of high energy consumption and other problems such as noise.

The European Union relies on maritime transport for trade with the rest of the world; approximately 90 % of the EU's external trade and 40 % of its internal trade is transported by water, accounting for around 3.5 billion tonnes of freight loaded and unloaded at EU ports every year (EC, 2006d). Sea freight grew by 34 % between 1995 and 2005 in the EU-25 Member States, bringing the share of freight carried by sea to 39 % (1995–2005, domestic and intra-EU-25 transport only). Sea passenger travel decreased by 11 % between 1995 and 2004 (DG TREN, 2007a).

Inland waterways also have an important role to play in moving freight, and in 2005 accounted for just over 3 % of freight moved in the EU-25 (DG TREN, 2007a). In 2004, the total length of inland waterways, including navigable canals, rivers and lakes that are regularly used for transport was 35 317 km (EU-25), an increase of 1 625 km (5 %) since 1994. The benefits of inland waterways include reliability and unexploited capacity. The energy efficiency of inland waterways is also a key benefit and ensures that it is a competitive alternative to rail and road transport. It has been estimated that the energy consumption per tonne-km of transported goods by inland waterway is one sixth the consumption of road transport and half that of rail. The external costs of inland navigation are also anticipated to be up to seven times lower compared to road transport (including accidents, air and noise pollution and congestion) (EC, 2007e).

The majority of ports within Europe are continuing to grow in terms of the volume of freight loaded and unloaded (see Table 10.1).

As the transportation of goods and people by sea has lower carbon emissions per tonne/passenger-kilometre than other transport modes, negative environmental impacts can also be reduced by switching to sea transport. Through the Trans-European Networks (TEN-T) Programme the Commission is supporting the development of the 'Motorways of the Sea' concept in four regions. The aim is to develop integrated short sea shipping connections that provide a door-to-door service that can match or be better than that offered by road-only journeys. The regions are the Baltic Sea,

Table 10.1 Freight traffic at major EU seaports (million tonnes loaded and unloaded)

Port	Country	1990	2000	2001	2002	2003	2004	Change 1990/2004 (%)
Rotterdam	Netherlands	288.0	320.0	313.7	320.9	327.0	352.8	+ 22.5
Antwerp	Belgium	102.0	130.5	130.1	131.6	142.9	152.3	+ 49.3
Hamburg	Germany	61.0	85.9	92.7	98.3	106.5	114.5	+ 87.7
Marseille	France	90.0	94.1	92.4	92.3	95.5	94.1	+ 4.6
Le Havre	France	54.0	67.5	69.0	68.0	71.5	76.2	+ 41.1
Amsterdam	Netherlands	47.0	64.1	68.3	70.4	65.5	73.2	+ 55.7
Algeciras	Spain	25.0	44.0	49.0	51.3	56.8	61.3	+ 45.2
Grimsby and Immingham	United Kingdom	59.7	50.0	51.4	52.2	51.3	57.6	– 3.5
Genoa	Italy	44.0	50.8	50.2	51.7	53.7	55.8	+ 26.8
Tees and Hartlepool	United Kingdom	40.0	51.5	49.7	50.4	53.8	53.8	+ 34.5

Source: DG TREN, 2007a.

Western Europe (Atlantic Ocean, North Sea and Irish Sea), South-western Europe (western Mediterranean), and south-eastern Europe (Adriatic, Ionian and eastern Mediterranean) (EC, 2006c).

To support a modal shift from road to sea, industry will have to offer reliable, cost-effective and efficient services. The Commission's vision is therefore to achieve key sea routes between EU Member States that would offer regular, high-quality services that combined with other transport modes would offer shorter and quicker access to Europe's outlying regions and bypass geological bottlenecks such as the Alps and Pyrenees (EC, 2006c).

Cargo ships over 500 grt (gross register tonnage — the total internal volume of a vessel) are responsible for the majority of emissions on the EU seas. Approximately 45 % comes from EU flagged ships. 20 % of emissions are emitted within the 12-mile territorial zone, and in port cities, emissions from ships tend to be the dominant source of air pollution. However, where pollutants are emitted at sea, the effects may still be experienced on shore, because air pollutants travel hundreds of kilometres (EMSA, 2007). In terms of CO_2, the quantity emitted by EU flagged ships in 2000 was close to 200 million tonnes, which was significantly higher than emissions from EU aviation.

Whilst shipping has significant advantages in terms of overall carbon emitted per tonne pollution, sulphur emission is still a concern. Ships have become the largest source of sulphur dioxide (SO_2) emissions in the EU. Emissions of sulphur oxides (SO_X) give rise to human health problems and acidification, which is a problem for lake and forest ecosystems. Given the international nature of much of the world's maritime activities, intervention to reduce sulphur in maritime fuels may need to occur at an international level, possibly within the United Nations Convention for the Prevention of Air Pollution from Ships.

The level of sulphur permitted in marine fuel is currently 45 000 ppm (4.5 %) compared to 50 ppm for petrol cars. Directive 2005/33/EC addresses the sulphur content of marine fuels and has introduced a 0.1 % (1 000 ppm) maximum sulphur content requirement for ships at berth in EU ports from 1 January 2010. SO_X emission control areas (SECAs) have been implemented for the Baltic Sea area, the North Sea and the English Channel. Within the SECAs, the sulphur content of fuel cannot exceed 1.5 % sulphur by mass (15 000 ppm).

NO_X is another pollutant that is harmful to health and the environment. Emissions of this pollutant from maritime and waterway traffic is increasing due to the looser international regulation on maritime engines and fuels (UNECE, 2007).

In addition to the emission of pollutants, noise from shipping activities is also of concern, in particular in relation to marine life. There are currently a number of uncertainties regarding the specific impacts that this noise may have on marine life, but it is believed the ambient noise in certain frequency bands (primarily low) can interfere with marine animal communication signals.

Due to the large loads that can be carried by water transport, energy efficiency per tonne or per passenger can be very high. However, the need to compete with other modes has often meant that the speeds travelled at sea to deliver people and goods have increased (such as the introduction of high-speed ferries), thus reducing the overall energy efficiency of the mode, and increasing noise and air pollution problems.

Table 10.2 Example of average CO_2 index and average gross tonnage for ship groups

Vessel type	grt	Average emissions CO_2 (g/tkm)
Refrigerated cargo	10 000	124
Roll-on roll-off cargo	49 000	96
LNG tanker	79 000	66
Container	39 000	25
Chemical tanker	21 000	24
Crude oil tanker	58 000	8
Bulk dry	82 000	8

Source: Estimates provided by DG ENV, unpublished.

CO_2 emission indexing for ships

The amount of CO_2 emitted from ships is directly related to their consumption of bunker fuel oil, which therefore acts as a source of information on the energy efficiency of ships. The International Maritime Organization (IMO) has published guidelines on voluntary CO_2 indexing to be undertaken by ships. The index considers the total fuel consumption, distance travelled and the cargo mass being carried. The use of such an index can promote the energy efficiency of ships, whilst identifying areas for improvement in daily operation. However, in order to reduce emissions from shipping, indexing needs to be implemented within emission reduction schemes with established reference levels (IMO, 2005).

11 Focus on non-motorised transport

Cycling and walking have an important role to play in sustainable transport systems. They provide access to public transport and provide alternatives to the use of the passenger car for short local trips.

Statistics for non-motorised transport modes and activities are not routinely collected in Europe, and have not been published by Eurostat since 2000 due to difficulty in obtaining reliable and consistent information (see Figures 11.1 and 11.2). It is therefore difficult to analyse or monitor trends in cycling and walking activity within the EEA member countries. Where data is collated at a national level, it is often in a variety of formats, incomparable with data from other countries.

In the Netherlands, trends show that the Dutch cycle more than they used to, with the distance covered increasing to 14 billion km by bicycle in 2005 (an average of 2.5 km per day per person), an increase of 10 % since 2002. In the United Kingdom, walking has reportedly declined by 1 % (from 322 km to 317 km per person per year) and cycling by 16 % (from 69 km to 58 km per person per year) during this period (DfT, 2006).

The promotion of cycling and walking to achieve a shift away from motorised transport will address not only policy objectives related to transport, but also those focused on climate change, health, social inclusion and community cohesion, and energy security. Approximately 80 % of citizens within the European Union live in urban areas, and 60 % of these live in areas with more than 10 000 inhabitants (EC, 2007a). European citizens make, on average, 500 trips per year, shorter than 5 km. Cycling and walking could therefore be a realistic alternative for many of these trips (EC, 2007f).

Cycling and walking tend to generate a variety of local benefits, particularly in terms of increased social cohesion where areas become progressively traffic free, and improved health and physical fitness when undertaken as regular exercise. Health benefits can include maintaining ideal and healthy body weight (thereby reducing associated health risks), prevention of falls and osteoporosis, and mental health and wellbeing (Sustrans, 2006). In terms of the economy, healthier employees may benefit their employers through reduced absenteeism, lower turnover rates, improved productivity and employee

Barriers to increased cycling and walking

Safety (actual and perceived) is one of the primary barriers: non-motorised users are amongst the highest casualty groups in accidents involving motorised transport. It is understood that as more people cycle, the safer it becomes for each cyclist. According to Jacobsen's Growth Rule, if the amount of cycling doubles, the risk per cyclist falls by 34 %. If cycling halves, the risk per cyclist increases by 52 % (Jacobsen, 2003). Policy on the wearing of cycle helmets varies across Europe, but where it is compulsory there are concerns that it can discourage potential cyclists. Security is also an issue, particularly for bicycle theft and vandalism, and for pedestrians walking alone at night. Networks, rather than individual routes for cyclists will ensure higher ridership, whereas high-quality footpaths, crossings, cycle parking and other amenities will increase the attractiveness of cycling and walking. Journey distance and purpose can also create barriers for the use of non-motorised modes. UK travel survey data shows that for shopping trips 51 trips per person per year are undertaken by walking, compared for 82 by car as driver (42 as passenger) (DfT, 2006). However, the average length of walking trips is 1 km, compared to 8.4 km for car as driver (10.9 km car as passenger), illustrating that it is mainly shorter shopping trips that are likely to be undertaken on foot.

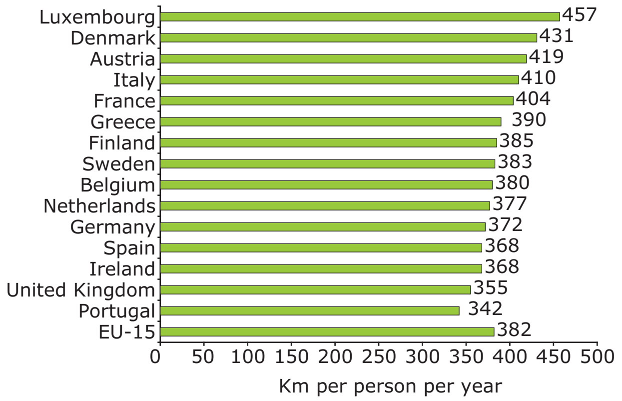
morale, and lower health care costs. For example, monitoring in Finland has shown that employees undertaking an average of 157 minutes of physical activity per week took on average three days of sick leave per year, compared with eight days for those who undertook 48 minutes of physical activity per week (Kunto-Finnish Sport for All Association, Sustrans, 2005). Promotion of walking and cycling could therefore help improve the health of Europe's workforces while helping reduce emissions of greenhouse gases.

A variety of factors influence levels of cycling and walking in towns and cities, including bicycle ownership, location of key services and activities in relation to residential areas, density of the public transport network, car ownership, demand management measures (including parking restrictions and pricing), topography and climatic factors. Journey purpose is a major consideration when determining mode selection. Most common journeys are for employment, education, shopping and leisure purposes. Whilst cycling and walking may be viable modes for travelling to places of employment and education (dependent on distance, nature of employment etc.), they may be less so for shopping, due to limited carrying capacity.

The European Commission Green Paper on Urban Mobility identifies promoting cycling and walking (through improving their attractiveness and safety) as a potential contributor towards tackling growing congestion problems, which are having negative economic, social, health and environmental impacts and degrading the natural and built environment (EC, 2007a). This could be achieved by ensuring that cycling and walking are integrated into the development and monitoring of urban mobility policies; the provision of adequate infrastructure; and involving cities, companies and schools in the promotion of cycling and walking.

Figure 11.1 Walking rates in 2000 (EU-15)

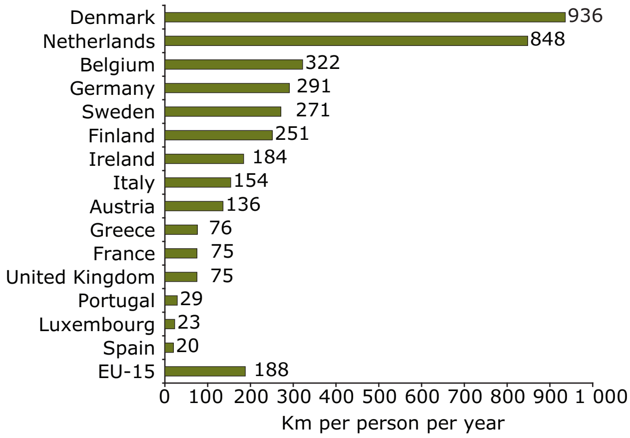
Walking data for EU-15 Member States show an average of 382 km per person *per annum* in 2000. Luxembourg (457) and Denmark (431) have the highest levels, whereas the United Kingdom (355) and Portugal (342) have the lowest.



Source: Eurostat, 2000.

Figure 11.2 Cycling rates in 2000 (EU-15)

The differences in cycling are vast: levels in Denmark and the Netherlands are 946 km and 838 km per person per year respectively, whereas people in countries such as Luxembourg and Spain are cycling just 23 km and 20 km per year respectively.



Source: Eurostat, 2000.

Increasing cycling by European Commission staff in Brussels

The European Commission in Brussels has set a target of reducing the use of private cars amongst Commission officials commuting to work by 35 % by 2009 (aiming to increase the share of bicycle trips from 17 % to 19 %). The European Commission has provided 200 bicycles for its staff as a means of increasing the use of alternative and sustainable modes of transport. The bicycles are increasingly being used for short-distance work-related trips within the city. Between January and June 2007, there was an increase of 30 % in the use of these bicycles compared to the same period in 2006. Measures that have been implemented to encourage increased levels of cycling have included increasing the number of bicycle racks in the parking garages to 2 400, providing changing rooms and showers for those cycling to work, and initiatives such as 'Friday Bikeday' (EC, 2007f).

12 Focus on land use and transport planning

The integration of land use and transport planning can be instrumental in managing the demand for transport in Europe's towns and cities. Spatial planning can facilitate walking, cycling and the use of public transport for the majority of travel purposes, thereby reducing the negative impacts on the environment of private vehicle use and provide social and economic benefits.

Integrated land use and transport planning is a key tool in managing the demand for travel and transport. It is widely acknowledged that urban design affects travel patterns. For example, some land use patterns are essentially inaccessible by public transport and discourage more sustainable travel, such as walking or cycling. Today, the aim is often to reduce the movement of non-essential traffic through new housing areas, towns and cities, whilst increasing accessibility to and viability of public transport services and non-motorised modes. Across the EU-15, cities account for approximately 80 % of all congestion costs, road accidents in cities lead to 20 000 fatalities each year and another 20 000 fatalities outside cities, more than 100 000 premature deaths each year can be attributed to traffic pollution, and urban transport contributes approximately 40 % of transport-related CO_2 emissions. German research suggests that there are 1 800 premature deaths — most in urban areas — each year through excessive noise (ECMT, 2006). Therefore, through implementing land-use changes and stimulating more sustainable travel patterns, emissions of greenhouse gases and other negative transport-related impacts can be reduced.

To deliver integrated land use and transport planning there is a need at the national level for greater collaboration between the Transport Ministry and other ministries that influence transport, such as Finance, Planning, Environment and Industry (ECMT, 2006). Barriers arising from inconsistent policies are identified in ECMT reports on CO_2 abatement, road safety and accessibility. Failures have also been identified in ECMT reports on sustainable transport and on the successes and failures of transport policy. Without high-level coordination, the delivery of integrated transport and land use planning will rest in the hands of pioneering authorities rather than be a common deliverable across Europe.

At regional and local levels, similar coordination is needed between transport and land use. Moreover,

Land-use strategies influencing travel patterns

- Increasing densities to increase the viability of local services that are accessible on foot or by bicycle, as well as increasing the viability of public transport.
- Changing the mix and layout of development components to deliver local services and employment opportunities.
- Concentrating dense development within transport corridors.
- Reducing parking space as a trip-end restraint.
- Requiring developer contributions to transport infrastructure and including provision of public transport services as a part of the planning consent process.
- Requiring payments from commuters to aid delivery of public car parks or park-and-ride schemes.
- Adopting measures such as travel plans to reduce car use.
- Locating development close to nodes accessible to public transport.

the transport impacts of policies on health, education and social inclusion, and the potential contributions of transport to those policies, need to be fully integrated into the overall strategy. The ECMT has shown that despite widespread agreement that spatial and transport planning need to be coordinated, it remains a remote objective for many cities. Urban transport and spatial planners still have difficulties finding a 'common language', skills and knowledge, even when policy and institutional structures are designed to promote interaction. As with the other sustainability imperatives cited above (health, education and social inclusion, etc.), the task of integration has become more complex.

Where integration of transport and land use planning has occurred, transport technology and transport costs have always been among the key determinants of urban location and form (ECMT, 2006).

Suburbanisation based upon the private car has taken place and pressure is mounting for new settlements or expansions to existing urban areas. In turn this is accompanied by the loss of open space, decaying historical urban structures, urban air and water pollution, traffic congestion, the loss of a sense of community, patchwork housing developments on what were once agricultural land, the separation of residential from work locations and greater public investment requirements.

Within urban areas, there are a variety of key traffic generators, including housing, shops, healthcare, business and offices, all increasingly located at the edge of urban areas or greenfield locations. The transport and travel patterns associated with these key services and activities need to be considered at the planning stage to ensure sustainable travel patterns can be integrated.

With the growth in the movement of goods, attention has been given to measures designed to manage the flow of goods vehicles in urban centres. The planning system may respond to the effects of new development upon traffic congestion, air quality, noise levels and road safety by restricting when delivery vehicles may operate. It may also specify the routes that may be used. The types of policy measures vary but include freight quality partnerships, effective road signing, lorry routes, real time information systems on urban congestion, weight restrictions, access time restrictions, low-emission zones, controlling night-time deliveries, freight-only road lanes, road pricing, freight transport management systems, traffic management systems, vehicle type restrictions, urban consolidation centres and collection point services (particularly within Belgium, Luxembourg, France and the Netherlands). Across Europe, the freight logistics industry has also responded by altering delivery schedules and making changes to its vehicle fleets.

In the Netherlands, 53 % of cities have time restrictions on when freight vehicles may enter the cities. 43 % have vehicle restrictions and 59 % have restricted access (Guis, 2006). This has resulted in freight villages, urban consolidation centres and measures to address the growth in home deliveries led by e-commerce. Paris is addressing growth in freight though a 10-year plan offering four major rail freight facilities (Batignolles, Evangile, Bercy and les Gobelins) connected with each other by rail (Mairie de Paris, 2006). Land (on average 90 000 square metres) is provided in the City masterplan, as well as an array of other activities such as warehousing and transit, concrete processing and waste processing. This plan encourages the mass handling of goods at the logistic centres with urban distribution by environmentally friendly vehicles.

Car-free housing developments

Along with urban development, spatial planning has delivered a variety of measures aimed at reducing congestion and promoting public transport and non-motorised modes. Often designed in conjunction with other congestion-reducing measures (for example, car clubs and lift-share schemes) car-free housing developments have increased in number. Local authorities and other planning bodies are directly contributing to this process through a range of incentives. Car-free housing is also being introduced in cities such as Amsterdam, Berlin, Bremen, Munster, Vienna, Cambridge, Glasgow and Edinburgh. Car-free housing has also been linked with mobility management initiatives where designs address non-motorised modes such as the walking bus in County Meath, Ireland (Kollinger, 2007; DG TREN, 2007b; DG TREN, 2007c).

13 Focus on transport mode comparisons

The occupancy rate of different transport modes can, in many cases, be a more significant factor in the resulting relative emissions of greenhouse gases compared to the specific efficiency of modes. In addition to technological improvements, policies to ensure better capacity utilisation within each mode may result in substantial additional reductions of emissions of CO_2.

Transport users tend to base their choice of transport mode on functional characteristics and price rather than on environmental performance. It is therefore no surprise that present mode choice has unintended environmental consequences. Internalisation of environmental costs into the charges paid to use transport modes and infrastructure, as will be proposed in the summer of 2008 by the Commission, will go some way towards remedying the problem, but differences in how each mode serves users can still cause users to select options that are not the best when seen from an environmental angle.

This chapter focuses on the performance of different modes of transport in relation to greenhouse gas emissions. Comparisons are usually made on the basis of averages. Distribution around those averages can be wide. For example, whilst an average journey by average car with average number of passengers is likely to be more polluting than an average trip by rail, a full hybrid car is likely to be less polluting in terms of emissions per passenger-kilometre than a rural, off-peak diesel train.

Passenger cars

Approximately 12 % of the overall EU emissions of CO_2 come from fuel consumed by passenger cars. Depending on the engine type and size, fuel type, driver behaviour and, importantly, car occupancy, the emissions of CO_2 from passenger cars expressed as emissions per passenger-kilometre (pkm) can vary significantly. Improvement in efficiency, driven by the voluntary commitments by car manufacturers, has almost come to a standstill and the occupancy rate is gradually decreasing. In addition, there are increasing emissions tied to use of auxiliary equipment such as air conditioners, which are not covered by the measurements made for type approval of vehicles. On a per-vehicle basis, emissions listed in the type-approval range from around 100 to 500 g CO_2/km.

Air travel

Many organisations and airlines have published calculations of the actual CO_2 emissions per pkm for air travel, which fall into the range of 77 to 240 g CO_2/pkm for short haul, and 118 to 153 g CO_2/pkm for long haul (Transport Watch, 2007). However, this is based on 80 % occupancy rate for all types of aircraft, which in reality can vary greatly. Short-haul air travel tends to have higher emissions of CO_2 per pkm due to the proportion of trip attributed to landing and takeoff (which has higher fuel consumption). Turboprop planes are, on the other hand used on many short routes, and are significantly more efficient than jets. The full climate

Factors affecting emissions from transport vehicles

- Vehicle characteristics: weight, vehicle shape, engine type, fuel type and loading capacity.
- Operational characteristics: driving speed and driving dynamics (speed variations while the vehicle is being driven, acceleration and deceleration).
- Logistical characteristics: occupancy rates, density of infrastructure networks which may determine the distance travelled.
- Life-cycle emissions tied to provision and maintenance of infrastructure, vehicles, fuels, etc.

impacts of air travel go beyond CO_2 emissions, although the scale of these impacts is still uncertain. Water vapour and nitrogen oxides emissions are non-CO_2 climate gases, which imply that the total climate impacts are larger than from CO_2 alone.

Rail

The key variable in rail is engine type: diesel or electric. Whilst emissions from diesel engines are direct, electric rail has no direct emissions. It is therefore more difficult to identify the emissions of CO_2 per pkm for electric rail as the electricity energy sources vary greatly between countries. Other variables include the differences between urban and long-distance rail, and the occupancy levels onboard, which can change greatly over the duration of a trip. High-speed rail, which is becoming more popular within Europe, generally emits higher levels of CO_2 per pkm. Typical emission values are 45–130 and 80–165 g CO_2/pkm for normal and high-speed rail.

Bus and coach

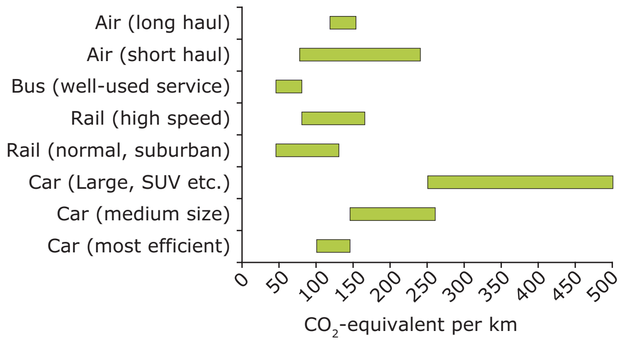
Buses and coaches can be energy efficient when compared to other methods of urban and long-distance travel (45–80 g CO_2/pkm) particularly where demand is high (i.e. higher passenger occupancy rates) and cleaner/alternative fuels are being used. Occupancy level can therefore have a significant effect on the fuel efficiency of public transport per pkm, making it one of the most environmentally friendly methods of urban travel.

Non-motorised modes

As discussed earlier in this report, non-motorised modes such as cycling and walking have few, if any, emissions of local or global air pollutants. Indirect emissions from the manufacture of bicycles and accessories are the limited impacts of these modes. Therefore, cycling and walking should be at the forefront of any hierarchy of sustainable modes, particularly when considering travel within urban areas and in the context of land-use planning.

Figure 13.1 Approximate greenhouse gas emissions across different modes of transport

Figure 13.1 shows the range of emissions per passenger-kilometre for different mode choices. Air, bus and rail assume realistic load factors whereas car assumes one person per car. If more people use the car, the emission per person will be proportionally lower. Also the real distance travelled must be taken into account, for example planes fly in a more direct line.



Source: Adapted from AEF, 2007.

Rail versus air travel — Eurostar example

Eurostar recently compared CO_2 emissions from its services between the United Kingdom and France/Belgium to emissions from air travel on the same routes. In all cases, the results showed that rail was more energy efficient.

Trip/mode	CO_2 (kg/ passenger trip — return)	CO_2 (g/pkm)	Journey time (one-way direct — information from service provider web sites)
London–Paris (return)			
Short-haul (average) Heathrow	122	168	1 hour 40 minutes
Eurostar	10.9	11.0	2 hours 45 minutes
London–Brussels (return)			
Short-haul air (average) Heathrow	160	219	1 hour 15 minutes
Short-haul air (average) Gatwick	222	322	1 hour 5 minutes
Eurostar	18.3	24.3	2 hours 20 minutes

The figures used in the study were based on actual passenger numbers, exact distances of the rail and air routes, actual aircraft types used on the different routes and the mix of electricity sources used by Eurostar trains. Transport from city centre to airport was not included for aviation (Paul Watkiss, 2007).

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Metadata and supplementary information

Throughout the report abbreviations are used to refer to specific country groupings. The following definitions are used:

- EU-15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
- EU-10: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.
- EFTA-4: Iceland, Liechtenstein, Norway and Switzerland
- CC-1: Refers to Turkey.
- EU-12: EU-10, Bulgaria and Romania.
- EU-25: EU-15 and EU-10.
- EU-27: EU-15 and EU-12.
- EEA-32: EU-27, EFTA-4 and CC-1.

Where other groupings are used, they are generally described in the text and in the metadata.

Chapter		Supplementary information
2	Freight transport growth outpaces economic growth	**Figure 2.1** **Note:** No data available for Switzerland or Liechtenstein. GDP is in euro at constant 1995 prices. Freight transport (tonne-kilometre) includes transport by road, rail and inland waterways. Short-sea shipping and oil pipelines are excluded due to lack of data. **Source:** EEA Core Set Indicator 036, to be published (based on Eurostat 2007). **Figure 2.2** **Note:** No data available for Switzerland and Liechtenstein. **Source:** EEA Core Set Indicator 036, to be published (based on Eurostat 2007).
3	Passenger transport continues to increase	**Figure 3.1** **Note:** No data available for Bulgaria, Cyprus, Estonia, Latvia, Lichtenstein, Lithuania, Malta, Romania, Switzerland. GDP is in euros at constant 1995 prices. Passenger-kilometre includes transport by road, rail and bus. **Source:** EEA Core Set Indicator 035, to be published (based on Eurostat 2007 and updated data received in 2008). **Figure 3.2** **Source:** Eurostat, 2007.
4	Greenhouse gas emissions grow due to transport growth	**Figure 4.1** **Source:** EEA, 2008. Data compiled by European Topic Centre for Air and Climate Change. **Figure 4.2** **Source:** EEA, 2008. Data compiled by European Topic Centre for Air and Climate Change.

Chapter		Supplementary information
5	Harmful air pollutant emissions and air quality	**Figure 5.1** **Note:** The transport emissions data include all of 'road transport' and 'other transport/mobile sources', less the 'memo' items, which include international aviation (landing and take off, and cruise) and international marine (international sea traffic — bunkers). These are reported separately to EMEP for information purposes. **Source:** EEA, 2008. Data compiled by European Topic Centre for Air and Climate Change. **Figure 5.2** **Note:** Bars represent average annual concentrations over a limited number of monitoring stations along busy roads in major European cities (Vienna, Prague, Paris, Berlin, Athens, Krakow, Bratislava, Stockholm and London — NO_X, and Prague, Copenhagen, Berlin, Reykjavik, Rome, Bratislava, Stockholm and London — PM_{10}), error bars represent the highest annual concentration measured at one single monitoring station. The dotted line represents the EU limit set for PM_{10} (2005) and NO_X (2010). **Source:** EEA, 2008. Data compiled by European Topic Centre for Air and Climate Change.
6	Biofuels in transport	**Figure 6.1** **Note:** EU including 25 Member States from 2004. Prior to 2004, the production of the EU-15 was taken into account. However, the biofuel production of the EU-10 was limited during this time. **Source:** Data from DG TREN published as 'Biofuels Barometer' 2007. **Figure 6.2** **Note:** As from 1 May 2004, the Oil Bulletin system changed as a result of Accession Country inclusion. Data has been approximated to the trimester cycle used previously: 19/07/2004, 18/10/2004, 17/01/2005, 18/04/2005, 17/10/2005, 16/01/2006, 10/04/2006, 17/07/2006, 16/10/2006, 15/01/2007, 16/14/2007, 16/07/2007. No bulletin 10/04/2006. **Source:** EEA, 2008. Based on data from DG TREN, European Commission.
7	Focus on road transport	**Table 7.1** **Note:** Totals are for petrol- and diesel-fuelled vehicles only, other fuels and statistically not identified vehicles are not expected to affect these averages significantly. Figures for year 2000 have not been corrected for the change in driving cycle used for type approval. Data for Malta have not been included. Data for 2005 and 2006 have been corrected for the absence of Latvia and Poland. **Source:** T&E, 2007, EC, 2002. **Figure 7.1** **Source:** EC, 2005a.
8	Focus on rail transport	**Figure 8.1** **Note:** No data available for Belgium, Bulgaria, Cyprus, Greece, Hungary, Italy, Luxemburg, the Netherlands, Norway and Turkey. **Source:** EEA, 2008. Based on data from International Transport Forum (formerly known as ECMT).
9	Focus on air transport	**Table 9.1** **Note:** Data limited to EU-25 Member States. **Source:** DG TREN, 2007a.
10	Focus on waterborne transport	**Table 10.1** **Source:** DG TREN, 2007a. **Table 10.2** **Note:** Average grt (gross register tonnage) and CO_2 emissions (g/km) have been used to compile this information. **Source:** Estimates provided by DG ENV, unpublished.

Chapter		Supplementary information	
11	Focus on non-motorised transport	**Figure 11.1**	
		Note:	Data only available for EU-15.
		Source:	Eurostat, 2000.
		Figure 11.2	
		Note:	Data only available for EU-15.
		Source:	Eurostat, 2000.
13	Focus on transport mode comparisons	**Figure 13.1**	
		Note:	Figures have been compiled from a variety of sources and provide only an approximate range of values for mode types (grams of CO_2 per km may be outside the ranges illustrated in the diagram).
		Source:	AEF, 2007.
Data annex		**Table 1**	
		Note:	Switzerland and Lichtenstein not included. Figures in *italics* = Eurostat estimate; Green = Estimate; Red = Break in series.
		Source:	Eurostat 2007.
		Table 2	
		Note:	Switzerland and Lichtenstein not included. Data include freight moved by road, rail and inland waterways.
		Source:	Eurostat 2007.
		Table 3	
		Note:	Switzerland and Liechtenstein not included. Year 2005 only include 'Rail', 'Bus' and 'Car' passenger transport.
		Source:	EEA, 2007. TERM fact sheet 12a (based on Eurostat, 2008).
		Table 4	
		Note:	Switzerland and Liechtenstein not included.
		Source:	EEA, 2007. TERM fact sheet 12a (based on Eurostat, 2008).
		Table 5	
		Source:	Eurostat, 2007.
		Table 6	
		Source:	EEA, 2007 (http://dataservice.eea.europa.eu/dataservice/viewdata/viewpvt.asp).
		Table 7	
		Note:	Iceland, Liechtenstein, Luxemburg, Norway, Switzerland and Turkey not included.
		Source:	EurObservER, 2007, Biodiesel data for 2006 — EEB, 2007.
		Table 8	
		Source:	EEA, 2008. Based on data from International Transport Forum (formerly known as ECMT).

Overview of TERM fact sheets

TERM indicators have been published annually since 2000 subject to data availability. In 2000, the indicators appeared only in the annual TERM report, but since then they have been published individually on the EEA website albeit sometimes with some delay (www.eea.europa.eu/themes/transport/indicators). When the indicator set was defined it was foreseen that data would eventually become available in areas where few data were available at the time. Therefore, not all indicators have been published every year.

<table>
<tr><th colspan="2">Indicator</th><th>2000</th><th>2001</th><th>2002</th><th>2003</th><th>2004</th><th>2005</th><th>2006</th><th>2007</th></tr>
<tr><td>TERM 01</td><td>Transport final energy consumption by mode</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td></tr>
<tr><td>TERM 02</td><td>Transport emissions of greenhouse gases</td><td></td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td></tr>
<tr><td>TERM 03</td><td>Transport emissions of air pollutants</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td></tr>
<tr><td>TERM 04</td><td>Exceedances of air quality objectives due to traffic</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td></tr>
<tr><td>TERM 05</td><td>Exposure to and annoyance by traffic noise</td><td>+</td><td>+</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 06</td><td>Fragmentation of ecosystems and habitats by transport infrastructure</td><td>+</td><td>+</td><td>+</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 07</td><td>Proximity of transport infrastructure to designated areas</td><td></td><td>+</td><td>+</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 08</td><td>Land take by transport infrastructure</td><td>+</td><td>+</td><td>+</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 09</td><td>Transport accident fatalities</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td></td><td>+</td></tr>
<tr><td>TERM 10</td><td>Accidental and illegal discharges of oil at sea</td><td></td><td>+</td><td>+</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 11</td><td>Waste oil and tires from vehicles</td><td></td><td></td><td>+</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 11a</td><td>Waste from road vehicles (ELV)</td><td>+</td><td>+</td><td>+</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 12a</td><td>Passenger transport</td><td rowspan="2">+</td><td rowspan="2">+</td><td rowspan="2">+</td><td>+</td><td>+</td><td>+</td><td>+</td><td rowspan="2">+</td></tr>
<tr><td>TERM 12b</td><td>Passenger transport modal split by purpose</td><td>+</td><td>+</td><td>+</td><td>+</td></tr>
<tr><td>TERM 13a</td><td>Freight transport</td><td rowspan="2">+</td><td rowspan="2">+</td><td rowspan="2">+</td><td>+</td><td>+</td><td>+</td><td>+</td><td rowspan="2">+</td></tr>
<tr><td>TERM 13b</td><td>Freight transport modal split by group of goods</td><td>+</td><td>+</td><td>+</td><td>+</td></tr>
<tr><td>TERM 14</td><td>Access to basic services</td><td>+</td><td>+</td><td></td><td>+</td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 15</td><td>Regional accessibility of markets and cohesion</td><td></td><td>+</td><td></td><td>+</td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 16</td><td>Access to transport services</td><td>+</td><td>+</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 18</td><td>Capacity of infrastructure networks</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td></td><td></td></tr>
<tr><td>TERM 19</td><td>Infrastructure investments</td><td>+</td><td>+</td><td>+</td><td></td><td></td><td></td><td></td><td>+</td></tr>
<tr><td>TERM 20</td><td>Real change in transport prices by mode</td><td>+</td><td>+</td><td>+</td><td></td><td>+</td><td>+</td><td></td><td>+</td></tr>
<tr><td>TERM 21</td><td>Fuel prices and taxes</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td></tr>
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<tr><td>TERM 27</td><td>Energy efficiency and specific CO_2 emissions</td><td>+</td><td>+</td><td>+</td><td>+</td><td></td><td>+</td><td></td><td>+</td></tr>
<tr><td>TERM 28</td><td>Specific emissions</td><td>+</td><td>+</td><td></td><td>+</td><td></td><td>+</td><td></td><td>+</td></tr>
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<tr><td>TERM 32</td><td>Size of the vehicle fleet</td><td rowspan="2">+</td><td>+</td><td>+</td><td>+</td><td>+</td><td></td><td>+</td><td></td></tr>
<tr><td>TERM 33</td><td>Average age of the vehicle fleet</td><td>+</td><td>+</td><td>+</td><td></td><td>+</td><td></td><td>+</td></tr>
<tr><td>TERM 34</td><td>Proportion of vehicle fleet meeting certain emission standards</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td></td><td>+</td><td></td></tr>
<tr><td>TERM 35</td><td>Implementation of integrated strategies</td><td>+</td><td>+</td><td>+</td><td></td><td>+</td><td></td><td></td><td></td></tr>
<tr><td>TERM 36</td><td>Institutional cooperation</td><td></td><td>+</td><td>+</td><td></td><td>+</td><td></td><td></td><td></td></tr>
<tr><td>TERM 37</td><td>National monitoring systems</td><td>+</td><td>+</td><td>+</td><td></td><td>+</td><td></td><td></td><td></td></tr>
<tr><td>TERM 38</td><td>Implementation of SEA</td><td>+</td><td>+</td><td>+</td><td></td><td>+</td><td></td><td></td><td></td></tr>
<tr><td>TERM 39</td><td>Uptake of environmental management systems by transport companies</td><td>+</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>TERM 40</td><td>Public awareness</td><td>+</td><td>+</td><td></td><td></td><td>+</td><td></td><td></td><td></td></tr>
</table>

Data annex

Table 1 Freight transport mode share (Unit: %)

	1991			1996			2001			2006		
	Rail	**Road**	**IWW**	**Rail**	**Road**	**IWW**	**Rail**	**Road**	**IWW**	**Rail**	**Road**	**IWW**
EU-27							*18.6*	*74.9*	*6.5*	*17.7*	*76.7*	*5.6*
EU-25				*20.7*	*72.6*	*6.7*	*18*	*75.5*	*6.5*	*17.5*	*77*	*5.5*
EU-15	*18.3*	*73.3*	*8.4*	*15.3*	*77.1*	*7.6*	*14.3*	*78.3*	*7.4*	*14.4*	*79.1*	*6.5*
Austria	45	49.6	5.4	*30.8*	*64.3*	*4.9*	29.6	65.9	4.5	33.8	63.2	3
Belgium	16.4	73.2	10.5	13.2	76.4	10.4	10.4	78.3	11.3	14	71.2	14.7
Bulgaria							36.7	60.2	3.1	27.1	69	3.9
Cyprus		100			100			100			100	
Czech Republic				42.4	57.1	0.5	30.1	69.7	0.1	23.8	76.1	0.1
Denmark	9.2	90.8		7.7	92.3		8.2	91.8		8.2	91.8	
Estonia				68.9	31.1	0	68.8	31.2	0	65.3	34.7	0
Finland	23.6	76.2	0.2	26	73.7	0.3	24.4	75.4	0.2	27.1	72.7	0.2
France	22.9	73.3	3.9	21	76.4	2.6	19	77.9	3.1	15.7	80.9	3.4
Germany	24.6	58.6	16.7	19	64.3	16.7	17.7	67.2	15.1	21.4	65.9	12.8
Greece	4.2	95.8		*2.2*	*97.8*					1.9	98.1	
Hungary				*32.7*	*61.3*	*6*	28.1	67.3	4.6	23.9	71.6	4.5
Iceland		100			100			100				
Ireland	10.5	89.5		8.3	91.7		4	96		1.2	98.8	
Italy	12.9	87.1	0.1	10.8	89.2	0.1	*10.6*	*89.4*	*0*	9.9	*90.1*	0
Latvia	77	22.4	0.6	84.9	15.1	0	72.6	27.4	0	61	39	0
Lithuania	71.2	28.2	0.6	65.9	34.1	0.1	48.3	51.7	0	41.6	58.4	0
Luxemburg	16.7	75.2	8.1	13	79.7	7.3	6.5	89.6	3.8	4.6	91.5	4
Malta		100			100			100			100	
Netherlands	3.2	60.2	36.6	2.9	64.2	32.8	3.4	63	33.5	4.1	63.6	32.3
Norway				18.3	81.7		16	84				
Poland	61.9	37.6	0.5	54	45.3	0.7	37.9	61.1	1	29.4	70.4	0.2
Portugal	8.2	91.8		7.4	92.6		6.7	93.3		5.1	94.9	
Romania	58.9	37.4	3.7	50.7	41.4	7.9	43.1	49.6	7.3	19.4	70.5	10
Slovakia				40.8	53.8	5.4	42.4	53.6	4	30.9	68.8	0.3
Slovenia	42.7	57.3		*30*	*70*		28.7	71.3		21.8	78.2	
Spain	10.7	89.3		*9.8*	*90.2*		6.8	93.2		4.6	95.4	
Sweden	42.6	57.4		36.1	63.9		36.4	63.6		35.5	64.5	
Turkey				6.2	93.8		4.7	95.3				
United kingdom	9.9	90	0.1	8.3	91.6	0.1	10.6	89.3	0.1	*11.8*	*88.1*	0.1

Note: Switzerland and Lichtenstein not included. Figures in *italics* = Eurostat estimate; Green = Estimate; Red = Break in series.

Source: Eurostat 2007.

Table 2 Freight transport volume by country (Unit: 1 000 million tonne km)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Austria	27.18	27.36	26.71	26.86	28.94	41.75	43.21	44.88	47.24	51.25	54.17	56.98	58.48	58.70	59.69	58.20
Belgium	51.71	49.51	48.49	50.99	58.51	58.90	54.74	56.96	54.70	51.02	65.94	67.92	68.26	66.06	63.96	60.54
Bulgaria	37.74	31.71	35.10	40.09	40.71	40.17	35.36	34.55	29.23	24.65	12.26	13.37	13.99	15.38	17.87	20.29
Cyprus	1.01	1.03	1.04	1.06	1.08	1.08	1.11	1.13	1.17	1.19	1.23	1.27	1.32	1.40	1.12	1.39
Czech Republic	47.55	48.55	50.09	49.25	46.85	54.33	52.65	61.75	52.72	53.76	54.90	56.03	59.56	62.46	61.15	58.38
Denmark	19.90	20.41	21.32	21.78	23.67	24.35	23.07	23.49	23.48	25.21	26.08	24.14	24.46	25.02	25.44	25.28
Estonia	11.49	10.31	4.83	5.06	5.01	5.39	6.10	7.33	9.03	10.77	12.92	12.43	13.91	13.64	15.59	16.46
Finland	34.73	32.40	32.59	34.32	35.73	33.85	33.89	35.68	38.13	39.53	42.20	40.44	41.74	41.08	42.51	41.64
France	214.16	215.57	219.87	208.47	220.61	232.99	235.52	242.36	250.99	266.63	268.56	265.51	262.66	258.47	265.74	254.89
Germany	303.69	334.19	330.19	322.26	345.37	372.27	367.88	381.93	395.84	413.02	424.67	429.95	425.66	428.75	459.34	469.62
Greece	11.65	14.52	13.02	15.87	16.06	13.53	16.25	18.46	16.32	16.95	17.93	18.88	19.63	19.80	21.69	24.02
Hungary	32.54	26.61	23.72	21.12	21.64	23.67	23.35	24.44	28.38	27.29	28.10	27.48	27.33	27.75	31.26	36.35
Iceland	0.31	0.34	0.38	0.41	0.43	0.47	0.49	0.52	0.55	0.58	0.58	0.64	0.66	0.68	0.74	0.82
Ireland	5.72	5.74	5.78	5.67	5.83	6.10	6.89	7.52	8.67	10.73	12.77	12.84	14.71	16.05	17.54	18.21
Italy	151.46	154.77	161.45	152.54	160.04	184.85	196.52	196.79	207.30	199.00	207.60	208.73	213.15	194.44	219.22	234.62
Latvia	25.89	21.74	12.64	11.11	10.92	11.59	14.62	17.32	17.10	16.37	18.10	19.54	21.22	24.76	26.00	28.17
Lithuania	26.76	24.86	16.37	16.86	12.60	12.40	12.30	13.78	13.89	15.59	16.69	16.02	20.48	22.92	23.92	28.37
Luxembourg	4.24	4.22	5.04	5.20	4.94	6.39	4.40	5.36	5.96	7.32	8.67	9.71	10.03	10.49	10.54	9.54
Malta	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Netherlands	95.71	94.89	97.27	96.80	102.70	105.62	108.12	115.04	122.98	128.99	125.44	124.58	122.25	123.50	138.01	138.21
Norway	9.40	10.10	10.76	11.41	12.06	12.37	15.27	17.06	17.66	17.82	18.13	18.08	18.13	19.22	20.31	21.40
Poland	122.79	105.40	100.38	104.59	110.85	120.26	124.77	132.29	131.53	126.44	127.95	126.35	129.17	136.41	155.51	162.13
Portugal	13.50	20.63	18.77	17.46	20.01	20.81	25.06	27.07	27.34	28.27	29.02	32.11	31.92	29.50	43.10	45.30
Romania	80.00	55.29	41.98	38.99	41.65	47.08	47.84	48.19	36.61	30.94	33.28	37.39	44.21	49.41	58.44	76.55
Slovakia	25.30	25.90	21.72	21.88	25.01	41.68	29.47	29.24	30.94	30.04	26.97	25.76	25.38	26.96	28.32	32.12
Slovenia	9.11	7.50	7.21	6.86	7.56	8.76	8.50	8.87	9.18	9.28	9.51	9.87	9.69	10.32	12.16	14.28
Spain	98.65	98.22	98.63	99.87	106.69	112.60	113.11	122.01	136.32	145.75	160.33	172.76	196.12	204.34	232.70	244.87
Sweden	45.62	44.18	43.49	44.49	46.06	51.00	52.17	54.24	52.50	52.27	55.71	53.71	55.85	56.81	57.81	60.25
Turkey	101.89	107.98	110.54	106.24	103.22	121.02	144.69	149.40	160.58	159.20	171.31	158.90	158.09	160.78	166.19	163.13
United Kingdom	163.20	154.50	151.31	158.16	168.57	174.97	181.46	186.25	189.45	184.62	183.93	182.85	182.92	186.06	190.68	190.06

Note: Switzerland and Lichtenstein not included. Data include freight moved by road, rail and inland waterways.

Source: Eurostat 2007.

Table 3 Total passenger transport demand in EEA member countries (1990–2005) (Unit: 1 000 million pkm)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Austria	89.1	91.4	95.1	96.7	99.4	102.0	105.6	106.6	109.6	113.1	115.4	116.1	117.5	119.2	123.5	
Belgium	114.3	117.2	118.4	119.4	123.3	125.9	127.1	130.8	138.9	143.5	146.5	144.8	134.8	138.3	142.0	
Bulgaria	40.6	28.4	27.0	25.2	22.8											
Cyprus																
Czech Republic	75.6	75.5	76.0	73.1	74.5	76.6	85.0	84.8	85.8	87.7	90.7	91.9	92.3	94.1	94.3	89.9
Denmark	62.4	62.7	63.2	64.6	65.1	66.2	67.4	68.8	69.4	70.4	70.3	70.3	70.9	71.3	73.3	
Estonia																
Finland	67.9	66.6	66.2	66.2	67.4	69.7	70.4	72.9	75.2	73.7	74.4	76.2	78.1	79.7	83.0	72.9
France	743.8	754.6	777.9	790.7	821.1	805.5	832.9	847.1	875.4	908.9	925.6	952.4	963.6	965.4	972.1	847.8
Germany	842.1	870.6	895.6	916.3	999.1	1 019.0	1 033.9	1 043.7	1 059.3	1 094.8	1 089.8	1 108.4	1126.1	1146.3	1 180.2	
Greece	56.5	56.2	58.8	61.5	64.4	66.7	67.7	71.8	74.3	78.4	86.4	90.3	93.4	95.2	100.5	
Hungary	79.2	75.6	73.8	70.1	72.0	72.5	74.9	74.9	75.1	76.7	78.6	78.4	79.0	79.1	79.2	
Iceland	4.7	4.8	5.0	5.2	5.6	5.9	6.4	7.0	7.8	8.3	8.7	8.8	8.4	8.4	9.2	6.1
Ireland	22.1	22.6	23.5	24.0	25.7	27.8	29.8	32.1	34.6	38.4	42.2	43.7	49.6	59.5	67.7	
Italy	674.9	690.7	760.0	757.0	754.7	779.1	797.1	810.7	832.7	838.4	911.6	901.0	889.2	895.4	904.7	
Latvia													9.4			16.5
Lithuania						15.4							19.9	23.3	30.4	38.8
Luxembourg	4.9	5.1	5.4	5.6	5.8	5.9	6.1	6.0	6.3	6.6	7.1	7.4	7.4	7.6	7.7	
Malta																
Netherlands	192.7	174.2	185.6	187.0	192.1	210.0	216.1	224.8	228.4	233.9	237.0	233.5	235.9	236.1	243.7	
Norway	54.9	54.1	54.5	55.6	57.6	57.7	60.4	60.8	62.1	63.1	64.1	65.3	66.4	67.4	68.1	60.2
Poland	168.3	161.3	159.6	165.7	167.7	175.6	179.3	189.3	199.9	202.4	210.3	216.1	222.6	227.5	235.9	
Portugal	50.3	52.5	60.0	60.9	63.1	65.1	68.0	72.7	76.7	80.3	84.6	85.8	89.1	92.3	97.6	
Romania																
Slovakia	32.1	32.3	32.3	33.6	32.4	33.4	32.9	31.7	31.4	32.5	35.3	35.2	36.0	35.5	35.3	
Slovenia	21.4	19.1	18.3	18.7	20.2	21.4	23.1	24.4	23.9	25.4	25.2	25.6	26.1	26.3	26.7	26.3
Spain	247.4	281.2	297.6	308.4	319.6	336.4	352.7	365.4	383.1	405.9	423.9	434.2	459.4	472.1	492.8	
Sweden	110.1	109.0	110.0	108.9	109.4	110.7	111.7	112.9	114.4	117.8	120.1	120.9	123.9	126.1	126.5	
Turkey	130.1	125.3	137.6	143.4	139.8	153.6	165.3	177.5	184.6	187.7	188.8	182.5	189.5	196.3	203.3	
United Kingdom	772.6	759.8	776.8	783.7	826.4	845.2	866.1	847.5	869.4	888.3	895.8	899.0	920.5	932.7	953.0	770.7
EEA member countries	4 617.1	4 662.3	4 850.9	4 916.3	5 106.3	5 232.0	5 379.9	5 464.2	5 618.3	5 776.2	5 932.4	5 987.7	6 079.6	6 171.6	6 320.4	

Note: Switzerland and Liechtenstein not included. Year 2005 only include 'Rail', 'Bus' and 'Car' passenger transport.

Source: EEA, 2007. TERM fact sheet 12a (based on Eurostat, 2008).

Table 4 Passenger transport demand by modal share (Unit: %)

	1990				1995				2000				2004			
	Rail	Bus	Private cars	Air	Rail	Bus	Private cars	Air	Rail	Bus	Private cars	Air	Rail	Bus	Private cars	Air
Austria	9.6	16.0	70.1	4.3	9.4	14.5	69.4	6.6	7.1	12.9	67.7	12.3	7.0	12.3	66.5	14.2
Belgium	5.7	9.5	78.1	6.7	5.4	10.4	77.4	6.8	5.3	9.1	72.4	13.2	6.1	12.0	78.6	3.3
Bulgaria	19.2	63.9	11.2	5.7												
Cyprus																
Czech Republic	17.6	17.7	62.0	2.7	10.5	15.4	71.2	3.0	8.0	17.9	70.4	3.7	7.0	15.0	71.7	6.4
Denmark	5.8	10.3	76.4	7.5	7.4	11.0	73.6	8.0	7.9	10.6	72.9	8.7	8.1	10.0	71.2	10.7
Estonia																
Finland	4.9	12.5	75.4	7.2	4.6	11.5	71.7	12.3	4.6	10.4	74.9	10.2	4.0	9.2	73.4	13.4
France	8.6	5.6	78.7	7.1	6.9	5.2	79.5	8.5	7.5	4.6	75.6	12.3	7.6	4.5	75.8	12.0
Germany	5.2	8.7	81.1	5.0	7.0	6.7	80.0	6.3	6.9	6.3	76.3	10.5	6.2	5.7	73.6	14.5
Greece	3.5	31.4	51.4	13.8	2.3	30.3	55.4	11.9	2.2	25.1	61.3	11.4	1.7	21.5	67.7	9.1
Hungary	14.4	24.3	59.4	1.9	11.6	22.9	63.1	2.3	12.3	23.8	59.3	4.5	12.8	23.6	59.1	4.4
Iceland	0.0	7.2	56.1	36.7	0.0	6.6	51.2	42.2	0.0	5.7	48.8	45.5	0.0	6.0	54.3	39.6
Ireland	5.5	17.4	56.4	20.6	4.6	18.5	55.8	21.1	3.3	14.5	49.8	32.4	2.3	9.7	36.9	51.1
Italy	6.6	12.4	77.4	3.5	5.6	11.2	78.9	4.3	5.2	10.3	79.7	4.9	5.0	11.0	79.1	4.8
Latvia																
Lithuania					7.4	27.1	63.5	2.0					0.9	12.5	84.8	1.8
Luxembourg	4.2	9.7	81.0	5.1	4.9	9.1	79.6	6.4	4.7	8.7	78.8	7.8	3.3	10.0	79.3	7.4
Malta																
Netherlands	6.9	6.7	71.3	15.1	6.2	3.8	62.6	27.4	6.5	3.2	59.5	30.8	5.8	3.1	60.1	31.1
Norway	3.7	7.1	77.4	11.9	4.0	6.5	75.6	13.9	4.5	6.5	72.9	16.2	3.9	6.2	74.8	15.1
Poland	29.9	27.5	40.5	2.1	15.2	19.4	63.0	2.4	11.5	15.1	71.2	2.3	7.8	12.8	76.9	2.5
Portugal	11.3	20.5	54.6	13.7	7.4	17.4	62.8	12.4	4.5	14.0	68.2	13.3	3.8	11.1	68.7	16.5
Romania																
Slovakia	19.9	37.1	43.0	0.0	12.6	33.5	53.8	0.1	8.1	23.9	67.7	0.3	6.3	22.3	68.9	2.4
Slovenia	6.7	30.4	62.3	0.6	2.8	19.2	76.3	1.7	3.2	13.9	80.6	2.2	2.9	12.0	82.4	2.7
Spain	6.3	13.5	70.5	9.8	4.6	11.8	74.4	9.2	4.4	11.9	71.4	12.4	4.1	10.8	72.0	13.0
Sweden	6.0	7.3	78.5	8.3	6.2	7.7	78.4	7.7	6.9	7.9	75.9	9.3	6.8	7.0	76.7	9.5
Turkey	4.9	64.8	26.4	3.9	3.8	55.8	34.3	6.2	3.1	46.3	41.9	8.7	2.6	38.5	48.8	10.1
United Kingdom	4.3	6.0	76.1	13.6	3.6	5.2	73.1	18.1	4.3	5.2	71.4	19.0	4.5	5.0	71.2	19.2
Croatia																
United States	0.3	3.1	84.7	11.8	0.3	3.2	83.8	12.6	0.3	3.3	82.3	14.1				
Japan	33.0	9.4	49.1	8.6	31.3	7.6	50.9	10.2	27.7	6.3	53.4	12.6	28.0	6.3	54.7	11.0
FYR of Macedonia																
EEA member countries	7.4	12.1	73.0	7.5	6.2	10.4	73.9	9.5	6.0	9.7	72.4	11.9	5.7	9.1	72.3	12.9

Note: Switzerland and Liechtenstein not included.

Source: EEA, 2007. TERM fact sheet 12a (based on Eurostat, 2008).

Table 5 Car Ownership 1995, 2005 (Unit: Cars per 1 000 inhabitants)

	1995	2005
Austria	452	503
Belgium	422	468
Bulgaria	196	329
Cyprus	338	463
Czech Republic	295	386
Denmark	321	362
Estonia	267	367
Finland	372	462
France	434	500
Germany (including ex-GDR)	495	559
Greece	207	355
Hungary	217	287
Iceland	445	625
Ireland	274	395
Italy	529	590
Latvia	134	324
Lichtenstein	612	705
Lithuania	198	428
Luxembourg	568	669
Malta	488	526
Norway	387	437
Netherlands	366	434
Poland	195	323
Portugal	374	397
Romania	97	149
Slovakia	189	242
Slovenia	357	471
Spain	362	463
Sweden	411	459
Switzerland	459	518
Turkey	51	80
United Kingdom	374	469

Source: Eurostat, 2007.

Table 6 Greenhouse gas emissions from transport in Europe, 1990–2005 — Part A

	Emissions included in the Kyoto Protocol																	
	'Total transport (excl. international aviation and international navigation)'			Road transportation			Navigation (domestic)			Civil aviation (domestic)			Railways			Other transportation		
	1990	2005	1990–2005	1990	2005	1990–2005	1990	2005	1990–2005	1990	2005	1990–2005	1990	2005	1990–2005	1990	2005	1990–2005
EU-27	785	990	26 %	717	923	29 %	24	22	– 7 %	19	26	39 %	15	9	– 42 %	11	10	– 8 %
EU-15	700	880	26 %	648	818	26 %	19	22	12 %	18	25	44 %	8	6	– 23 %	7	9	28 %
Austria	13	24	91 %	12	23	91 %	0	0	55 %	0	0	588 %	0	0	– 13 %	0	1	142 %
Belgium	20	26	29 %	20	26	31 %	0	0	25 %	0	0	– 36 %	0	0	– 43 %	0	0	– 33 %
Bulgaria	11	8	– 25 %	8	7	– 6 %	0	0	– 100 %	0	0	– 62 %	0	0	– 72 %	3	1	– 72 %
Cyprus	1	2	115 %	1	2	115 %	0	0		0	0		0	0		0	0	
Czech Republic	7	18	135 %	6	17	176 %	0	0	– 72 %	0	0	– 38 %	1	0	– 58 %	0	0	– 30 %
Denmark	11	14	29 %	9	13	34 %	1	1	– 2 %	0	0	– 45 %	0	0	– 22 %	0	0	
Estonia	3	2	– 31 %	2	2	– 10 %	1	0	– 96 %	0	0	– 98 %	0	0	– 24 %	0	0	– 100 %
Finland	13	14	10 %	11	12	12 %	0	1	20 %	0	0	– 15 %	0	0	– 34 %	1	1	7 %
France	121	144	20 %	113	135	20 %	2	3	54 %	5	5	8 %	1	1	– 35 %	0	1	352 %
Germany	164	166	1 %	152	154	1 %	2	1	– 51 %	3	5	77 %	3	1	– 48 %	4	4	3 %
Greece	16	23	48 %	12	20	62 %	2	2	15 %	1	1	– 15 %	0	0	– 38 %	0	0	
Hungary	8	12	45 %	8	12	52 %	0	0	– 89 %	0	0		0	0	– 65 %	0	0	
Iceland	1																	
Ireland	5	13	160 %	5	13	169 %	0	0	– 33 %	0	0	82 %	0	0	14 %	0	0	165 %
Italy	104	132	27 %	96	122	27 %	5	6	14 %	2	3	66 %	0	0	– 31 %	0	1	85 %
Latvia	3	3	– 1 %	2	3	9 %	0	0	163 %	0	0		1	0	– 52 %	0	0	
Liechtenstein	0																	
Lithuania	6	4	– 27 %	5	4	– 27 %	0	0	6 %	0	0	0 %	0	0	– 35 %	0	0	
Luxembourg	3	7	168 %	3	7	170 %	0	0	0 %	0	0		0	0	– 17 %	0	0	
Malta	0	0	– 100 %															
Netherlands	26	35	33 %	26	34	33 %	0	1	58 %	0	0	0 %	0	0	16 %	0	0	
Norway	11	15	29 %															
Poland	28	37	31 %	22	35	64 %	3	0	– 99 %	0	0	– 20 %	2	1	– 75 %	1	1	– 53 %
Portugal	10	20	99 %	9	19	103 %	0	0	10 %	0	0	142 %	0	0	– 54 %	0	0	
Romania	9	12	38 %	7	12	77 %	1	0	– 88 %	0	0	– 54 %	1	0	– 77 %	0	0	600 %
Slovak Republic	5	7	27 %	5	6	37 %	0	0	6 %	0	0	18 %	0	0	– 72 %	0	0	
Slovenia	3	5	68 %	3	4	71 %	0	0		0	0	– 33 %	0	0	– 42 %	0	0	
Spain	58	105	83 %	51	95	86 %	2	3	71 %	4	7	67 %	0	0	– 26 %	0	0	– 100 %
Sweden	18	20	10 %	17	19	11 %	1	1	– 1 %	1	1	– 2 %	0	0	– 36 %	0	0	18 %
Switzerland	15	16	7 %															
Turkey	26	41	57 %															
United Kingdom	119	135	14 %	111	125	13 %	4	4	1 %	1	2	94 %	2	2	36 %	0	1	65 %

Source: EEA, 2007 (http://dataservice.eea.europa.eu/dataservice/viewdata/viewpvt.asp).

Table 6 Greenhouse gas emissions from transport in Europe, 1990–2005 — Part B

	'Total transport (estimation)'			Emissions not included in the Kyoto Protocol					
				International aviation			International navigation		
	1990	2005	1990–2005	1990	2005	1990–2005	1990	2005	1990–2005
EU-27	960	1 277	33 %	66	126	90 %	109	162	49 %
EU-15	867	1 156	33 %	62	121	96 %	105	156	49 %
Austria	14	26	91 %	1	2	95 %	0	0	
Belgium	38	54	43 %	3	4	15 %	14	24	69 %
Bulgaria	13	9	– 29 %	1	0	– 47 %	1	0	– 60 %
Cyprus	2	4	92 %	1	1	23 %	0	1	250 %
Czech Republic	8	18	129 %	1	1	51 %	0	0	
Denmark	15	19	22 %	2	3	48 %	3	3	– 15 %
Estonia	3	3	– 14 %		0			0	
Finland	16	17	9 %	1	1	28 %	2	2	– 10 %
France	137	169	23 %	8	16	86 %	8	9	10 %
Germany	184	195	6 %	12	21	77 %	8	9	8 %
Greece	26	35	32 %	2	2	– 3 %	8	9	13 %
Hungary	9	13	45 %	0	1	39 %	0	0	
Iceland	1			0			0		
Ireland	6	16	158 %	1	2	132 %	0	0	477 %
Italy	113	146	30 %	4	9	108 %	4	6	41 %
Latvia	5	4	– 16 %	0	0	– 20 %	2	1	– 44 %
Liechtenstein	0								
Lithuania	7	5	– 26 %	0	0	– 63 %	0	0	51 %
Luxembourg	3	9	176 %	0	1	229 %	0	0	
Malta	1	0	– 100 %	0			0		
Netherlands	65	100	53 %	5	11	140 %	34	54	57 %
Norway	11	15	29 %						
Poland	30	38	28 %	1	1	0 %	1	1	– 18 %
Portugal	13	25	86 %	1	3	80 %	2	2	20 %
Romania	9	12	38 %		0			0	
Slovak Republic	5	7	30 %		0			0	
Slovenia	3	5	65 %	0	0	– 19 %	0	0	
Spain	73	140	93 %	3	10	177 %	12	25	118 %
Sweden	22	29	31 %	1	2	45 %	2	7	198 %
Switzerland	18	19	9 %	3	4	14 %	0	0	
Turkey	26	41	57 %						
United Kingdom	141	176	25 %	16	35	123 %	7	6	– 12 %

Source: EEA, 2007 (http://dataservice.eea.europa.eu/dataservice/viewdata/viewpvt.asp).

Table 7 Biofuels production (Unit: Tonnes)

	Biodiesel					Bioethanol				
	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
Austria	25 000	32 000	57 000	85 000	123 000					
Belgium				1 000	25 000					
Bulgaria					4 000					
Cyprus				1 000	1 000					
Czech Republic	68 800	70 000	60 000	133 000	107 000	5 000	5 000	0	1 120	13 200
Denmark	10 000	41 000	70 000	71 000	8 0000					
Estonia				7 000	1 000					
Finland								3768	36 800	0
France	366 000	357 000	358 000	492 000	743 000	90 500	82 000	102 000	99 780	234 306
Germany	450 000	715 000	1 035 000	1 669 000	2 662 000			20 000	120 000	315 760
Greece				3 000	42 000					
Hungary									11 840	4 818
Ireland					4 000					760
Italy	210 000	273 000	320 000	396 000	447 000					102 400
Latvia				5 000	7 000			9 800	960	9 600
Lithuania			5 000	7 000	1 0000				6 296	14 400
Malta				2 000	2 000					
Netherlands					18 000			11 146	5 971	11 680
Poland				100 000	116 000	65 660	60 430	35 840	68 000	104 000
Portugal				1 000	91 000					
Romania					1 0000					
Slovakia			15 000	78 000	82 000					
Slovenia				8 000	11 000					
Spain		6 000	13 000	73 000	99 000	176 700	180 000	194 000	240 000	27 600
Sweden	1 000	1 000	1 400	1 000	13 000	50 100	52 300	52 000	130 160	
United Kingdom	3 000	9 000	9 000	51 000	192 000					

Biofuel production (PJ)		
	Bio-diesel	Bio-ethanol
2000	27.03	5.81
2001	30.34	6.74
2002	37.80	9.60
2003	54.62	10.65
2004	73.08	10.61
2005	120.36	18.10
2006	184.84	31.65

Note: Iceland, Liechtenstein, Luxemburg, Norway, Switzerland and Turkey not included.

Source: EurObservER, 2007, Biodiesel data for 2006 — EEB, 2007.

Table 8 Investment in infrastructure by mode and country (Unit: Million euro — current prices) — Part A

	Inland waterways					Sea ports					Airports				
	1992	**1995**	**1998**	**2001**	**2004**	**1992**	**1995**	**1998**	**2001**	**2004**	**1992**	**1995**	**1998**	**2001**	**2004**
Austria	10.5	3.3									116.5	91.7	61.8	81.1	252.0
Czech Republic		1.4	5.6	8.6	11.5						–	73.5	22.2	50.4	150.6
Denmark						61.0	61.3	56.7	96.3	99.2	20.1	47.9	293.1	62.3	25.3
Estonia							18.8	21.9	27.7	66.6	0.0	1.6	3.8	1.0	5.3
Finland	1.7	1.7	0.4	3.5	3.9	41.5	41.5	56.3	72.5	118.3	59.6	50.5	77.9	62.5	48.2
France	76.2	107.3	84.7	113.7	109.1	214.3	235.3	189.2	295.5	377.5	703.1	570.1	731.1	836.8	836.3
Germany	593.0	711.0	828.0	843.0	790.0	476.0	506.0	450.0	506.0	430.0	1 580.0	1 156.0	1 115.0	1 230.0	540.0
Iceland						19.0	18.3	22.1	18.6	34.4			4.3	10.3	2.8
Ireland						9.2	29.9				19.0			107.0	80.0
Italy		10.8	22.2	25.8	38.8		213.2	250.1	272.0	1 358.6		275.1	299.0	415.2	1 234.0
Latvia										97.6				25.0	4.5
Liechtenstein															
Lithuania		0.7				0.0	5.7	19.2	32.9	16.2	0.0	18.7	6.0	1.4	2.9
Malta															
Poland	2.4	9.6	0.0	0.0	14.1	19.5	29.6	6.9	11.7	13.7	185.6	27.5	43.2	89.3	48.8
Portugal						4.6	28.9	54.0	59.7	21.0				130.3	154.3
Romania	1.2	244.5	106.9	168.8	190.6	0.0	6.0				1.1	12.2	3.0	7.3	2.2
Slovakia	35.4	21.4	9.6	0.7	1.2						9.4	4.3	5.4	4.0	11.4
Slovenia											2.1	4.7			
Spain						336.8	383.4	446.1	604.4	885.9	153.7	457.7	450.4	871.6	1 874.1
Sweden							51.0	47.6	49.9	93.2		53.3	113.5	635.4	92.0
Switzerland	2.8	7.8	39.5	0.0	1.3						59.4	130.7	131.3	500.5	158.7
United Kingdom						145.1	199.1	314.0	374.7	297.6	585.6	703.4	876.6	1 104.7	2 202.9
Total	723.2	1 119.3	1 096.8	1 164.1	1 160.6	1 326.8	1 829.3	1 940.2	2 446.4	3 919.0	3 495.1	3 685.2	4 248.6	6 228.9	7 741.7

Source: EEA, 2008. Based on data from International Transport Forum (formerly known as ECMT).

Table 8 Investment in infrastructure by mode and country (Unit: Million euro — current prices) — Part B

	Railways					Road				
	1992	**1995**	**1998**	**2001**	**2004**	**1992**	**1995**	**1998**	**2001**	**2004**
Austria	640.4	521.3	979.0	1 071.0	1 334.7	556.7	456.7	431.6	641.3	908.0
Czech Republic		113.6	301.7	393.7	411.8		285.7	373.7	302.2	1 031.3
Denmark	723.8	726.0	818.1	459.7	341.5	190.5	351.8	387.8	532.9	727.8
Estonia	0.3	3.8	15.3	14.8	22.1	1.5	7.5	17.0	18.6	57.3
Finland	174.4	225.7	254.5	203.7	328.3	339.9	457.2	443.0	507.9	599.4
France	3 553.9	2 726.2	2 879.0	2 443.6	3 680.5	10 554.8	10 775.1	10 509.5	11 106.4	11 236.7
Germany	6 128.0	6 810.0	5 384.0	6 422.0	7 147.0	12 159.0	10 216.0	10 850.0	11 558.0	11 990.0
Iceland						37.6	74.6	139.7	61.4	85.6
Ireland	15.6	29.3	4.0	141.0		219.0	283.0	446.0	908.0	1 190.0
Italy		1 987.5	2 170.4	4 855.7	8 614.9		4 980.1	6 257.7	4 582.5	7 268.3
Latvia	0.0	7.3	27.3	30.4	33.0	0.0	3.1	1.5	16.1	63.1
Liechtenstein						18.7	14.0	26.8	30.3	26.2
Lithuania	0.0	4.4	29.0	24.6	70.4	0.0	15.1	96.3	69.5	136.7
Malta						2.3	3.3	7.8	8.3	10.1
Poland	57.1	247.6	337.3	113.0	219.4	177.0	638.4	299.0	1 093.9	1 236.9
Portugal	114.0	196.0	536.0	418.0	484.0	464.6	804.3	948.4	1 669.0	1 870.6
Romania	4.7	72.3	45.6	56.9	57.8	22.6	356.3	486.6	735.8	1 095.3
Slovakia	24.5	59.2	63.8	170.1	90.7	85.4	53.2	299.3	201.3	240.1
Slovenia	8.6	54.6				45.9	187.6	274.4	303.6	582.6
Spain	973.3	648.0	856.2	1 105.7	1 900.0	4 212.9	4 166.6	4 730.8	5 417.0	7 169.0
Sweden		1 301.3	1 023.7	649.0	1 524.6		1 393.4	1 729.5	1 327.5	1 803.0
Switzerland	815.3	1 079.1	1 290.4	1 643.8	2 116.2	2 197.8	2 519.8	2 297.8	2 765.3	2 729.6
United Kingdom	3 173.6	2 414.4	3 459.4	5 872.6	6 294.8	6 444.8	5 224.5	4 232.6	5 930.5	6 968.1
Total	16 407.8	19 268.9	20 540.9	26 122.4	34 804.1	37 751.0	43 414.2	45 711.5	50 201.6	60 115.1

Note: Iceland, Liechtenstein, Luxemburg, Norway, Switzerland and Turkey not included.

Source: EurObservER, 2007, Biodiesel data for 2006 — EEB, 2007.

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