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Transport and environment: on the way to a new common transport policy

TERM 2006: indicators tracking transport and environment in the European Union

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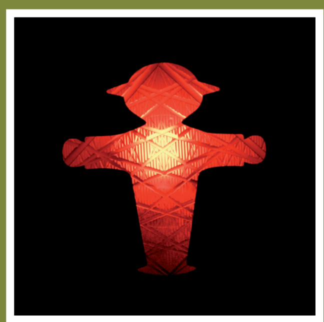

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Key messages

Transport in perspective

- The environmental performance of the transport sector is still unsatisfactory. There is a need to intensify efforts to improve it, not least concerning the sector's contribution to climate change.

- The Commission's mid-term review of the 2001 Transport White Paper proposes changes that can bring both improvements and negative effects depending on how they are applied at European, national and regional level. Concerning the environment, the mid-term review changes the focus from managing transport demand to addressing negative side effects. This change in focus means that transport demand growth is no longer explicitly identified as one of the main environmental issues within the transport sector. However, as the extent of important environmental impacts such as climate change, noise and landscape fragmentation are closely linked to transport volumes, addressing them still requires the management of transport demand. The overall success of the new policy therefore still hinges on limiting (growth in) transport volumes. This is something which the White Paper failed to do. It therefore remains to be seen whether the new elements in the mid-term review concerning the use of scenarios for long-term planning and a common framework for charging can help to improve the situation.

Freight transport volume growth outpaces economic growth

- More goods are transported over longer distances and more frequently. Addressing overall transport demand is important because of the link between transport volume and its environmental impact. Modal shift in specific markets can also contribute to reducing the environmental impacts of transport.

Passenger transport volumes continue to increase

- Passenger transport volumes have grown strongly in and between EEA member countries. Air transport, in particular, has shown massive growth. For the next decade further growth of passenger transport volumes is expected, especially in the EU-10.

Greenhouse gas emissions from transport grow

- Emissions of greenhouse gases in the transport sector are steadily increasing. Improvements within energy efficiency of different means of transport and the introduction of renewable fuels are not sufficient to offset the growth of transport volumes. This tendency threatens both Europe's and individual EU Member State's progress towards their Kyoto targets. Therefore, additional policy initiatives and instruments are needed.

Harmful emissions decline, but air quality problems require continued attention

- Transport, especially road transport, is becoming less polluting due to increasingly strict emission standards for the different transport modes. Nevertheless, air quality in cities does not yet meet the limit values set by European regulation, and still has a major negative impact on human health.

- SO_X emissions have shifted from land to sea rather than actually decreased.

Vehicle efficiency improvements slow down, but diesels can become clean

- Efficiency improvements in passenger cars were slower than expected, partly due to market trends. The European Commission has announced a new policy for CO_2 emissions from light duty vehicles.

- Application of NO_X and particulate abatement devices rapidly improves the environmental performance of new diesel vehicles and offers opportunities for further steps.

Developments in transport fuels: increasing the share of alternative transport fuels and application of cleaner fuels

- Biofuels targets and policies are being implemented in most Member States and biofuels production volumes increase annually, albeit from a low level. However, the production of biomass must be carried out in a sustainable way to avoid loss of biodiversity.

Transport subsidies and external costs

- Transport subsidies are significant. At least EUR 270–290 billion of annual transport subsidies have been identified in Europe. Although not all these subsidies can be labelled as environmentally harmful, some of them are. The external costs of transport even exceed the size of transport subsidies. Internalising external costs should remain a main focus of transport pricing policy and reducing transport subsidies is one of the options available.

Introduction

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

The objective of the report is to indicate some of the main challenges to reducing the environmental impacts of transport and to making suggestions to improve the environmental performance of the transport system as a whole. The report examines seven key issues 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 on-going projects at the 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 as well as various transport and environmental directives.

The report does not represent a full inventory of conclusions that can be extracted from TERM but rather a selection covering the breadth of TERM. Readers are therefore encouraged to seek further information in the TERM fact sheets themselves (see link below).

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, it offers important guidelines for 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 overview in TERM indicators section later in this report) structured around seven policy questions (see Box). 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 aggregates the key messages from the indicators. Indicator fact sheets constitute a more detailed information layer, and provide an in-depth assessment for each indicator. This includes: an overview of the main policy context and existing EU policy targets related to the indicator; analysis of data quality and shortcomings; a description of metadata; 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 web site at http://themes.eea.eu.int/Sectors_and_activities/transport/indicators

Scope of the report

The report aims to cover all EEA member countries. These are the 25 EU Member States, three candidate countries (which at the time of writing were Romania, Bulgaria and Turkey) and Norway, Iceland, Liechtenstein and Switzerland. Switzerland only recently became a member and provides data in some cases. Where data are not complete, this is generally noted in the metadata section. Different country groupings are also described here.

In terms of time, most indicators cover the years after 1990, although they are subject to data availability. Note: 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 major changes that comparisons 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 the consulting company CE-Delft. The project was managed and the final version of the text written by Peder Jensen, EEA.

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). The purpose of this mechanism was to enable policy-makers to gauge the progress of their integration policies. The sixth environmental action programme (EC, 2001b) and the EU strategy for sustainable development (EC, 2001a) 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 Transport and Energy, Eurostat) and the EEA. The EEA member countries and other international organisations provide input and are consulted on a regular basis.

Transport in perspective

The environmental performance of the transport sector is still unsatisfactory. There is a need to intensify efforts to improve it, not least concerning the sector's contribution to climate change.

The Commission's mid-term review of the 2001 Transport White Paper proposes changes that can bring both improvements and negative effects depending on how they are applied at European, national and regional level. Concerning the environment, the mid-term review changes the focus from managing transport demand to addressing negative side effects. This change in focus means that transport demand growth is no longer explicitly identified as one of the main environmental issues within the transport sector. However, as the extent of important environmental impacts such as climate change, noise and landscape fragmentation are closely linked to transport volumes, addressing them still requires the management of transport demand. The overall success of the new policy therefore still hinges on limiting (growth in) transport volumes. This is something which the White Paper failed to do. It therefore remains to be seen whether the new elements in the mid-term review concerning the use of scenarios for long-term planning and a common framework for charging can help to improve the situation.

Transport continues to be a burden to the environment in spite of progress made in a number of areas. At the same time transport is an integrated element of our lifestyle. More success has been achieved in improving the environmental performance of vehicles than in addressing the ever increasing transport demand. However, several studies have pointed out that technology improvements alone cannot solve the problems within the foreseeable future. In fact, technology can only reduce their magnitude. Therefore, previous TERM reports also concluded that addressing transport demand should be an indispensable policy aim.

At the beginning of the summer of 2006 the European Commission presented a communication on the mid-term review (MTR) of its 2001 White Paper on the Common Transport Policy (CTP). The 2001 paper listed around 60 policy initiatives which were later endorsed by subsequent European Council meetings. The mid-term review takes stock of what has been achieved over the past five years and proposes a number of new actions to further improve the European transport system.

Decoupling or disconnection?

A key word in the 2001 transport policy was 'decoupling' of transport volume from economic growth as an important tool to limit or reduce environmental impacts and the other negative side effects of transport. The MTR talks instead about 'disconnection' of mobility from its negative side effects.

From an environmental point of view there is no principle difference. Some side effects can be addressed relatively easily by technological means (e.g. air emissions), whereas others are much more closely tied to transport volumes (emissions of greenhouse gases, noise, landscape fragmentation, etc.).

Therefore, disconnection will — if interpreted as disconnection of mobility from all its side effects — mean the same as decoupling. In both cases it is however important to emphasise that what is needed is an absolute reduction in environmental impacts. Just slowing the growth in emissions of greenhouse gases from transport is not enough if Europe is to play a significant part in combating climate change.

It should also be noted that addressing transport demand also reduces the cost of achieving environmental goals in the areas where technology plays an important role.

Overview of the revised common transport policy

At the outset the MTR reconfirms the general objectives of the transport policy, namely: to offer a high level of mobility to people and business throughout the EU; protect the environment; ensure energy security; promote minimum labour standards for the sector; protect passengers and citizens; innovate in support of the above aims; and finally connect Member States and the Union internationally. The link to jobs and growth is specifically mentioned as well as the disconnection of mobility from negative side effects. To a certain degree, modal shift is drawn out as a key need. Despite the fact that there is more emphasis on growth and job creation (see text boxes on decoupling and modal shift), little else has changed.

The MTR also sets out to assess the context in which the transport policy must function. Of particular interest is the challenge the EU faces in living up to the Kyoto protocol requirements; a challenge transport growth is making more difficult to meet. Also air quality and other air pollution related problems, noise and intrusion on the landscape have to be addressed together with areas such as the high dependence on imported oil.

In evaluating the progress over the past five years, there is a need for new initiatives since existing ones will not be enough to 'achieve the fundamental objectives of EU policy, in particular to contain the negative environmental and other effects of transport growth while facilitating mobility as the quintessential purpose of transport policy'.

In total, the MTR proposes 16 areas of action. 14 of these are directly linked to improving the transport system on the supply side. This includes further deregulation in the rail sector, better training of drivers, removing transport bottlenecks, etc. Some of these actions may have significant environmental impact (both in a positive and negative direction) while others will not. Some may also have a minor effect on transport demand. The underlying assumption of all actions is that a more efficient transport system is better for Europe, both in economic and in environmental terms.

What is driving the change in transport policy?

There is a link between economic growth and transport volume growth. Most of the activities that are tabulated and added together to calculate GDP have a transport component. A better transport system is a precondition for a certain type of economic development, and economic development in turn requires more transport. The fact that freight transport is actually growing faster than the economy can be seen as a natural consequence of the establishment of the internal market in the EU and growing world trade as well as being an indicator of the success of these policies. The drive for economic

Modal shift policy — the 'burden of proof'

Using the least polluting mode of transport is a rather straightforward way of reducing the environmental impact of transport. Rail is in most cases cleaner than other land transport modes. Therefore, the 2001 transport policy included a specific aim of reversing the gradual loss of market shares by the rail sector. This aim has been criticised as being a 'blank check' for the rail industry because of the a priori assumption of better environmental performance.

The MTR modifies the modal shift aim so that it is now stated that a shift to more environmentally friendly modes should be sought 'where appropriate'.

This position has been strongly criticised both by the green NGOs and by the rail industry as caving in to the road lobby. However, the main change is in the 'burden of proof', where rail projects now have to be justified on a case by case basis rather than on block.

Road transport is inherently more flexible than rail transport, and can therefore adapt much faster to changes in production sites. Changes may be caused both by the general structural development in society or by more deliberate policies aiming to strengthen specific regions. Such policies are rarely developed specifically to address environmental issues and therefore they often fail to take the 'transport impact' into account. They are therefore likely to favour the flexibility that road transport offers rather than the environmental advantages of rail.

If the more environmentally friendly mode is to be favoured it may therefore require that development policies in other sectors be built round a sustainable transport policy rather than the transport system trying to adapt to development. In other words, there is a need for policy integration to be both integration of the environmental perspective into transport policy and the sustainable transport perspective into other policy fields.

growth in the EU received new impetus with the Lisbon agenda (which set out the objective of Europe becoming the world's most competitive region with better jobs and a cleaner environment).

Transport is an integrated part of the way we produce and consume. Companies will locate themselves in places where they have access to the resources they need (energy, workers, space, etc.). At most, transport costs constitute a small share of the overall costs, whereas ease of access and the time cost involved in non-ease of access play a much greater role in location decision. This is the line of reasoning behind, e.g. just-in-time logistics concepts. Because transport cost is not a dominant factor, the minimisation of transport has rather low priority. The pressure placed on policy makers by industry is therefore that they should remove the bottlenecks and obstacles to transport that may jeopardize production planning. This process is often described as the removing of geographical friction and integrating regions. It means allowing access to larger regions within the same transport time and money budget, and thereby exploiting comparative advantages of different regions. And because of the comparative advantages, both transport distances and environmental impacts grow.

A common economic framework for charging

The development of a common framework for charging in transport has been under discussion for decades with varying scope and success. The MTR proposes the development of an infrastructure charging methodology. This will include a generally applicable model for assessment of all external costs to serve as basis for future calculation of infrastructure charges for all modes of transport.

The common framework will allow Member States to put in place a comprehensive charging system consistent with the 'polluter pays principle'. However, this also requires the incorporation of all subsidies and other transfers that affect competition between transport modes at present. The EEA is presently working on the mapping of transport subsidies and preliminary results are included in Chapter 7.

Using a common pricing tool should, according to economic theory, have a direct effect on transport demand, if charges are set to reflect external costs. As many of these are not determined in the market, but rather extracted from studies or political compromises, the result is presently not easy to predict.

Freight transport is only part of the challenge of securing the benefits of better transport systems, while at the same time the avoiding negative impacts. Passenger transport poses the other challenge. In a society that is gradually getting richer, economic considerations are slowly becoming less important in transport decisions. Most people can afford a car, which gives them a larger commuting range than when they had to rely on public transport. This trend is modulated by increasing congestion which constrains the spreading of people, because there is a limit to how much time they will spend on daily transport. But time pressure in two income households means that people favour improvements to the infrastructure, as this will save them time — at least until traffic growth brings motorway traffic to a standstill again. So, there is pressure from both freight transport users and passengers to improve the transport system to allow for more transport. These issues are further explored in the next chapters (1 and 2).

What consequences will the changes have?

The most important aspect is the shift from a combined demand and supply management to a focus on the supply side of transport. TERM 2005 report concluded that, in general, transport demand was determined by developments and policies in other sectors outside the transport sector. Therefore, transport policy was ill equipped to address transport demand growth. Policy integration, as requested by the Cardiff summit in 1998, means both that transport (and other sectors) must integrate an environmental perspective into their thinking and that other sectors must integrate a transport perspective into their thinking. This may possibly require a broader and more active use of strategic impact assessment than is currently done. Moreover, transport policy makers must become involved in policy development in other areas. So far, the common transport policy has enjoyed little success with transport demand management. The fact that MTR does not propose any further work on demand can be seen as a reflection of real status of today.

Another aspect that has changed dramatically is the status of the rail sector in land transport. In the 2001 transport policy it was taken for granted that rail was environmentally superior. This is correct for the average case, but not in all cases (see Chapter 1) In the MTR the requirement is that each mode should be improved as much as possible and that we should favour the most environmentally friendly modes where appropriate. This has placed the burden of proof on the shoulders of the rail industry. It may prove difficult to lift this burden in a society where external costs are not always taken into account sufficiently. A possible positive effect is that it may push rail transport towards faster European integration than previously seen, where rail lags far behind road and air transport.

Outlook — the new opportunities!

The MTR highlights the increasing problem of emissions of CO_2, though without offering any effective proposals on how to deal with the problem. It is clear that technology alone will not solve the problem and that the flagship of the CO_2 reduction policy — the voluntary commitment by the auto industry — will not solve it either; even if industry manages to meet its commitment (which seems more and more unlikely). One of the lessons from the voluntary commitment is that even though automakers have low emitting vehicles available, they are not sold in sufficient numbers to bring down the average emissions sufficiently. There are however examples of success stories (see Chapter 5 for example) where it has been shown that economic incentives do work to promote the sale of small vehicles.

With such a success story in mind the drive for a common charging framework could pave the way for a much more environmentally oriented charging structure in the whole transport system. However, implementation of charging at national and regional level will be important for the long-term success of such a strategy. Experience with common fuel taxation and common frameworks for road pricing illustrate the difficulty of the task ahead.

In addition, the use of scenarios to feed a debate on which society we want and how transport should serve us is a promising option. It is, however, important that the exercise does not become restricted to simple projections of present trends and adaptations to gaps. If this was to be the case the exercise would provide little more than what normal project assessment reports provide now. Because transport ties most physical elements of society together, fundamental changes to the transport system require and foster fundamental changes to all or most of these elements. Therefore, the changes take time and require a major debate on the aim and direction. Scenario techniques are particularly well suited to feeding this process because they allow the exploration of more abrupt events (e.g. major climate impact, civil unrest, new inventions, etc.) in conjunction with more the normal projection of trends.

So, although the MTR may have narrowed the focus in comparison to previous versions, it has provided a number of new opportunities. The common transport policy is, however, mainly a framework. In addition to European actions, a lot of concrete policy actions need to be implemented at national, regional and local level. It is therefore up to the policy makers at these levels to fully exploit the new opportunities provided by the framework as well as existing and future European action.

Developing long-term scenarios

A novel aspect of the MTR is a suggestion that a set of scenarios with a 20 to 40-year horizon should be developed to help devise and evaluate future policy options.

Scenarios can be rather simple projections of present trends into the future that show the unsustainability of present trends. But scenarios can also be an active tool for exploring probable and less probable futures. This in turn can guide the development of policies to support positive trends and counteract possible negative developments.

How the scenarios will be used could have a significant bearing on the debate about tomorrow's transport system and how it should interconnect communities.

1 Freight transport volume growth outpaces economic growth

More goods are transported over longer distances and more frequently. Addressing overall transport demand is important because of the link between transport volume and its environmental impact. Modal shift in specific markets can also contribute to reducing the environmental impacts of transport.

More goods are transported over longer distances and more frequently than ever before. As a result, the freight transport volume has grown by 43 % since 1992. After some years of more moderate growth, volumes grew strongly once again in 2004. Over the same period GDP grew by 30 %. Therefore, freight transport intensity has increased over the past decade. As is shown below growth has resulted in increased transport CO_2 and slowed the decline in air pollutant emissions. Noise emissions have been affected as well, though it is not possible to quantify the effect yet. A consistent dataset on this will only be available at the end of 2007. A continued volume increase is projected for the next decade as well. This will put further pressure on measures to reduce transport CO_2 emissions.

Over the past decade, the share of road transport in the inland freight transport markets in the EEA member countries (no data for Switzerland and Liechtenstein) increased to 78 % (2004) at the expense of rail and inland shipping. These modes have largely been unable to attract additional cargo but have maintained their absolute volume within their respective niches. This means that transport growth is dominated by road transport. In EU-10 the share of rail transport is declining rapidly, while road transport's share is growing fast. The main reason behind this change seems to be similar to the one behind the corresponding change in EU-15 Member States; it is just at a different point in time. Road transport is generally faster and more flexible when compared to other modes. In addition, road networks are developed much faster than rail networks. These qualities also play a part in a growing demand for just-in-time delivery. Therefore, a continued shift in the EU-10 is likely as a consequence of the continued economic transition.

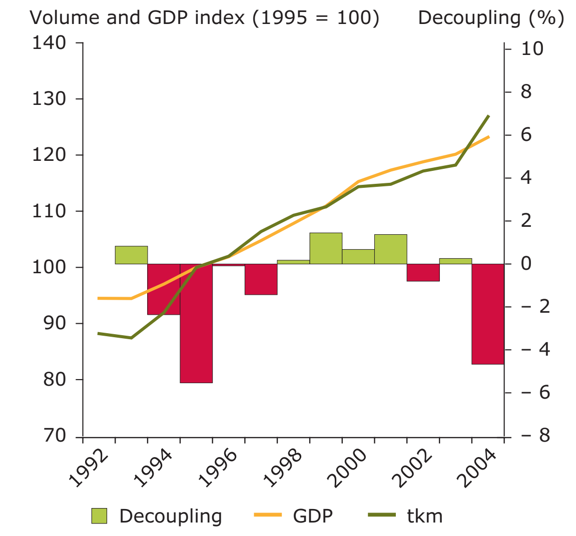
Modal shift towards rail and inland shipping is not in all circumstances an efficient way to reduce the environmental impact. Advantages are most pronounced for long distance transport (EC, 2006). In addition, specific measures aimed at modal shift, like building new rail infrastructure, may in some cases boost the transport volume of rail without necessarily decreasing road transport volumes significantly. In those cases, the net effect is higher transport volume and higher total emissions (CE Delft, 2003). Therefore, in addition to modal shifting in specific cases, all modes of transport have to improve their environmental performance.

Growing incomes enable people to consume more. This in turn increases transport demand. Distances between consumers and producers grow, facilitated by the removal of barriers to trade in the internal market and in the wider world. Production chains are also subject to globalisation. Components are produced all over the world and assembled at various locations. This happens because the differences in production costs are higher than the transport costs, making transport more profitable than local production. In short, low transport costs allow companies to benefit from differences in labour costs and skills in different regions.

The MTR aims to disconnect transport volume increases from increases in its negative side effects. This has been achieved for air pollutants (Chapter 4), but reducing the GHG and noise emissions, and preventing landscape fragmentation cannot be achieved by technical improvement alone. Freight transport demand is expected to increase by around 50 % between 2000 and 2020 in the EU-25, so energy efficiency improvements will not be sufficient to offset the increase in CO_2 emissions (De Ceuster G. *et al.*, 2005). Therefore, policy development must aim both at the environmental consequences and at freight transport volumes.

Figure 1.1 Freight transport volumes grow along with GDP

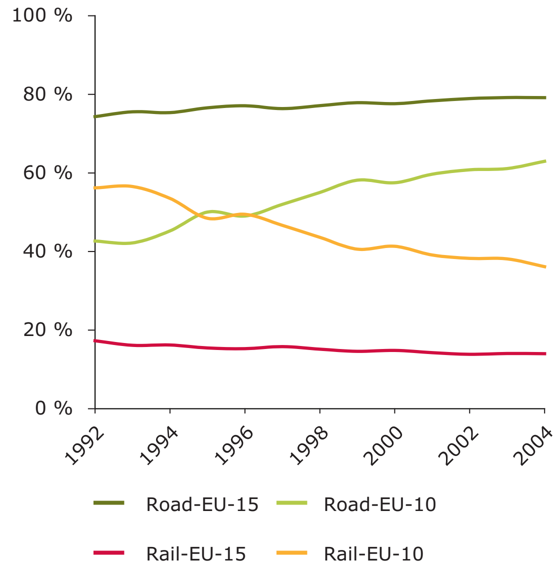
The growth in transport volume in the EEA member countries as a whole has closely followed growth in GDP since 1995. There have been no clear signs of decoupling. The decoupling columns in the chart represent annual decoupling. Positive values indicate decoupling (percentage decline in transport intensity since the previous year). Data for 2004 show strong growth in transport volumes. Disaggregated by region, the EU-15 countries show an increase in the freight intensity between 1992 and 2004, while the EU-10 countries show decreasing levels (Figure 1.3).



Source: Eurostat, see also metadata section.

Figure 1.2 Road transport's share increases strongly in EU-10

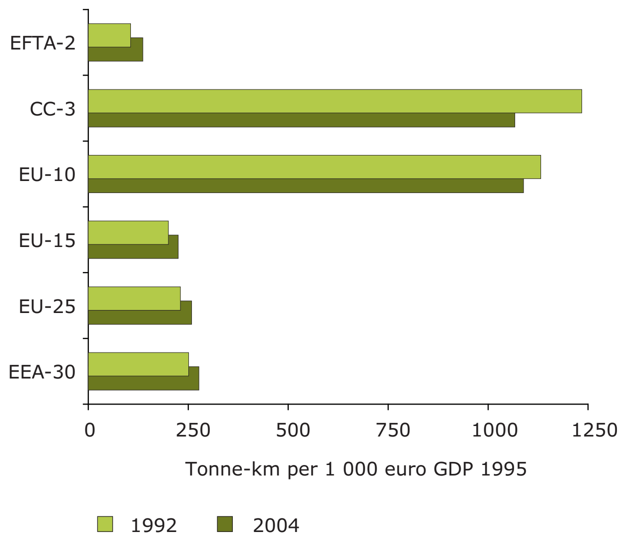
With a 78 % market share, road transport dominates the inland freight transport market in EEA member countries. Moreover, the share of road transport has grown steadily over the past decade at the expense of rail and inland waterway transport. In the EU-10, road and rail transport changed position in the early 1990s. The share of road transport is growing strongly and reached 63 % in 2004; at the cost of rail transport. This can be explained by historical preference for rail transport in the centrally led economies in EU-10. Due to the liberalisation of markets, the decrease of heavy industries in those economies and the poor standard of many rail links, the demand for more flexible road transport has increased. The share of inland shipping is limited at approximately 5 % in EEA member countries.



Source: Eurostat, see also metadata section.

Figure 1.3 Freight transport intensity differs strongly in EU

Differences in the structure of the economy lead to differences in the amount of goods transported per unit of GDP (freight transport intensity). As such it is a measure of the amount of transport needed for each produced unit of GDP. It is influenced by both the structure of the economy and consumption patterns of a country's citizens. Physical products tend to require more transport than services. Moreover, an economy which is more integrated into the world economy tends to require more transport than a less integrated economy. There are therefore two different trends that affect transport intensities across Europe. In the EU-15, freight intensity is approximately 225 tkm per 1 000 euro and increasing due to globalisation. In the EU-10 this figure is almost four times higher but decreasing because of shifts in production structure.



Source: Eurostat, see also metadata section.

2 Passenger transport volumes continue to increase

Passenger transport volumes have grown strongly in and between EEA member countries. Air transport, in particular, has shown massive growth. For the next decade further growth of passenger transport volumes is expected, especially in the EU-10.

Between 1990 and 2003, passenger transport volumes in the EEA member countries grew by 20 % while GDP increased by 30 %. Air transport grew the most during this period (96 %), followed by private car transport. Increased incomes, more and better infrastructure and spatial developments explain the growth of transport volumes. Current trends are projected to continue. Road and aviation were recently estimated to increase by 36 % and 105 % respectively between 2000 and 2020 in the EU-25, with the strongest growth taking place in EU-10. (De Ceuster G. *et al.* (2005).

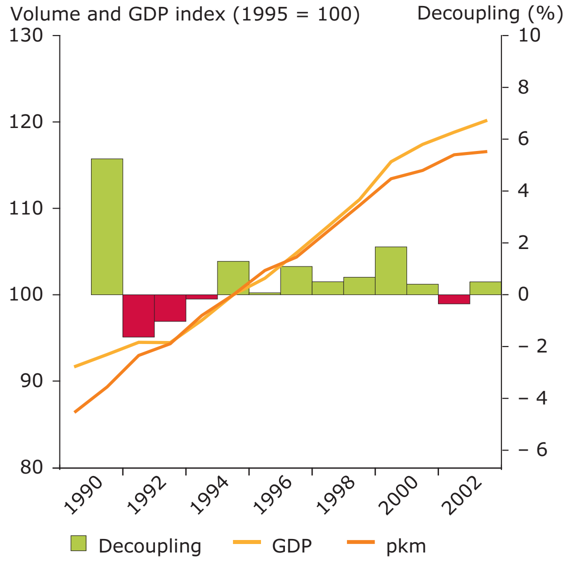
Research shows that generally people tend to spend a fixed share of their income and time on transport (the Brever law). Therefore, greater income is a major driver of increased transport volumes (WBCSD, 2001) and higher transport speeds. This is due to improved technology and infrastructure which boosts the number of passenger kilometres. Spatial development is also an important determinant for transport volumes. For example, the construction of out-of-town shopping malls requires car mobility of shoppers and creates transport demand. Therefore, especially in the EU-10 , there will be strong pressure on growth in transport volumes in the next decade. This will be due to rising incomes, increasing car ownership and better infrastructure. In the five EU-10 where data is available, the amount of kilometres travelled per capita is currently more than 40 % under the EU-15 level.

Rising incomes have also made leisure travel a significant contributor to the increased passenger transport volumes. Due to cheaper tickets, the supply of holidays by air has increased and hence the share of air transport in holiday travel. Airports in tourist areas like Mallorca are therefore high on the list of the busiest EU airports. However, traffic is also increasing to destinations in Asia and the Caribbean. Accordingly, the share of aviation in the total passenger transport volume has increased rapidly to approximately 11 % in 2003. The strong growth of aviation can be partly explained by the exemption of fuel excise duties and VAT, while the taxes of other modes are much higher and gradually increase (see Chapter 7 and the data annex). To address the increasing environmental impacts caused by aviation, the Commission is currently preparing legislation to include the aviation sector into the European Emissions Trading Scheme (ETS). However, studies show that the short-term effect on emissions within the aviation sector will be limited and that the operators are likely to buy emission credits on the market instead of taking action to reduce them (CE Delft *et al.*, 2005). Aviation could thus contribute to the funding of reductions in other sectors.

In urban areas, motorised transport has many negative localised side effects. The challenge for future urban transport systems is to meet the demand for accessibility for people, while at the same time minimising the impact on the environment. Therefore, the European Commission is supporting many initiatives to optimise urban transport systems. Because of the subsidiarity principle however, this remains mainly within the area for local governments. However, it can be underpinned by Community legislation and other incentives within the field of pricing and distribution of good practices (see Box).

The environmental impact of the passenger transport system depends on the transport volumes and vehicle technology. Pollutant emission reduction has been achieved by effective emission standards, but the technical solutions to compensate the growth in CO_2 emissions have been easily offset by increased volumes. Pricing is being discussed as a tool to address transport volumes. Research has shown that people tend to change their behaviour as the prices for transport increase (Goodwin, *et al.*, 2004). Also, the London and Stockholm congestion charges for road transport demonstrate that people are sensitive to prices.

Figure 2.1 Economy grows slightly faster than passenger transport volumes

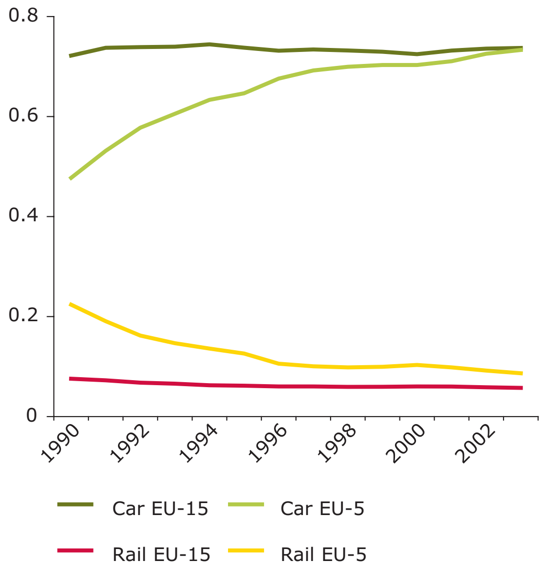


Note: Coverage of countries is different than last year report.

Source: Eurostat, see also metadata section.

In contrast to freight transport, passenger transport has on average grown more slowly than the economy since the mid 1990s. After 1995, the economy grew slightly faster than passenger transport volumes, except in 2002. An explanation may be that time constraints are beginning to play a role in limiting passenger transport growth. The decoupling indicator is expressed as the change in transport intensity (pkm/euro of GDP) compared to the previous year. Green columns represent decoupling; a decrease in transport intensity compared to the previous year, whereas red columns indicate an increase in transport intensity compared to the previous year. The decoupling shown in the figure is only relative, i.e. it is below the level of economic growth. In other words, transport is still growing, but more slowly than the economy.

Figure 2.2 Mobility patterns in EU-10 show a resemblance to EU-15



Source: Eurostat, see also metadata section.

Public transport enjoyed a high share in the EU-10 at the beginning of the 1990s compared to EU-15. Nowadays the modal split across the EU does not show much difference, though there are national variations. Transport volumes per capita in the EU-10 are, however, still lower (8 000 vs. 14 000 pkm) than in EU-15. Nevertheless, they grew 26 % between 1993 and 2003, compared to 19 % in EU-15. Although the share of road was under 50 % at the beginning of the 1990s, this caught up to western European levels in 2003. The change in mobility patterns can be explained by rising incomes. Due to higher incomes, people can afford a car and holiday trips by air. It is also projected that in time transport volumes will increase up to levels close to those in EU-15. Strong investments in motorways contribute to this development as new roads increase people's accessibility.

Integration between urban transport and transport planning

In Freiburg (Germany), 60 % of all trips are made using public transport, walking or cycling. This is much higher than the average in western Germany. The example of Freiburg illustrates the benefits of close integration between urban development and municipal transport policy. Compact urban development promotes the use of public transport, while efficient public transport is only possible with compact urban development. Careful planning, high-quality service and pricing are the key elements for success. Since the mid-1990s the new Rieselfeld residential area has been developed on the western outskirts of the city, where working and living is combined. The emphasis was on the compact settlement structure and a forward-looking transport concept with a priority on public transport and non-motorised modes. The Rieselfeld area was connected to the existing public transport system before the first residents moved in. This information was made available to all planners years in advance, and consequently changed many private decisions. The compact urban structure offers great benefits for the environment, at zero cost: less energy consumption, less air pollution and improved livability (GTZ, 2001).

3 Greenhouse gas emissions from transport grow

Emissions of greenhouse gases in the transport sector are steadily increasing. Improvements within energy efficiency of different means of transport and the introduction of renewable fuels are not sufficient to offset the growth of transport volumes. This tendency threatens both Europe's and individual EU Member State's progress towards their Kyoto targets. Therefore, additional policy initiatives and instruments are needed.

Transport is responsible for 21 % of total greenhouse gas (GHG) emissions in EU-15 (excluding international aviation and maritime transport — see metadata section for details). For the EEA area as a whole the number is slightly lower, because of the lower EU-10 level (11 % of total). From 1990 to 2004, EU-15 greenhouse gas emissions decreased in most sectors, particularly energy supply, industry, agriculture and waste management. During the same period, emissions from domestic transport increased by approximately 26 %. Even with all planned reduction measures included transport GHG emissions are projected to grow slightly (EEA, 2006b).

The growth in GHG emissions and energy use in the transport sector is the result of increased transport volumes (Chapters 1 and 2). Road transport is by far the biggest transport emission source (93 % share). Emissions have increased continuously both for passenger transport (increase of 27 % between 1990 and 2004) and for freight transport (increase of 51 % between 1990 and 2003).

Road freight transport growth in the EU is projected to continue, resulting in an increase in energy demand of more than 15 % between 2000 and 2020 (according to a study made for DG Energy and Transport in preparation for MTR) (De Ceuster *et al.*, 2005). The average European passenger car is becoming more efficient each year due to the industry agreement (Chapter 5). Total energy demand from passenger cars would therefore be expected to decrease slightly over the coming decade if progress matches current ambitions. Insufficient progress may however invalidate these projections.

To reverse the current trend of growth in GHG emissions, further measures are needed. In addition to an action plan for energy efficiency in transport (as proposed in the MTR) there could be action to address transport demand.

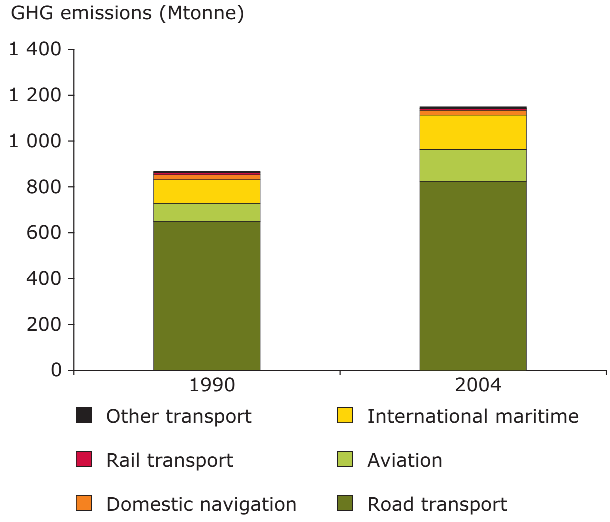
CO_2 emissions from international aviation and navigation — which are not included in the commitments in the Kyoto Protocol (see metadata section) — are growing faster than emissions from other transport modes. In EU-15 they show a combined increase of 59 % between 1990 and 2004 (EEA, 2006b). Emissions from international aviation are growing fastest; an increase of 86 % was witnessed in the same period. In addition to emissions of CO_2, aviation is also contributing to climate change by emitting NO_x, and particles as well as by contributing to the formation of contrails and cirrus clouds. Some of these have a cooling effect. However, in total the warming effect is 2–4 times higher when those other effects are taken into account and compared to the impact of CO_2 emissions alone (IPCC, 1999).

The European Commission has announced a proposed legislation by the end of 2006 to include the aviation sector in the EU Emissions Trading Scheme for CO_2 (EU-ETS). This can be seen as a first step to reduce the climate impact of air transport. However, the sector is expected, to a great extent, to buy allowances on the market instead of taking action to reduce the emissions.

Maritime transport is responsible for 13 % of the world's total transport GHG emissions at the moment. Projections foresee a growth of 35–45 % in absolute levels between 2001 and 2020, based on the expectations of continued growth in world trade (Eyring *et al.*, 2005). Since shipping basically is a very energy efficient mode of transport little attention has been paid to it so far. However, there might still be room for energy efficiency improvements. In addition, transport demand is also an issue for maritime transport.

Figure 3.1 GHG emissions from transport increase

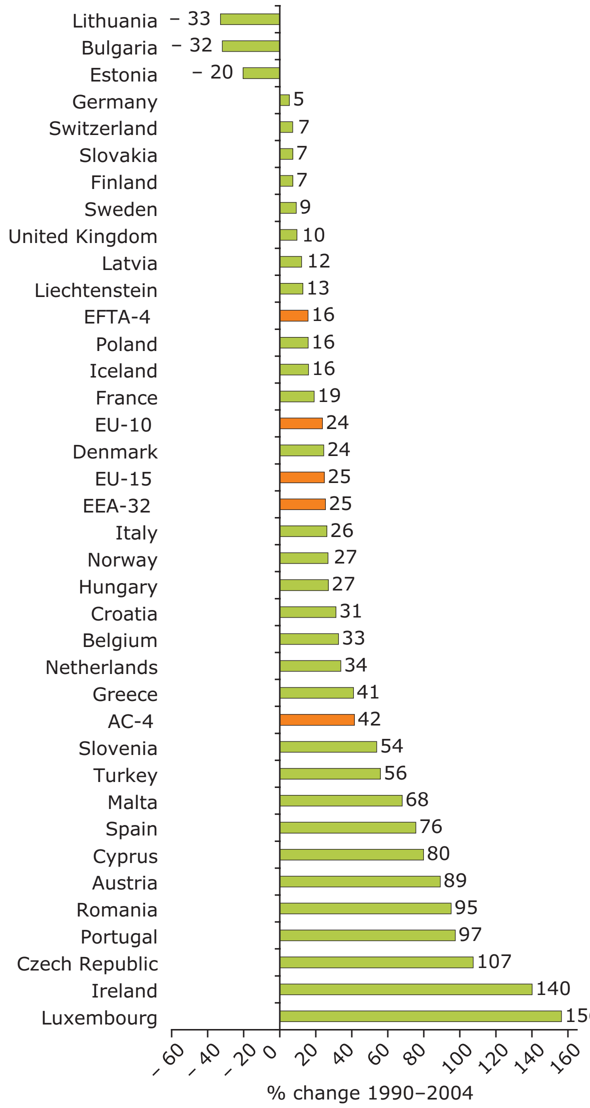
Greenhouse gas emissions from transport increased in EEA member countries by more than 32 % between 1990 and 2004. The EU-15 is responsible for 83 % of the total GHG emissions from transport in all EEA member countries (international aviation and maritime transport are not included). This growth can be explained by the increased volumes of road transport (e.g. private cars, vans and trucks), aviation and international maritime shipping.



Source: EEA, see also the metadata section.

Figure 3.2 Trends in transport GHG emissions by country (1990–2004)

Most countries show an increase in the emissions of transport GHGs, due to an increase in transport movement. On average, the EU-10 has witnessed smaller growth numbers than the EU-15. This can be explained by the re-structuring of the economy and resulting decreases in transport intensity, especially in freight transport. However, the difference between the regions is rapidly decreasing.



Note: The figures do not include greenhouse gas emissions from international aviation and maritime transport.

Source: EEA, see also the metadata section.

Changes in EU-15 GHG emissions by sector and share of sectors

From 1990 to 2004, EU-15 greenhouse gas emissions decreased in most sectors, particularly energy supply, industry, agriculture and waste management. During the same period, however, emissions from transport increased by nearly 26 %.

With the help of additional measures, emissions from energy supply, agriculture and waste management are projected to further decrease, while emissions from transport and industrial processes will both roughly stabilise at 2004 levels (EEA, 2006b).

4 Harmful emissions decline, but air quality problems require continued attention

Transport, especially road transport, is becoming less polluting due to increasingly strict emission standards for the different transport modes. Nevertheless, air quality in cities does not yet meet the limit values set by European regulation, and still has a major negative impact on human health.

SO_X emissions have shifted from land to sea rather than actually decreased.

The emissions of acidifying substances, particulate matter and ozone precursors from transport fell by 30 % to 40 % from 1990 to 2004 in EEA member countries (excluding international aviation and maritime transport). Emission regulation targeted road vehicles from the end of the 1980s via EU emission standards. Standards for two-wheelers, barges, diesel trains and non-road mobile machinery came into force more recently. Further tightening of standards will be introduced in the coming years.

Continued attention to air quality in cities is needed. Approximately 9 % of the EU-25 population live closer than 200 meters from a road with more than 3 million vehicles per year, and as many as 25 % live within 500 meters (ENTEC, 2006). Consequently, approximately 4 million life-years are lost each year due to high pollution levels (EC, 2005). In the past, emission standards have been the most powerful tool for reducing transport emissions. A fast introduction of tighter emission standards for cars, vans and trucks (Euro 5/6) may have great health benefits and help Member States to meet the EU Directives on air quality and national emission ceilings (NEC).

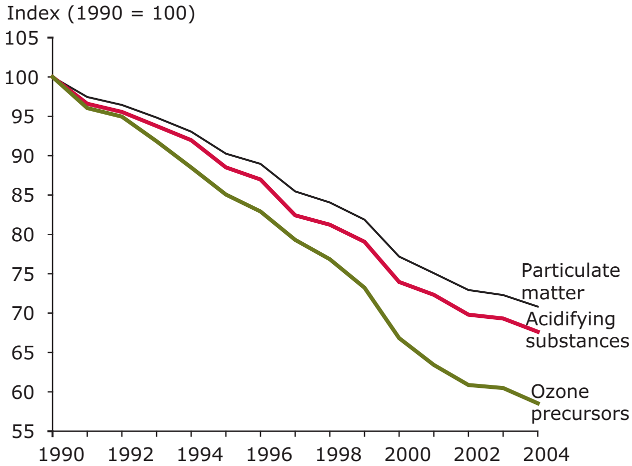
Recently, the EU adopted the Thematic Strategy on air pollution that sets out a long-term strategy for clean air in Europe (CAFE). Therefore, the Commission has proposed a new Directive that merges all separate existing legislation on ambient air quality and cleaner air for Europe. In addition to the existing PM_{10} limit value, the proposal also holds a limit value for $PM_{2.5}$ to be applied from 2010. The figure on the next page shows how annual average concentrations exceed both the current limit values for PM_{10} and NO_2. Most of the variation seen in the graph is due to variations in weather which has a strong impact on the dispersion of pollutants. The increasing share of diesel vehicles in urban transport is a significant problem within this context.

Maritime transport is the major emitter of SO_X in transport. For the EEA area, the contribution has increased from 50 % in the early nineties to 78 % in 2004. Maritime emissions are regulated by the Marpol convention Annex VI that entered into force in May 2005. The general sulphur limit for marine fuel is 4.5 % (45000 ppm) and 1.5 % in Sulphur Emission Control Areas (SECA — the Baltic, North Sea and English Channel). The average marine fuel sulphur content is slightly below 3 %. Therefore, the general limit will not affect sulphur emissions except for in SECAs. Sulphur emissions from marine transport have increased more or less in parallel with the reductions made in land transport. Desulphurisation at refineries has mainly shifted sulphur from one fuel type to another. Rather than being reduced, sulphur emissions have simply been shifted from land to sea. As part of the implementation of SECA, ship operators are allowed to experiment with after-treatment technologies (scrubbing) to reduce emissions to levels comparable with those cleaner fuels would provide. However, this can only be carried out if strict environmental impact evaluation guidelines are applied. Such evaluation may help demonstrate the potential for after-treatment technology in the marine sector.

Annex VI also contains a limit for NO_X emissions of marine engines. Most engine manufacturers have been building engines compliant with this standard since 2000, so the replacement of older technology has been ongoing for five years. However, improved technology to further reduce emissions of NO_X or SO_X has not been introduced on the market, since there have been no legislative incentives. Therefore, the Commission has called for a further strengthening of shipping emission standards.

Figure 4.1 Transport emissions of air pollutants in EEA member countries

Emissions of air pollutants from transport (excluding international aviation and maritime) have decreased significantly since 1990 in EEA member countries: particulate matter by 29 %, acidifying substances by 32 % and ozone precursors by 41 %. This is mainly due to innovations in exhaust gas treatment in road vehicles and improved fuel quality. The introduction of EU standards for automotive emissions and fuel quality (especially reduced sulphur concentration) has had a significant impact. Further reductions will take place as even stricter limits enter into force and older vehicles are replaced by new models.

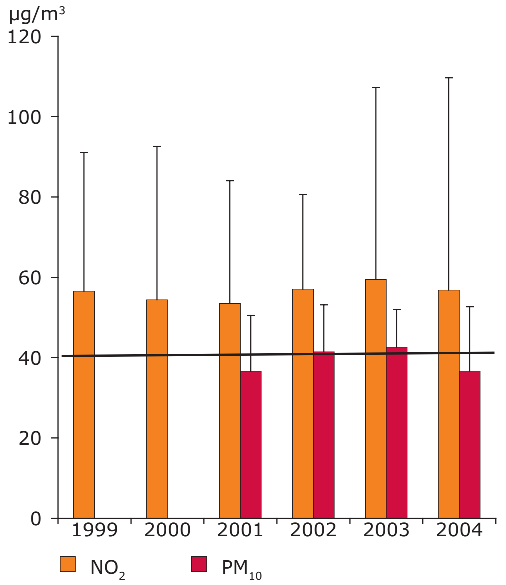


Source: EEA, see also the metadata section.

Figure 4.2 Average annual concentrations of NO_2 and PM_{10} in urban areas

Data from selected measuring stations in urban agglomerations close to major traffic arteries indicate that the concentrations of NO_2 (2010 limit) and PM_{10} (2005 limit) are at or above the European air quality limits at these sites.

Air quality is affected by a combination of emission and meteorological factors. It is therefore too early to offer solid conclusions on the impact of transport on air quality development in urban areas. However, two elements may help to explain why the improvement still fails to appear: the increased use of diesel in urban areas and an increase of the fraction of NO_X emitted as NO_2 since 2000. Oxidation catalysts and regenerative traps in modern diesel vehicles have been found to cause the increase (AQEG, 2006).



Note: The error bars represent maximum value. The dotted line represents the yearly limit value set for PM_{10} (2005) and NO_2 (2010).

Source: EEA, see metadata section.

Environmental zoning: an effective instrument to reduce pollutant emissions

Environmental zones are an effective means to combat air pollution. One essential element of an environmental zone could be less polluting trucks. This reduces NO_X and PM_{10} emissions and improves air quality. Banning older trucks and private cars seems to be very effective, as they have a high share in total emissions. Several European cities have an environmental zone or have announced plans. Sweden and Italy have environmental zones in operation, while Denmark, the United Kingdom, Norway and the Netherlands have announced plans or are making provisions for cities to do so. In Sweden, reductions of 40 % and 10 % in PM_{10} and NO_X emissions respectively have been found. Most environmental zones are directed at trucks, but in Italy also older passenger cars are banned.

To harmonise the introduction of environmental zones in the EU, a working group under the joint expert group on transport and environment has come with a proposal for actions at the Community level. Issues as type approval procedures for retrofit systems and equal vehicle identification systems need attention (JEG, 2005).

5 Vehicle efficiency improvements slow down, but diesels can become clean

Efficiency improvements in passenger cars were slower than expected, partly due to market trends. The European Commission has announced a new policy for CO_2 emissions from light duty vehicles.

Application of NO_x and particulate abatement devices rapidly improves the environmental performance of new diesel vehicles and offers opportunities for further steps.

Progress in the reduction of average new passenger car CO_2 emissions is slowing down, causing serious doubts about whether the automanufacturers (organised in ACEA (Europe), JAMA (Japan) and KAMA (Korea)) will meet the target of 140 g/km, as set in the self commitments for 2008/2009. The consumer trend towards larger, more luxurious and thus heavier cars is an important obstacle to achieving net reductions. Fiscal measures, another pillar of the EU policy, could have helped to overcome this obstacle. However, these have been insufficiently implemented. Technological progress in 2005 has manifested itself mostly in incremental improvements of conventional engine technology rather than by the introduction of new powertrain technologies. Apart from a new hybrid SUV, the number of hybrid car models available on the European market has not changed. For example, in 2005 approximately 10 000 fuel-flexible vehicles running on E85 (85 % ethanol, 15 % gasoline) were sold in Sweden. The number of filling stations selling E85 has risen to 320. In the heavy-duty market, where efficiency improvement is driven by economic motives rather than CO_2 policy, the application of selective catalytic NO_X reduction (SCR-deNO_X) has generated an opportunity for modest efficiency improvement.

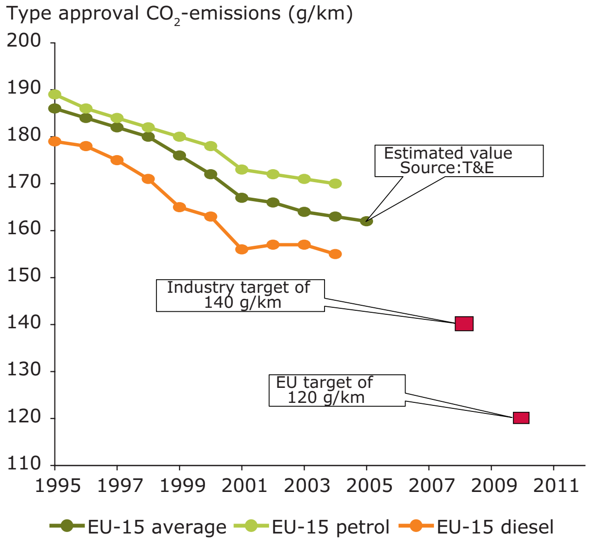
In 2005 the European Commission initiated a review of options for reaching the Community objective of 120 g/km in the period 2008–2012. In line with the 'Integrated Approach' discussed by the CARS 21 high-level group, this review also assesses reduction measures other than vehicle efficiency improvements in terms of their cost-effectiveness for achieving the desired CO_2 emission reductions. It also includes light commercial vehicles. At the time of writing the debate is over whether there should be legislative action requiring automanufacturers to reach 120 g/km or if emission trading-like schemes should be applied instead.

An important development concerning air polluting emissions has been the introduction in the market of Euro 4/IV passenger cars and trucks. The latter are sometimes equipped with advanced exhaust gas recirculation (EGR) and particulate filters (DPF), but mostly with SCR-deNO_X systems using urea. Other developments include the increased availability of particulate filters for new Euro 4 diesel passenger cars and as retrofit option for existing vehicles as well as the early market introduction of Euro V trucks and buses.

The increasing share of diesel vehicles is having an adverse effect on the development of some regulated pollutant emissions from the passenger car fleet. Average on-road emissions of NO_X and PM_{10} are decreasing more slowly than previously expected. This affects both local air quality and overall emission levels covered by National Emission Ceilings (NEC). This issue is partly tackled by the Euro 5 and 6 emission limits for passenger cars and vans, which were agreed in December 2006. The Euro 5 PM limit for diesels is a factor of 10 lower than Euro 3. As a result, Euro 5 diesel cars will have to be equipped with a particulate filter, which will significantly help to reduce local problems with PM_{10} concentrations. Euro 5 NO_X-limits for diesels are 28 % lower than Euro 4 and Euro 6 will reduce emissions a further 40 % compared to Euro 4. Additional local measures may still be necessary (e.g. environmental zones), especially for short-term local NO_2-problems. For HD-vehicles Euro VI limits are still being discussed.

Figure 5.1 Doubtful if industry can meet the 2008/2009 target of 140 g/km

Recent evaluation of progress made by the associations (2004 data) to meet their own commitment of an average emission of 140 g/km for the passenger car vehicle fleet shows a slowdown. It seems more and more unlikely that auto manufactures will manage to meet the target unless car buying behaviour changes dramatically. Low emitting cars are available on the market, but are not sold in sufficient numbers to affect the average. Between 2004 and 2008/2009 annual reduction rates of around 3.5 % will be necessary to meet the target. Preliminary data over 2005 from the European Federation for Transport and Environment (T&E) calculations indicate that the industry will fall further behind.

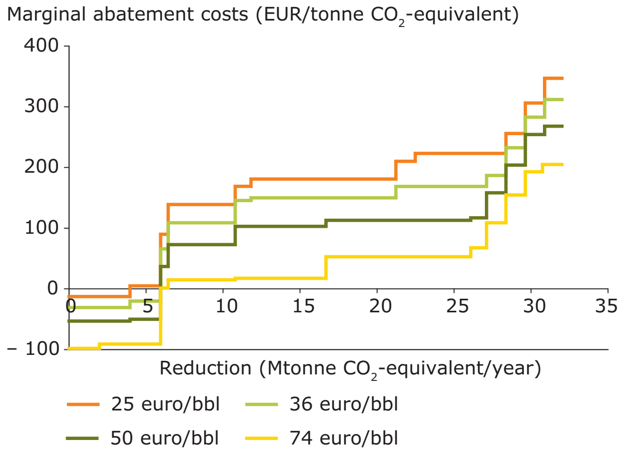


Source: COM(2006)463, T&E, 2006.

Figure 5.2 Costs for going beyond 140 g/km

In preparation of a new European Commission policy on CO_2 emissions of light duty vehicles beyond 2008 a recent study for DG Enterprise and Industry has assessed CO_2-abatement costs for various reduction measures. Reducing passenger car CO_2 emissions from 140 to 120 g/km through technical measures could increase the retail price by EUR 2 500 and result in abatement costs between 130 and 230 euro/tonne depending on oil price ranging between 25 euro/bbl to 74 euro/bbl. The numbers are significantly higher than numbers from earlier studies.

Due to the fact that vans have so far not been subject to CO_2-reduction policy, emission reductions up to 45 g/km may be achieved at lower abatement costs than a 20 g/km reduction in passenger cars.



Note: Each line in the graph shows the incremental savings achieved by applying increasingly expensive technologies. Savings below 6 Mt are free whereas the price increases rapidly if the target is higher than 25 Mt CO_2.

Source: TNO, 2006 (draft report).

CO_2 differentiation of vehicle taxation to promote fuel efficiency

The Commission proposal for a Directive on passenger car taxes proposes a phase out of registration taxes (RT) over five to ten years and a restructuring of the tax base of RT and circulation taxes (CT) to be totally or partially CO_2 based. The main environmental rationale for the proposal is to introduce the 'polluter pays' principle in the area of passenger cars and to implement the third strand of the Community Strategy on Passenger Car CO_2 Emissions. The proposed phase out of RT, however, could make it more difficult to design a CO_2-based vehicle taxation that effectively influences consumer behaviour at the moment of car purchase. Some Member States have already introduced various forms of CO_2-based vehicle taxation:

- In the United Kingdom tax bands for CT are linked to the absolute CO_2 emission of vehicles.
- The Netherlands introduced a CO_2-based differentiation of RT linked to the Dutch car labelling system.
- France has adopted an RT scheme for business cars where a charge per gram of CO_2 per kilometre is introduced, which is a function of the car label.
- In Denmark circulation tax is differentiated in 24 bands related to fuel consumption. This has resulted in a significantly increased share of low CO_2-vehicles in recent new vehicle sales. In addition Denmark has one of the highest registration taxes in EU.

Source: COM(2005)261.

6 Developments in transport fuels: increasing the share of alternative transport fuels and application of cleaner fuels

Biofuels targets and policies are being implemented in most Member States and biofuels production volumes increase annually, albeit from a low level. However, the production of biomass must be carried out in a sustainable way to avoid loss of biodiversity.

After a century of fossil fuel dominance in the transport sector, biofuels are beginning to be more and more common on the market. However, they still remain on a small scale. This is happening as a result of government policies that were implemented in response to the EU Biofuels Directive 2003/30/EC. Most Member States have implemented targets equal to the EU indicative target for 2010 (see Figure 6.1). This has created a market for biofuels and promoted the development of a biofuels industry in the EU. Both biodiesel and bioethanol production volumes increase annually (see Figure 6.2). Furthermore, biofuels are becoming an integral part of the various sectors involved: the agricultural sector, the oil industry and the car industry.

In the coming years, both the European Commission and Member States are expected to decide on the future biofuels policy. In doing so they must address the concerns expressed by an increasing number of countries and stakeholders about negative impacts of biofuels on the environment. Impacts may occur if policies do not ensure the sustainability of the biomass used and the GHG reduction achieved by the fuels.

From an environmental point of view, the main reason for using biofuels is the possible reduction of GHG emissions as plants absorb CO_2 while growing. This CO_2 is then later released when the biomass is burned to release the energy. To estimate the potential of different biofuels in this respect, emissions from well-to-wheel (WTW) must be taken into account. The net GHG emissions vary significantly between different biofuels (see text box). A detailed analysis of the WTW emissions for different fuel types is therefore necessary to achieve the most positive impact on climate change. Such detailed analysis could also give indications about the risk for biodiversity (see below). In addition, it will give a basis for examining alternatives and may ensure a more cost effective use of biomass for energy production.

Concerns about the potential negative effect of biofuels on biodiversity are growing. The substantial rise in the demand for biomass from

Figure 6.1 Indicative biofuel targets in the member states

Many EU Member States have implemented biofuels targets corresponding to the indicative EU target for 2010 (Directive 2003/30/EC, 5.75 %). However, some Member States have lower targets. Targets for Cyprus, Denmark, Estonia, Finland, Ireland, Malta, and Portugal have not yet been fixed, and are not required until 2007.

Source: Submissions by Member States to DG TREN, and information received directly.

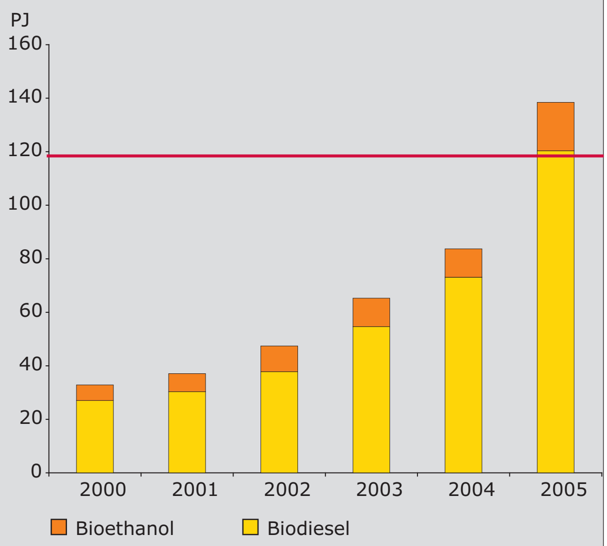
both the biofuels and bioenergy sector (heat and power) puts additional pressure on farmland and forest biodiversity as well as on soil and water resources. It may also counteract other current and potential environmental policies and objectives, such as waste minimisation or environmentally-oriented farming. Significant amounts of biomass can be technically available to support ambitious renewable energy targets, even if strict environmental constraints are applied. However, an appropriate policy framework combined with advice and guidance to bioenergy planners, farmers and forest owners on environmental considerations needs to be put in place to steer bioenergy production in the right direction (EEA, 2006a).

A recent global study for the Convention on Biological Diversity (MNP, 2006) confirms the relationship between increased biomass use and potential biodiversity loss.

Figure 6.2 Biofuels production data

Today biofuels are mainly produced as biodiesel and bioethanol. Overall 3.9 million tons of biofuels were produced in the European Union in 2005, marking a 65.8 % growth in production from the year before. Biodiesel accounted for 81.5 % of the total production.

The red line (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: EurObersv'ER, Biofuels Barometer.

In December 2005, the EC issued the Biomass Action Plan (COM(2005)628). This was followed up by an EU Strategy for Biofuels (COM(2006)34) early in 2006. In the latter the Commission states that a review of the Biofuels Directive will be carried out by the end of 2006. In this review, attention will be paid to the issue of cost-effectiveness, the level of ambition after 2010, and to assessing and monitoring the full environmental impact of biofuels.

Many of the responses to a recent public consultation on the Biofuels Directive also pointed out that the sustainability issues of biofuels are important to resolve. An increasing number of European Member States has started working on this issue (e.g. the United Kingdom and the Netherlands), and are investigating options for certifying the sustainability of the biofuels sold. The EC is also planning to assess the possibilities to implement sustainability certification within the coming months.

Biofuels will also be part of the EU renewable energy roadmap that will be issued early in 2007, as part of the strategic EU energy review. An important element of such a review is the balance between the use farmland for biomass cultivation and food supply, and the balance between biomass use for biofuels or for bio-electricity. In this context it is important to bear in mind that conversion of biomass to liquid fuels consumes energy. Therefore, the immediate GHG saving is slightly smaller than if biomass is used for heat and power production. The comparison is, however, very sensitive to the baseline. If for example the baseline assumption is that the transport sector in the future has to rely on synthetic diesel made from natural gas (Fischer-Tropsch Diesel), the balance will shift in favour of biofuels. This is due to the high baseline CO_2 emission of this synthetic fuel.

To further increase biofuels volume in the future, fuel standards need to be adapted and the compatibility of the vehicles with biofuels needs to be improved. Both issues are currently under investigation. With existing standards, the maximum biofuels percentage is 5 %. Currently, several car manufacturers produce flexi-fuel cars that can drive on a mix of petrol and ethanol (up to 85 % ethanol then called E85).

Other alternative fuels and improved fuel quality

Fossil alternative fuels currently commercially available are LPG (liquid propane gas) and CNG

Figure 6.3 Significant variations in the well-to-wheel GHG emissions of biofuels

In May 2006, JRC/Concawe/Eucar jointly issued an update of the 'Well-to-Wheels Analysis of Future Automotive Fuels and Powertrains in the European Context'. Various alternative fuels were assessed in the report, including various types of biofuels. In the graphs below, the GHG emissions of biodiesel and bioethanol are shown as calculated in that study. The figures illustrate the total net emissions of GHG needed to produce and consume enough fuel to move a specific vehicle one kilometre (i.e. emissions minus what is absorbed when plants grow).

The right hand figure shows the GHG emissions of different types of biodiesel. This synthetic diesel is made from waste or farmed wood, sunflower (SME) and rapeseed (RME). There are also two options for use of the by-product glycerine. The left hand figure shows the GHG emissions of different types of bioethanol. These are produced from various types of raw material (sugar beet, wheat, wheat straw and farmed wood and sugar cane), using different processing options. There are two options for use of the pulp that results in the case that sugar beet is used as feedstock. The figures are illustrative of European average figures, whereas the error bars illustrate the variation across different soil types and climatic regions.

There are clear savings along most production pathways compared to gasoline and diesel, but also a large variation in the net savings (i.e. the difference between the conventional and the biofuel).

Note: SME stands for sunflower methyl ester, RME stands for rapeseed methyl ester, CHP stands for combined heat and power, NGGT stands for next generation gas turbine. DDGS stands for dried distillers' grains with solids. This is a co-product of the ethanol production process that can be used as heating fuel or animal fodder.

Source: JRC/Concawe/Eucar, 2006 http://ies.jrc.ec.europa.eu/wtw.html.

The cost/benefit ratios, including cost of CO_2 avoidance and cost of fossil fuel substitution, crucially depend on the specific pathway, by-product usage and N_2O emissions. Ethanol from cellulose could significantly increase the production potential at a cost that is comparable to more traditional options for fuel production when using low value feed-stocks such as straw. New processes (second generation) are being developed to produce fuels from ligno-cellulosic biomass. These fuels offer lower overall GHG emissions, although they still have a high energy use.

(compressed natural gas), but their market shares are limited to specific niches. Nevertheless, they may both contribute to the security of supply and job creation, and their air pollutant emissions are lower than those from vehicles without advanced emission control devices. However, their environmental benefits have decreased and will become negligible when Euro 5 standards come into force in the next years. LPG and CNG have limited GHG benefits compared to petrol, but hardly any compared to diesel. The environmental push behind these fuels could therefore be neglected.

The future of hydrogen within the transport sector is as yet uncertain. There are still some technical and especially economic problems to solve before it can be seen as a commercially available solution. If these issues are resolved in the longer term, hydrogen could contribute to improving security of supply, and — if produced by renewable energy — reduce emissions of greenhouse gasses. From a GHG reduction and energy efficiency point of view, however, renewable energy might be better used directly in the power sector. (ECMT, 2006; CE, 2006).

7 Transport subsidies and external costs

Transport subsidies are significant. At least EUR 270–290 billion of annual transport subsidies have been identified in Europe. Although not all these subsidies can be labelled as environmentally harmful, some of them are. The external costs of transport even exceed the size of transport subsidies. Internalising external costs should remain a main focus of transport pricing policy and reducing transport subsidies is one of the options available.

Fair competition on the transport market is a key goal of European transport policy. However, compared to other markets the transport market is characterised by some privileges which may impede fair competition:

- different transport modes cause different external costs, and many transport activities do not pay full costs;
- transport depends on infrastructure networks, which are to a varying degree financed from public budgets;
- different transport modes gain large benefits from privileged regulations and land-use policy;
- different transport modes are fiscally supported by various forms of subsidies.

Transport subsidies influence current volumes and structures of transport, and consequently the environmental impact of transport.

- Subsidies can affect the environmental performance of vehicles, i.e. they may bridge the gap between the costs of environmentally friendly vehicles and conventional ones.
- Subsidies may affect transport management decisions (about volume and composition of vehicle fleets, route planning, etc.), which influence the efficiency of the transport system. Less (or more) mileage and thus environmental harm may be the consequence.
- The level playing field between different modes may be affected by subsidies resulting in a shift from environmental harmful modes of transport to less harmful ones or vice versa.
- Subsidies affect transport volume, i.e. cheaper transport encourages additional transport demand, which results in changes in total transport emissions.

Since subsidies can have simultaneous environmental effects on different levels it is difficult to determine their total environmental impact.

Definitions of transport subsidies differ widely. On the one hand, a broad welfare economic approach defines subsidies as all transport costs not covered by users, including all kind of externalities, infrastructure costs and different regulation (Nash, 2002; FACORA, 2004). On the other, a narrow fiscal-policy approach applies only to fiscal relevant transport subsidies with direct impacts to public budgets. Both definitions have their benefits in different contexts. To avoid overlapping with other EEA activities the latter definition is used here. It includes on-budget subsidies (e.g. government expenditure) including annual public funding of infrastructure and preferential tax treatment in fuel tax and VAT.

To estimate net public expenditures on infrastructure, which are considered a form of subsidy, two approaches are followed: the difference between infrastructure costs and charges related to infrastructure costs (Nash, 2002), like the Eurovignette charges, are considered as a proxy for net expenditures. However, in some European countries, other charges, such as circulation and registration taxes, are regarded as contributions to infrastructure costs as well. For that reason, the difference between infrastructure cost and all transport charges could also be considered as a proxy for net public expenditure on infrastructure.

The calculation of the tax subsidies depends on the choice of a reference value for standard rates. Two reference values were regarded: the average price for CO_2 allowances in the EU Emission Trading Scheme and the minimal excise road diesel excise duty (according to Directive 2003/96/EC). Finally, public transport receives payments for providing public service obligations (PSO), e.g. to ensure a sufficient quality of public transport services. It is not clear whether these PSO payments should be considered subsidies or not. The EEA defines a transport subsidy as fiscal support of transport with direct relevance to public budgets and with no direct service in return. According to that definition, PSO's should not be regarded as subsidies for public transport companies.

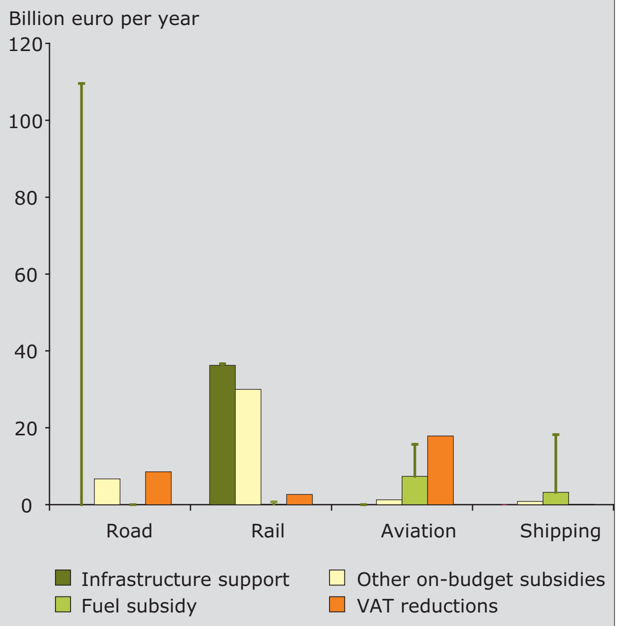
Annual transport subsidies in Europe are estimated at EUR 270–290 billion. However, this estimation is rather indicative for two reasons: Firstly, on-budget subsidies are not based on the analysis of financial budgets of EU and Member States, but are mainly derived from literature and expert consultations. Consequently, data gaps could exist. Potential data gaps include: subsidies for production of trains and aircrafts; subsidies for users of motor vehicles for some countries, e.g. tax deductible amounts for vehicles; and subsidies for road transport services, such as those for car rental and maintenance. For the latter group, there are no data available. Secondly, the data available on infrastructure costs and charges (Nash 2002) are extremely sketchy for aviation and shipping. Therefore, the number found for annual transport subsidies in Europe indicates only a rough order of magnitude.

If only charges directly related to infrastructure costs are taken into account, the largest share (approximately 59 %) of all transport subsidies found in EU-15 is spent on supporting road infrastructure (see Figure 7.1). In road transport, infrastructure charges are apparently much lower than infrastructure costs. The same conclusion, although less robust, holds for rail. As mentioned earlier, data for aviation and shipping are not reliable and thus not presented in Figure 7.1. Fuel subsidies are dominant for shipping and have some relevance for aviation, whereas they are not significant for road and rail transport. Furthermore, air travel in particular enjoys significant benefits due to its VAT exemption status. This applies for all international flights. Also, public transport (road as well as rail) is (partly) exempt from VAT. Finally, other on-budget subsidies are highly relevant for rail and somewhat relevant for shipping. However, they are of little importance for aviation and the road sector.

Environmental impacts and external costs

It is difficult to assess the environmental impact of transport subsidies. Subsidies can have environmental impacts at different levels which can counteract each other. For example, subsidies to railways can increase the competitiveness of rail compared to road transport, resulting in a shift from road to less environmentally harmful rail transport. On the other hand, this subsidy can also increase the total transport volume, which will have a negative environmental impact. It is possible to put an environmental label on some but not all transport subsidies. For example, the complete exemption of VAT and fuel taxes for international flights results

Figure 7.1 Transport subsidies by mode



Note: The large error bar on road infrastructure subsidies illustrates the two different definitions mentioned above. The upper band (109) represents infrastructure costs minus direct charges (e.g. Eurovignette) while the lower band represents infrastructure costs minus all transport related charges. As such it is less an uncertainty on the number, but rather on how to interpret the numbers. Further discussion on this issue will be published with an EEA report on transport subsidies due out in spring of 2007.

The range in estimates is due to varying approaches to estimate infrastructure support and fuel subsidies. This table is based on incomplete data; the total value of transport subsidies remains unknown. This note must accompany any use of this table.

Source: EEA, 2007b.

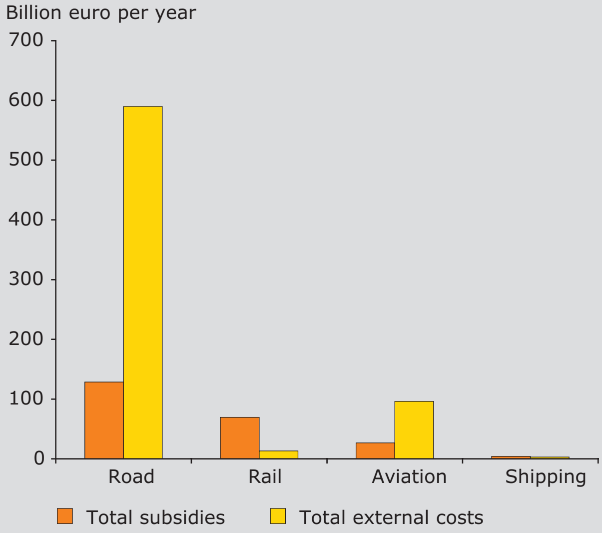
in low prices for air tickets. Where aviation is not exempt of VAT and fuel taxes, more flights take place. Consequently, this results in environmental damage. In a recent study, the potential CO_2 reduction for intra-Europe flights from the introduction of a fuel tax of EUR 330 per 1 000 litre was estimated at 10 % (CE Delft, 2006). Another example of environmentally harmful subsidies is the significant amount of public financing spent on road infrastructure. These subsidies will increase road transport volumes and consequently the negative environmental effects. In contrast to these environmentally harmful subsidies, some subsidies are aimed at supporting sustainable transport. Examples are the subsidy for environmentally friendly vehicles mentioned earlier and the financial support for biofuels.

Subsidies are not the only impediment to fair competition in the transport market. The lack of internalisation of transport's external costs (e.g. contribution to climate change, air pollution, accidents and congestion) as well as preferential regulations interfere with market processes.

The Stockholm Trial

In June 2004 the Stockholm City Council got permission from the Swedish Parliament to conduct a congestion tax trial. This trial began in August 2005 with extra public transport and was extended with the introduction of a congestion charge in January 2006. The trial ended in July 2006. The time dependent charge was applied on weekdays from 6.30 to 18.30. Special vehicles (e.g. electric and biofuels) were exempt from the charge. The revenues of the congestion charge were invested in public transport and other infrastructure associated with the trial. The evaluation of the Stockholm Trial performed by the city showed reductions in car traffic volumes by approximately 22 % and in emissions of 8–14 % in the inner-city. Additionally, a 5–10 % reduction in accidents involving personal injuries was registered, and journey times fell considerably.

Figure 7.2 Total external costs and transport subsidies found for EU-15



Note: The numbers for subsidies comprise on-budget subsidies, annual public funding of infrastructure and exemptions from or reductions to fuel tax and VAT. The numbers for external costs includes costs of accidents, noise, air pollution, climate change, nature and landscape, up- and downstream processes and additional urban costs.

Source: EEA, 2007b.

Figure 7.2 illustrates that for road and aviation external costs are much larger than the transport subsidies found. Large welfare effects can be achieved by internalising external costs.

In the 1990s the European Commission elaborated several proposals on how to estimate external costs and include them into pricing schemes. The need for fair and efficient pricing, which considered external costs, was underlined by the EC White book on the Common Transport Policy and reaffirmed in its recent mid-term review. Pricing policies can contribute to this internalisation strategy. For the road sector, the Commission announced the possibility for Member States to introduce road tolls for heavy vehicles on all roads. These tolls are allowed to be differentiated according to the capacity load and the environmental performance of vehicles, indicated by the Euro category of the lorry. An option to extend the pricing scheme towards integrating more external costs elements is left open. Currently, a framework for external cost calculation and internalisation strategies is being developed for the European Commission. In addition to these European initiatives in the field of pricing policies, national (e.g. HDV charge in Switzerland) and local (e.g. congestion charge in London and Stockholm) pricing schemes have been developed. Finally, also fiscal policy, e.g. in the field of transport subsidies can contribute to internalising the external costs of transport.

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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-5: The Czech Republic, Hungary, Poland, Slovenia and Slovakia.
- EU-15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, the Netherlands, Portugal, Spain, Sweden and United Kingdom.
- EU-10: Cyprus, The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.
- EEA-32: EU-15, EU-10, Bulgaria, Iceland, Liechtenstein, Norway, Romania, Switzerland and Turkey.

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

Chapter		Supplementary information	
1	Freight transport volume growth outpaces economic growth	**Figure 1.1**	
		Note:	No data available for Switzerland and Liechtenstein. GDP is in euro at constant 1995 prices. Freight transport (tonne-km) includes transport by road, rail and inland waterways. Short-sea shipping and oil pipelines are excluded due to lack of data.
		Source:	EEA, 2007a, Fact sheet 13a, 2006 (based on Eurostat, 2006).
		Figure 1.2	
		Note:	No data available for Switzerland and Liechtenstein.
		Source:	EEA, 2007a, Fact sheet 13b, 2006 (based on Eurostat, 2006).
		Figure 1.3	
		Note:	No data available for Switzerland and Liechtenstein.
		Source:	EEA, 2007a, Fact sheet 13a, 2006 (based on Eurostat, 2006).
2	Passenger transport volumes continue to increase	**Figure 2.1**	
		Note:	Figure refers to 23 countries: EEA-23 refers to EU-15, EU-5 (CZ, HU, PL, SI and SK), NO, IS, TR. Road, rail, bus/coach and air are included. GDP are in euro at constant 1995 prices.
		Source:	EEA, 2007a, Fact sheet 12 a/b (based on Eurostat, 2006).
		Figure 2.2	
		Note:	Figure refers to EU-15 and EU-5 (CZ, HU, PL, SI and SK).
		Source:	EEA, 2007a, Fact sheet 12 a/b (based on Eurostat, 2006).
3	Greenhouse gas emissions from transport grow	**Note:**	When discussing greenhouse gasses the transport sector is divided into domestic transport and international transport. The latter, which is not included in the commitments in the Kyoto protocol, consists of international aviation and maritime. International aviation in turn can be divided into intra EU-aviation (flights between Member States) and other international aviation (flights to and from the EU area).
		Figure 3.1	
		Note:	Data cover all 32 EEA member countries. Figure includes all international transport.
		Source:	EEA, 2007a, Fact sheet 02.
		Figure 3.2	
		Note:	Data cover all 32 EEA member countries. Figure does not cover international aviation and maritime shipping.
		Source:	EEA, 2007a, Factsheet 02.

Chapter		Supplementary information
4	Harmful emissions decline, but air quality problems require continued attention	**Figure 4.1** **Note:** Data cover all 32 EEA member countries. International aviation and maritime transport are not included in this figure. Particulate matter = PM_{10} Acidifying substances = NO_x, NMVOCs Ozone precursors = SO_x, NO_x, NH_3. **Source:** EEA, 2007a, Fact sheet 03, 2006. **Figure 4.2** **Note:** Bars represent average annual concentrations over a limited number of monitoring stations along busy roads in major European cities (Vienna, Bruxelles, Prague, Helsinki, Paris, Berlin, Athens, Krakow, Bratislava, Stockholm and London), error bars represent the highest annual concentration measured at one single monitoring station. The dotted line represent the EU limit set for PM_{10} (2005) and NO_x (2010). **Source:** EEA, 2007a, Fact sheet 04, 2006.
5	Vehicle efficiency improvements slow down, but diesels can become clean	**Figure 5.1** **Note:** Data derive from the EU monitoring on the effectiveness of the strategy COM (2006)463. For 2005, data from T&E calculations have been added. **Source:** COM(2006)463. **Figure 5.2** **Note:** The figure shows costs and the reduction potential of different kinds of measures for the passenger car vehicle fleet (new + existing), ranging from technological fuel efficiency measures for new cars to eco-driving. The figure covers the EU-15 and refers to the 2008–2012 period. **Source:** TNO, 2006 (report to be published).
6	Developments in transport fuels: Increasing the share of alternative fuels and application of cleaner fuels	**Figure 6.1** **Source:** Submissions by Member States to DG TREN, and information received directly. **Figure 6.2** **Note:** EU including 25 countries 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:** EurObserver, Biofuels Barometer 2006. **Figure 6.3** **Source:** JRC/Concawe/Eucar, 2006 http://ies.jrc.ec.europa.eu/wtw.html.
7	Transport subsidies and external costs	**Figure 7.1** **Note:** Data in euro of 2005 for EU-25 (except for infrastructure data which refer to EU-15). On budget subsidies are based on an inventory of existing studies for various years. Data were processed to obtain estimates of on-budget subsidies per year, in Euro of 2005. The estimates for infrastructure support are calculated with infrastructure costs and charges based on data from UNITE (aviation and shipping data are excluded because data for these modes are incomplete). The estimates for subsidies by fuel excise duties exemptions have been calculated using the average ETS price of EUR 20 as a reference value. For rail estimates are high for the excise duty exemptions compared with this reference value, because of lack of data on rail diesel excise duties. Exemptions in electricity taxes for rail transport are not included The estimates for subsidies by VAT exemptions have been calculated using standard VAT rates of the various countries as a reference value. **Source:** EEA, 2007b. **Figure 7.2** **Note:** For the subsidy estimates, the same data have been used as for the first figure of this chapter. The external cost estimates used are based on INFRAS, 2004 (in line with TERM fact sheet 25). **Source:** EEA, 2007b (To be published in 2007, Q1), 'Total subsidies found in EEA 2007. Total external costs (INFRAS/IWW 2004)'.

Chapter	Supplementary information
Data annex	**Table 1**
	Source: EEA, 2007a, TERM fact sheet 13a (based on Eurostat, 2006).
	Table 2
	Source: EEA, 2007a, TERM fact sheet 13a (based on Eurostat, 2006).
	Table 3
	Source: EEA, 2007a, TERM fact sheet 12a (based on Eurostat, 2006).
	Table 4
	Source: EEA, 2007a, TERM fact sheet 12a/b (based on Eurostat, 2006).
	Figure 1
	Notes: Data from Liechtenstein were not available. Data from Slovenia were not available for most modes. International navigation and aviation figures are for international bunkers and do not take into full account emissions in the EMEP area from non-EEA-32 activities.
	Source: 2006 National CRF submissions to IPCC.
	Figure 2
	Note: Fuel prices include cost price, excise duty and VAT. The weighted average price of all fuels is expressed per litre of PETROL equivalent (diesel prices are adjusted for their higher energy content). Prices are those applicable in the middle of January, April, July and October each year. Real prices are corrected for inflation and expressed as Euros of 2006 (January). Only EU Member States are included: EC-9 since 1980, EC-10 since 1981, EC-12 since 1986, EU-15 since 1995, EU-25 since 2004.
	Source: DG TREN Oil bulletin, different volumes.

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 (http://themes.eea.europa.eu/Sectors_and_activities/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></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></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></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></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></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></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></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></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></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></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></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></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></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></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></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></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></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></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></tr>
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<tr><td>TERM 23</td><td>Subsidies</td><td></td><td></td><td></td><td></td><td></td><td></td><td>+</td></tr>
<tr><td>TERM 24</td><td>Expenditure on personal mobility by income group</td><td></td><td></td><td></td><td></td><td>+</td><td>+</td><td></td></tr>
<tr><td>TERM 25</td><td>External costs of transport</td><td></td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td></td></tr>
<tr><td>TERM 26</td><td>Internalisation of external costs</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td></tr>
<tr><td>TERM 27</td><td>Energy efficiency and specific CO2 emissions</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></tr>
<tr><td>TERM 29</td><td>Occupancy rates of passenger vehicles</td><td rowspan="2">+</td><td>+</td><td>+</td><td></td><td>+</td><td>+</td><td></td></tr>
<tr><td>TERM 30</td><td>Load factors for freight transport</td><td>+</td><td>+</td><td></td><td>+</td><td>+</td><td></td></tr>
<tr><td>TERM 31</td><td>Uptake of cleaner and alternative fuels</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td><td>+</td></tr>
<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></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></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></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></tr>
<tr><td>TERM 36</td><td>Institutional cooperation</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></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></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></tr>
<tr><td>TERM 40</td><td>Public awareness</td><td>+</td><td>+</td><td></td><td></td><td>+</td><td></td><td></td></tr>
</table>

Data annex

Table 1 **Trends in freight transport intensities in EEA member countries, 1992–2004 (Unit: tonne-km per EUR 1 000 GDP (1995 prices))**

	1992	1995	2004
Austria	153	228	267
Belgium	238	271	243
Bulgaria	3 614	4 009	1 542
Cyprus	—	154	118
Czech Republic	—	1 285	1 196
Denmark	166	175	152
Estonia	2 154	1 877	3 151
Finland	348	339	307
France	189	194	180
Germany	178	193	207
Greece	148	151	—
Hungary	—	694	637
Iceland	—	89	99
Ireland	136	119	175
Italy	195	215	225
Latvia	3 030	3 098	3 940
Liechtenstein	—	—	—
Lithuania	2 616	2 537	2 968
Luxembourg	400	404	438
Malta	—	—	—
Netherlands	331	330	341
Norway	—	109	139
Poland	—	1 131	1 007
Portugal	234	239	395
Romania	1 751	1 737	1 729
Slovenia	524	564	571
Slovakia	—	2 810	1 332
Spain	230	247	369
Sweden	244	266	237
Switzerland	—	—	—
Turkey	—	934	919
United Kingdom	192	202	170
EEA-30	250	268	276
EU-25	230	248	259
EU-15	200	215	225
EU-10	—	1 204	1 088
CC-3	1 234	1 249	1 067
EFTA-2	106	108	137

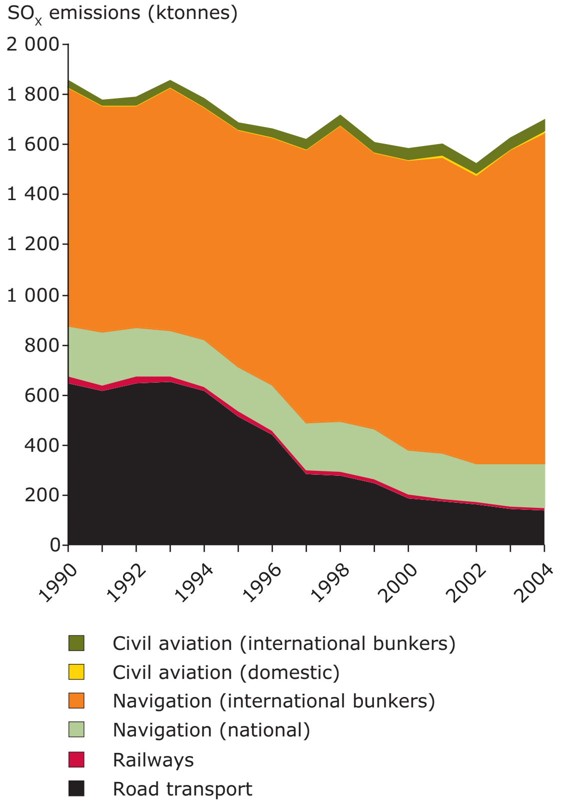
Source: EEA, 2007a, TERM fact sheet 13a (based on Eurostat, 2006).

Table 2 **Trends in freight transport demand in EEA-30 by mode (1992–2004) (Unit: 1 000 million tonne-km)**

	Road	Rail	Inland waterways
1992	1 204	356	112
1993	1 210	340	110
1994	1 281	349	118
1995	1 418	359	122
1996	1 459	360	120
1997	1 518	380	128
1998	1 589	370	131
1999	1 636	357	129
2000	1 680	374	134
2001	1 707	360	133
2002	1 756	359	132
2003	1 775	368	123
2004	1 911	388	134

Source: EEA, 2007a, TERM fact sheet 13a (based on Eurostat, 2006).

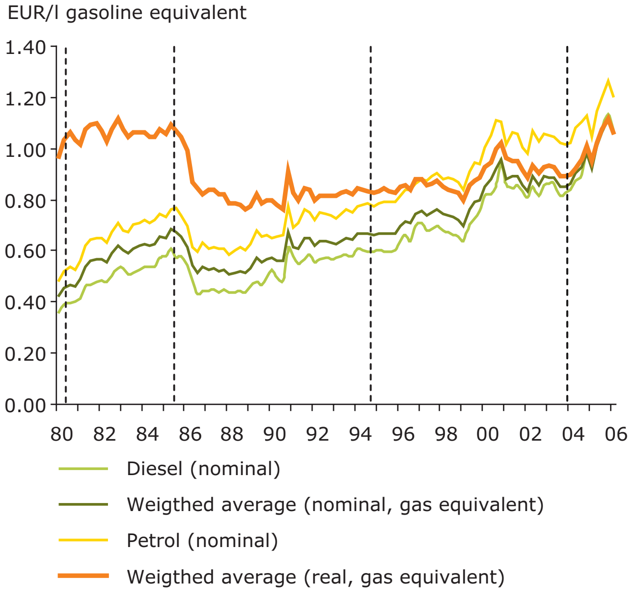
Figure A.1 **Total emissions of SO_x by different transport modes in EEA member countries plus Croatia (1990–2004)**



Notes: Data from Liechtenstein were not available. Data from Slovenia were not available for most modes. International navigation and aviation figures are for international bunkers and do not take into full account emissions in the EMEP area from non-EEA-32 activities.

Source: 2006 National CRF submissions to IPCC.

Figure A.2 **Road transport fuel price (including taxes) in EU Member States**



Note: Fuel prices include cost price, excise duty and VAT. The weighted average price of all fuels is expressed per LITRE OF PETROL EQUIVALENT (diesel prices are adjusted for their higher energy content). Prices are those applicable in the middle of January, April, July and October each year. Real prices are corrected for inflation and expressed as euros of 2006 (January).

Only EU Member States are included: EC-9 since 1980, EC-10 since 1981, EC-12 since 1986, EU-15 since 1995 and EU-25 since 2004.

Source: DG TREN Oil bulletin, different volumes.

Table 3 Total passenger transport demand in EEA member countries (1090–2004) Unit: 1 000 million pkm

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	89.1	91.4	95.1	96.7	99.4	102.0	106.3	107.1	110.3	114.1	115.2	114.6	116.3	104.3	
Belgium	114.3	117.2	118.4	119.4	123.3	125.9	127.1	130.8	138.9	143.8	146.5	144.8	133.9	134.5	
Bulgaria	40.6	28.4	27.0	25.2	22.8										
Cyprus															
Czech Republic	67.6	69.2	71.4	73.1	73.7	76.6	78.1	78.0	78.1	80.8	83.8	84.9	85.3	88.4	84.4
Denmark	65.8	66.6	67.7	69.6	70.7	72.5	74.5	76.5	77.7	79.6	79.9	80.3	82.1	83.3	
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	79.4	71.9
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	961.7	967.9	
Germany	759.4	881.8	905.7	925.4	1 012.9	1 032.5	1 047.2	1 056.9	1 072.0	1 108.3	1 103.3	1 120.4	1 137.8	1 125.5	
Greece	56.5	56.2	58.8	61.5	64.4	66.7	67.7	71.8	74.3	78.4	86.4	90.6	93.8	96.7	
Hungary	79.2	75.6	73.8	70.1	72.0	72.5	73.2	74.1	75.1	76.8	78.6	78.4	79.0	79.1	76.1
Iceland	4.7	4.8	5.0	5.2	5.6	5.9	6.4	7.0	7.8	8.3	8.2	8.2	7.7	8.1	
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	50.7	
Italy	674.9	690.7	760.0	757.0	754.7	779.1	797.1	810.7	832.7	838.4	911.3	900.2	888.5	888.2	848.1
Latvia													9.4		
Lithuania						15.4							19.9	23.3	30.0
Luxemburg	5.4	5.5	5.8	6.0	6.2	6.3	6.5	6.4	6.7	7.0	7.5	7.7	7.7	7.7	
Malta															
Norway	54.9	54.1	54.5	55.6	57.6	57.7	60.4	60.8	62.1	63.1	64.2	65.3	66.4	67.4	57.8
The 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	236.4	
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	227.1	230.0
Portugal	63.3	66.7	76.1	78.6	82.3	85.6	90.0	96.3	101.9	107.5	113.4	115.6	120.7	123.2	
Romania	56.4														
Slovakia	33.2	33.5	33.7	33.6	32.4	33.4	32.9	31.7	31.4	32.5	35.3	35.2	36.0	35.4	
Slovenia	21.5	19.2	18.3	18.7	20.2	21.4	23.1	24.4	23.9	25.3	25.2	25.6	26.1	26.2	26.0
Spain	247.4	281.2	297.6	308.4	319.6	336.4	352.7	365.4	383.1	405.9	422.2	432.4	459.4	468.7	
Sweden	110.1	109.0	110.0	108.9	109.4	110.7	111.7	112.9	114.4	117.8	119.9	121.3	124.7	127.9	
Turkey	130.1	125.3	137.6	143.4	139.8	153.6	165.3	177.5	184.4	187.7	193.1	188.3	207.2	214.7	
United Kingdom	765.6	759.8	775.6	783.7	802.4	819.2	844.9	820.5	844.4	856.3	867.8	866.0	876.5	875.1	
EU-23	4 537.3	4 687.0	4 877.6	4 948.6	5 120.5	5 246.7	5 393.8	5 475.1	5 632.6	5 789.0	5 951.3	6 001.5	6 097.0	6 115.7	

Note: Switzerland and Lichtenstein not included.

Source: EEA, 2007a, TERM fact sheet 12a (based on Eurostat, 2006).

Table 4 Passenger transport demand by mode (2003) and modal share (%)
Unit: billions pkm

	Passenger transport demand									Modal share							
	Private cars	Bus	Rail	Air	Tram and metro	Powered two-wheelers	Cycling	Walking	Total	Private cars	Bus	Rail	Air	Tram and metro	Powered two-wheelers	Cycling	Walking
Austria	81	15	8	14	2.8	1.6	1.1	3.4	127	64 %	12 %	6 %	11 %	2 %	1 %	1 %	3 %
Belgium	110	14	8	3	0.9	1.1	3.3	3.9	144	77 %	10 %	6 %	2 %	1 %	1 %	2 %	3 %
Bulgaria		13	3	0													
Cyprus				3													
Czech Republic	69	9	6	4	14.8												
Denmark	61	9	6	7	0.1	0.8	5.0	2.3	91	67 %	10 %	6 %	8 %	0 %	1 %	5 %	3 %
Estionia		2	0	0	0.1												
Finland	60	8	3	9	0.5	0.9	1.3	2.0	84	71 %	9 %	4 %	10 %	1 %	1 %	2 %	2 %
France	739	43	72	115	11.4	12.3	4.4	23.8	1020	72 %	4 %	7 %	11 %	1 %	1 %	0 %	2 %
Germany	854	76	71	124	14.8	17.9	23.9	30.6	1213	70 %	6 %	6 %	10 %	1 %	1 %	2 %	3 %
Greece	64	23	2	9	1.4	22.4	0.8	4.1	125	51 %	18 %	1 %	7 %	1 %	18 %	1 %	3 %
Hungary	47	19	10	3	2.5												
Iceland	4	1		3													
Ireland	24	7	2	19		0.4	0.7	1.4	53	45 %	12 %	3 %	35 %	0 %	1 %	1 %	3 %
Italy	711	98	45	34	5.9	69.8	8.9	23.7	997	71 %	10 %	5 %	3 %	1 %	7 %	1 %	2 %
Latvia		3	1	0	0.3												
Lithuania	19	3	0	0													
Luxembourg	6	1	0	0		0.1	0.0	0.2	8	75 %	13 %	3 %	5 %	0 %	1 %	0 %	3 %
Malta				2													
Netherlands	146	8	14	69	1.5	0.9	13.5	6.0	258	57 %	3 %	5 %	27 %	1 %	0 %	5 %	2 %
Norway	50	4	2	11													
Poland	172	30	20	5	4.5												
Portugal	97	11	4	12	0.8	8.0	0.3	3.5	136	71 %	8 %	3 %	9 %	1 %	6 %	0 %	3 %
Romania		9	9	2													
Slovakia	21	3	1	1													
Slovenia	25	8	2	0	0.3												
Spain	346	49	19	54	5.6	14.6	0.8	14.7	504	69 %	10 %	4 %	11 %	1 %	3 %	0 %	3 %
Sweden	96	11	9	12	2.0	1.0	2.4	3.4	137	70 %	8 %	7 %	9 %	1 %	1 %	2 %	2 %
Switzerland																	
Turkey	103	89	6	17													
United Kingdom	632	46	41	157	8.3	5.0	4.5	21.2	914	69 %	5 %	4 %	17 %	1 %	1 %	0 %	2 %
EU-15	4 027	415	304	637	55.9	156.7	70.9	144.2	5811	69 %	7 %	5 %	11 %	1 %	3 %	1 %	2 %
EEA-23	4 519	578	352	680													
EU-5	334	70	40	13													

Note: No data for Liechtenstein.
Data for powered two-wheelers is for 2002; data for walking and cycling for 2000.

Source: EEA, 2007a, TERM fact sheet 12a/b (based on Eurostat, 2006.

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