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Ten key transport and environment issues for policy-makers

TERM 2004: Indicators tracking transport and environment integration in the European Union

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Contents

Key messages

Growing transport volumes are challenging decoupling policy

Transport volumes are continuing to grow at roughly the same rate as GDP. The central aim of the Common Transport Policy — decoupling of transport growth from economic growth — has only been achieved in a few EU Member States.

Emissions of air pollutants from road transport are falling, despite a growth in traffic

The vehicle fleet is gradually becoming cleaner due to improvements in the technology required to meet European emission standards. Improvements are occurring significantly faster than the growth in traffic volumes, with absolute reductions in emissions of harmful substances to the air. Nonetheless, further initiatives will still be needed to reduce people's exposure to damaging pollutants and to achieve the air quality targets set for 2010 especially for NO_X and fine particles.

Greenhouse gas emissions from road and air transport increasing

Transport energy consumption and the resulting emissions of greenhouse gases are increasing steadily due to a rise in transport volumes that outweighs improvements in vehicle efficiency. Current policies are insufficient to stop the growth although average specific emissions of new passenger cars are on their way to meeting the 140 g CO_2/km emission target committed to by the automobile industry. International aviation emissions are rising especially fast, and are as yet not covered by the Kyoto Protocol.

Alternative fuels policy is starting to take effect with biofuels

There is strong growth in the use of biofuels, allowing the transport sector to reduce its emissions of greenhouse gases when the full life cycle of the fuels is considered. To maximise their environmental benefit, however, it is important to produce biofuels in a way that minimises negative impacts.

Market shares of road and air travel are continuing to grow

Contrary to the aim of the Common Transport Policy, the shares of aviation and road transport continue to grow, while the shares of rail, bus, and inland shipping are gradually decreasing. However, because the environmental performance of road transport is improving faster than other modes, the consequences of its growth are not as bad for the environment as might be expected. The rapid growth of air transport is a cause for concern because of its greenhouse gas emissions.

Access to many basic services is dependent on car use

The relatively high speed and flexibility of road passenger transport improves access to basic services — education, business, shopping and health services — but only for those with access to a car. As a consequence, many disadvantaged people do not enjoy the full benefits of transport.

Present price structures are favouring individual transport

Passenger fares for rail and bus services are increasing faster than the cost of private car use. This trend favours the private car over public transport. Transport prices for freight continue to fall, pushing transport demand higher and enabling more transport intensive economic activities and logistics. Both trends are moving away from the Common Transport Policy's target of revitalising rail transport.

Signs of promising developments for transport pricing

Progress is slow in restructuring transport charges towards better internalisation of external costs. The framework regulations being put in place for rail and road transport are positive developments towards fair and efficient pricing and a more sustainable transport system. However, air and water transport are still not covered.

Infrastructure investment needs to balance economic and environmental needs

Infrastructure — in particular road and high-speed rail — continues to expand. Extending transport infrastructure is the most common policy response to the need for improved accessibility and capacity. But optimising the use of existing infrastructure through road pricing or congestion charges offers a means of meeting demand with fewer new infrastructure developments.

Transport infrastructure is fragmenting natural habitats

Transport infrastructure networks are generally seen as a benefit but their expansion, traffic growth and urban sprawl pose a significant threat to habitats and biodiversity. Proximity to disturbances, land fragmentation and isolation of habitats create new barriers to natural migration and movement of animal populations.

Introduction

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

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

The selection does not represent a full inventory of conclusions that can be extracted from TERM but rather a selection that tries to cover the breadth of TERM. Readers are therefore encouraged to seek further information in the TERM fact sheets themselves.

TERM: a two-layered information system

TERM reports have now been published for five years as an official indicator-based reporting mechanism. As one of the environmental assessment tools of the Common Transport Policy (EC 2001a), 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.

Currently, TERM consists of 40 indicators that are structured around seven policy questions (see Box next page). 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. The fact sheets provide an in-depth assessment for each indicator, including: an overview of the main policy context and existing EU policy targets related to the indicator; an analysis of data quality and shortcomings; a description of metadata; and recommendations for future improvement of the indicator and data. The TERM indicator fact sheets form the reference information system of this report and can be downloaded from the EEA web site at http://themes.eea.eu.int/Sectors_and_activities/transport/indicators

Scope of the report

The report aims to cover all 31 EEA member countries. These are the 25 EU Member States, three candidate countries (Romania, Bulgaria and Turkey) and Norway, Iceland and Liechtenstein. Croatia, which applied for EU membership in the summer of 2004, is not included. Switzerland provides data in some cases and is covered by some statistics. Where data are not complete, this is generally noted.

In terms of time, most indicators cover either the years since 1990 or, in a few cases where it is deemed relevant, even longer. But there are cases where data for the new Member States have only become available recently, or where the transition from a centrally planned to market economy has led to such big changes that comparisons 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.

TERM policy context, process and concept

The Amsterdam Treaty identifies integration of environmental and sectoral policies as the way forward to sustainable development. The European Council, at its summit in Cardiff in 1998, requested the Commission and transport ministers to focus their efforts on developing integrated transport and environment strategies. At the same time, and following initial work by the EEA on transport and environment indicators, the joint Transport and Environment Council invited the Commission and the EEA to set up a transport and environment reporting mechanism (TERM), which should enable policy-makers to gauge the progress of their integration policies. The sixth environmental action programme (6EAP) (EC, 2001c) and the EU strategy for sustainable development (EC, 2001b) 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.

In this report EU-15 refers to the 15 old EU Member States and EU-10 to the ten new Member States.

The underlying fact sheets have been developed by the European Topic Centre for Terrestrial Environment, 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.

Upcoming developments

Not everything is covered in this report. There are areas where data are insufficient to make a judgement, such as noise exposure where more consistent datasets are only expected to be available from 2007. Also, areas such as the implementation of environmental management strategies and spatial planning strategies are insufficiently covered. These are currently focus areas for improvements to methodologies and the information database.

Another criticism of monitoring is that it is often based on old data. In most cases, data after 2001 are not available. It is certainly a problem in monitoring the effects of new or changed policies that a long time can elapse before the effects can be seen. To address this issue, the EEA is developing methods of making early estimates of key indicator values based on data from fewer countries, where data are available with a shorter delay. This will give earlier warnings of possible changes in the observed trends and allow for closer monitoring of such issues. In a few cases, such early data have been used in this report to see whether observed trend breaks do in fact represent a change or just a minor fluctuation.

Smileys

All assessments are accompanied by smileys and frownies. The different face should be interpreted as follows:


Positive trend, moving towards policy objective or target


Unfavourable trend, moving away from policy objective or target


Impossible to evaluate the trend because of data gaps or lack of policy objective or target

Ten key transport and environment issues for policy-makers

Growing transport volumes are challenging decoupling policy

Emissions of air pollutants from road transport are falling, despite a growth in traffic

Greenhouse gas emissions from road and air transport increasing

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Signs of promising developments for transport pricing

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Transport infrastructure is fragmenting natural habitats

1. Growing transport volumes are challenging decoupling policy

Transport volumes are continuing to grow at roughly the same rate as GDP. The central aim of the Common Transport Policy — decoupling of transport growth from economic growth — has only been achieved in a few EU Member States.

Freight transport volumes are closely linked to production volumes and will grow with these. But a shift towards service activities, with lower transport requirements, may moderate this growth. Passenger transport volumes are closely linked to income and car ownership and, as such, also closely linked to GDP (OECD, 2003a).

Transport volumes in the EU-25, expressed in tonne-km or passenger-km, have grown steadily over the past decade, by almost 20 % for passenger transport and about 30 % for freight transport. This is greater than any counterbalancing improvement in energy efficiency, so there has been an increase in energy consumption. However, the growth in volume has been less than the improvement in emission levels of regulated pollutants, leading to an overall decrease in these emissions. The aim of the Common Transport Policy — to decouple transport growth economic growth — has not been achieved for freight transport, but for passenger transport there are some indications that a moderate decoupling is taking place. In the EU-10, economic growth has outpaced transport growth (both passenger and freight), which is not the case in the EU-15. A plausible explanation is that the new Member States had much more transport intensive economies with a historical focus on industrial and agricultural production but are now in transition towards more service oriented economies, like those in the EU-15. In other words, the focus of economic growth has recently been in the less transport-intensive sectors of the economy, which then appears as decoupling.

The fact that an economy such as the Danish or the Irish can have a transport intensity that is low (about two thirds of the EU-15 average) and declining shows that it is possible to reduce the transport intensity of the economy in west European states as well. In a report (DETR, 1999), a UK expert group advised that decoupling of transport growth from GDP growth is possible, and suggests a combination of pricing policy and management of investment initiatives in order to achieve this. The group argued that even reductions in traffic volume can be achieved without harming the economy, primarily in cases where the external costs of transport are not taken into account (internalised).

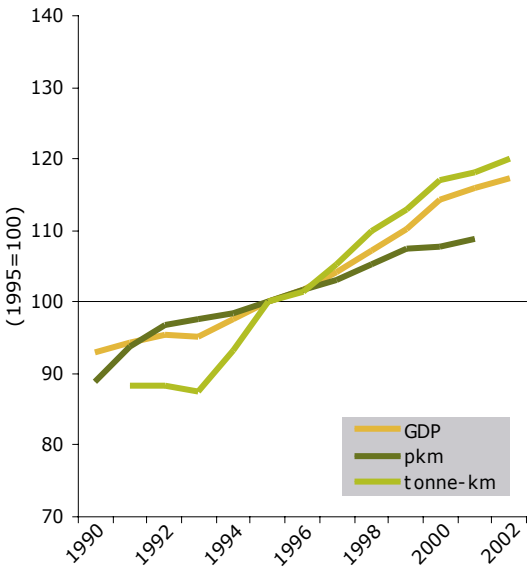
It should be recalled that the ultimate objective is the reduction of pressure on the environment, which is a combination of transport volumes and the environmental impact per unit of transport. An optimum strategy to reduce environmental pressures should aim at both. The greatest effort and success have been on the second aspect, as will be seen in the following sections, but a considerable part of the success has been neutralised by a failure to tackle the first.

Transport and GDP growth

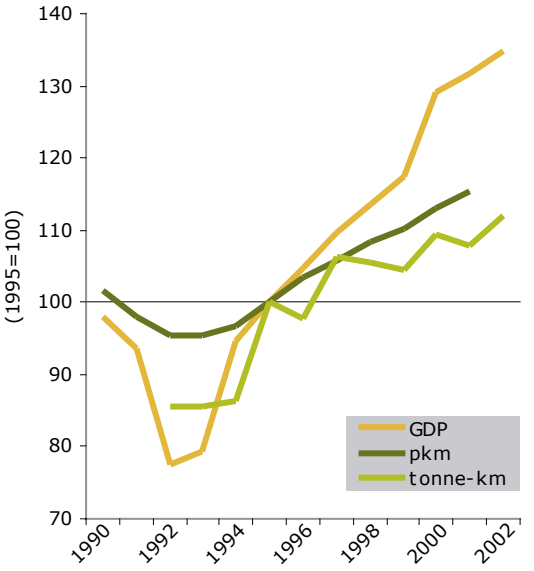
The charts show the strong growth in transport volume for freight and passengers and the coupling with economic growth. In the EU-15 (left hand chart), GDP grew somewhat faster than passenger transport, and somewhat slower than freight transport. This reflects the increasing integration of European economies following the introduction of the internal market, but also possibly a saturation of passenger transport demand. In five of the new Member States (CZ, SI, SK, PL, HU, right hand chart), GDP grew much faster than transport volumes. The large drop in transport intensity is the result of a transition to more service-oriented economies, combining substantial economic growth since 1992 with substantial decoupling.

For the EU-25 as a whole, freight volume growth outpaced the economy while passenger volumes grew slightly more slowly.

Transport growth in EU-15



Transport growth in 5 new Member States



E-business and teleworking may offer modest transport savings

Information and communication technology (ICT) can create transport savings, but this potential should not be overestimated. ICT is expected to reduce transport through, for example, teleworking (using ICT to work at home), online shopping, and teleconferencing. However, according to a report by the Wuppertal Institute, the benefits may be modest due to the following limitations:

- money or time saved will be spent on something else that also requires transport at some level;
- transport savings may be applicable only for small population segments;
- in the case of online shopping, savings in personal transport are compensated by delivery transports.

(Wuppertal Institute, 2003)

2. Emissions of air pollutants from road transport are falling, despite a growth in traffic

The vehicle fleet is gradually becoming cleaner due to improvements in the technology required to meet European emission standards. Improvements are occurring significantly faster than the growth in traffic volumes, with absolute reductions in emissions of harmful substances to the air. Nonetheless, further initiatives will still be needed to reduce people's exposure to damaging pollutants and to achieve the air quality targets set for 2010 especially for NO_x and fine particles.

Catalytic converters and other technical abatement measures on road vehicles have greatly reduced emissions of pollutants. The emissions of regulated pollutants decreased by 24 to 35 % between 1990 and 2001 in the EEA area (not counting aviation and marine shipping). Without EU emission standards for road vehicles (Euro emission classes), emissions would likely have been far above the level of the early 1980s. Vehicle technology goes hand in hand with improved fuel quality standards. Lead has been banned and new standards for sulphur content are set for 2005 (50 ppm) and 2009 (10 ppm). There is, however, increasing evidence that standardised test cycles used for the type approval of vehicles do not necessarily represent real world driving conditions. The issue of 'chip-tuning' of diesel vehicles to boost power at the expense of fuel consumption and low emissions is a cause for concern (MS, 2004).

To protect the environment and human health against the effects of pollutants, the National Emission Ceilings Directive (2001/81/EC), the Directive for non-road mobile machines (2004/26/EC, e.g. on inland ships and locomotives) and a directive on limit values for concentrations of air pollutants (1999/30/EC) have been agreed. In addition, newly proposed standards for light duty vehicles (Euro 5) and heavy duty vehicles (Euro 6) to be introduced in 2010/12 will contribute to this objective. However, in spite of the decrease in air pollution from transport, there are still serious air quality problems in urban areas.

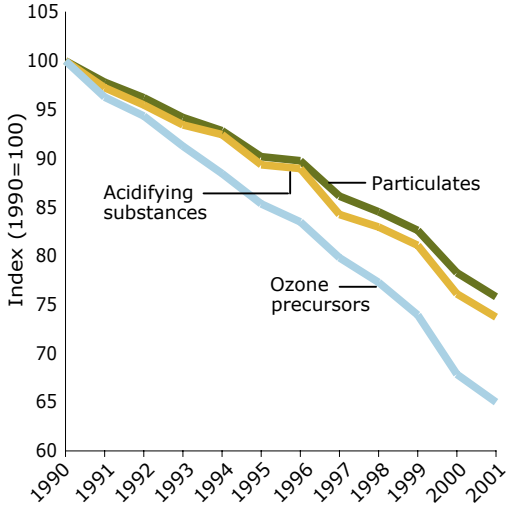
The number of people who are estimated to die prematurely as a result of exposure to air pollutants in Europe is still in the order of 100 000 per year. Of these, tens of thousands are associated with transport-related air pollution. These fatalities are in addition to those killed in accidents (58 000 in the 31 EEA member countries in 2002). Health risks imposed by transport-related air pollution include heart and lung problems, increased risk of developing respiratory symptoms (e.g. asthma) and exacerbation of allergic reactions (WHO, 2004).

Unlike road transport, emissions from rail, aviation, marine and inland shipping have remained stable or decreased only slightly, due to a lack of strict or mandatory emission standards. The directive on emission standards for non-road mobile machines is expected to lower the emissions from inland shipping and diesel fuelled rail transport in future; while ministers recently reached political agreement on the reduction of the sulphur content of marine fuel from 5.0 to 1.5 % or lower from 2006. But the long marine engine lifetime means that penetration of new technologies will be slow to take effect.

Transport volumes are forecast to continue to grow. If this growth is not to undermine the significant decreases already achieved and expected from new regulation, more focus needs to be put on user behaviour. Options include incentives for clean vehicles, road user pricing policies and environmental zoning.

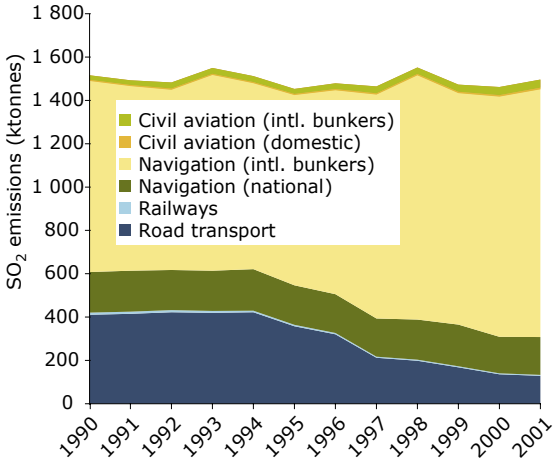
Decline in transport emissions of harmful air pollutants (31 EEA member countries)

Reductions in emissions of particulates (PM_{10}), acidifying substances (NO_X, NMVOCs) and ozone precursors (SO_X, NO_X, NH_3) come mostly from innovations in exhaust gas treatment in road vehicles and improved fuel quality. EU standards for automotive emissions and fuel quality (reduced sulphur concentration) have had great effect. Further reductions will take place as even stricter limits come into force and new vehicles replace older ones. Some countries have introduced bans on the import of old vehicles in order to modernise their vehicle fleet with cleaner cars.



International navigation dominates SO_2 emissions (25 EEA member countries)

Road transport emissions of sulphur dioxide were greatly reduced during the 1990s (70 %). This was the result of considerable reductions in the sulphur content of automotive fuels over that period and in spite of increased traffic volumes. Emissions from national navigation (inland waterways and shipping) also decreased by over 7 % due to similar fuel sulphur content restrictions. However, emissions from civil aviation and international shipping activities have increased substantially due to a lack of similar tightening of regulations. Recent estimates from EMEP (Environmental monitoring, evaluation and protection programme under the UN-ECE Convention on Long-Range Transboundary Air Pollution) suggest that emissions of sulphur dioxide from international shipping activities in the European waters may have contributed to as much as 39 % of all SO_2 emissions (all sectors) in the EU-15 countries. The recent agreement on marine fuel sulphur content should change that.



Test cycle emissions do not always reflect in-use emission behaviour

Engine test cycles are designed in principle to ensure that all vehicles are tested in the same manner and under realistic conditions. But current test cycles do not reflect how engines are used in the real world. Engine control systems designed to meet emission standards under test cycle conditions might therefore not work so well in real traffic. That this happens is well documented (COST346, 2004) and it may be part of the reason why air quality in cities is not improving as fast as vehicle fleet data suggest it should.

Another important issue is the increasing use of electronic engine modification of diesel engines (chip tuning). A recent report estimates that as many as half of new diesel cars may have been modified, and that the effect on emissions has been a strong growth (up to a factor of three) especially in particle emissions (MS, 2004).

3. Greenhouse gas emissions from road and air transport increasing

Transport energy consumption and the resulting emissions of greenhouse gases are increasing steadily due to a rise in transport volumes that outweighs improvements in vehicle efficiency. Current policies are insufficient to stop the growth although average specific emissions of new passenger cars are on their way to meeting the 140 g CO_2/km emission target committed to by the automobile industry. International aviation emissions are rising especially fast, and are as yet not covered by the Kyoto Protocol.

Transport now accounts for about 35 % of energy consumption in the EU-25. Total transport CO_2 emissions are rising, making it more difficult to meet the Kyoto targets. While passenger cars have become more efficient, the growth in transport demand has been greater, resulting in a net increase of about 20 % in greenhouse gas emissions from transport over the past decade.

The voluntary commitment by European auto makers (ACEA) to limit the average CO_2 emission of new passenger cars from 186 g/km in 1995 to 140 g/km by 2008 will not be sufficient to reduce transport's greenhouse gas emissions. Parallel commitments have been made by Korean and Japanese auto makers with a target date of 2009. Projections indicate that transport CO_2 emissions will increase by 25 % from 1990 to 2010 if the objectives of the commitment are met, compared with 35 % without the commitment. According to the Commission's progress report on the commitment, ACEA is on track to meet the 2008 target. This has been achieved largely by technological improvements, but some 15 % of the progress comes from a substantially increased share of diesel cars in vehicle sales. So in spite of some positive trends, an increased rate of improvement is still needed (EC, 2004a). Extending the commitment to include vans and trucks would help.

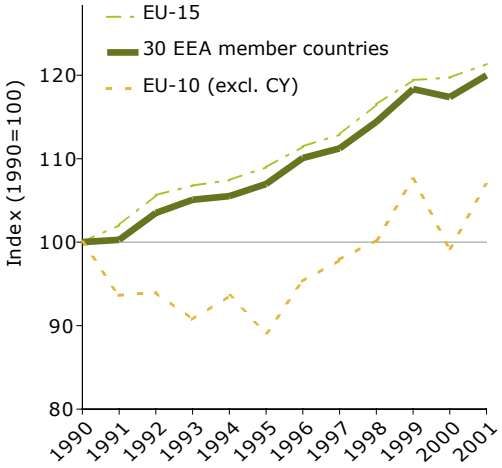
Increasing vehicle weight and auxiliary equipment such as seat heaters and air conditioners in cars adds to fuel consumption, while leaking of the coolant (HFC), a powerful greenhouse gas, leads to further climate forcing. Use of such equipment is not included in the engine test cycles used for type approval. Therefore it is not covered in the auto makers' commitments but could contribute to an extra CO_2 emission equivalent to 16–28 g/km, thereby eroding a substantial part of the improvements from the commitment, according to a report from the Commission (EC, 2003).

Aviation is an important and growing contributor to climate change. Aircraft contribute to climate change not just by direct climate forcing from emitted CO_2, but also indirectly through the formation of condensation trails (contrails) and increased formation of cirrus clouds. When the indirect effects are included, the total effects are likely to be 2–4 times as large as the contribution of CO_2 alone (IPCC, 1999). With air transport growing rapidly, its climate impacts will soon exceed those of passenger vehicles and by 2030, the impact is predicted to be twice as large. Along with international shipping, aviation is not regulated under the Kyoto Protocol.

At the moment, it appears that, if greenhouse gas emissions from transport are to be reduced, more effective policies are needed, such as taxation measures tied to CO_2 performance or a stronger focus on biofuels. The feasibility of introducing CO_2 emission limits, similar to the successful EU limits for polluting emissions, could also be looked at.

GHG emissions from transport in the EEA member countries are growing

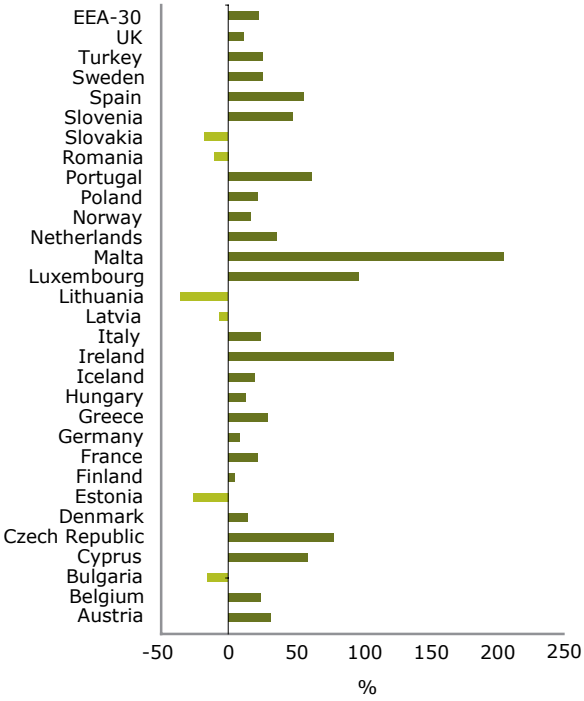
Greenhouse gas emissions from transport have increased steadily by more than 20 % since 1990 in the EEA member countries taken as a whole. Note that the emissions exclude those from sea shipping and aviation. The collapse of the centrally planned economies in eastern Europe in the early 1990s resulted in a reduction in energy consumption and therefore in greenhouse gas emissions.



Trends in transport energy consumption

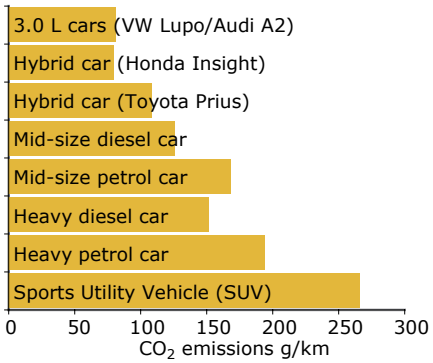
Energy consumption is closely connected to emissions of greenhouse gases, and has increased in most countries. In some of the new Member States, transport energy consumption is still below the level of 1990, due to the economic collapse in the early 1990s. However, today energy consumption is rising.

Note: The figures include energy consumption by short sea shipping and aviation.



A more efficient vehicle fleet is technically possible, but incentives are only used in a few countries

The fuel efficiency of cars depends on the technology on board, air and tyre resistance, and the weight of the vehicle. Differences between vehicles are considerable. The best vehicles on the market today emit less than one third of the CO_2 of a sports utility vehicle (SUV) (VCA, 2004). Some countries have implemented differentiated registration and ownership taxes that encourage fuel-efficient cars (e.g. Austria, Denmark, France, Hungary and the UK).



4. Alternative fuels policy is starting to take effect with biofuels

There is strong growth in the use of biofuels, allowing the transport sector to reduce its emissions of greenhouse gases when the full life cycle of the fuels is considered. To maximise their environmental benefit, however, it is important to produce biofuels in a way that minimises negative impacts.

Alternative fuels policy is about reducing the transport sector's 98 % reliance on gasoline and diesel and replacing them with other fuels. Additionally, it is about reducing the sector's CO_2 emissions. With conventional gasoline and diesel becoming virtually sulphur and lead-free and with even stricter emission norms coming into force, the possible emission advantage of alternative fuels is limited. Until now, biofuels have been the main focus of the alternative fuels policy but methane (CNG) and propane (LPG) are now also established in the market in several EU countries. Hydrogen is considered as a future fuel when the technology becomes available.

Growing plants absorb CO_2 and the carbon in biofuels made from the plants can therefore be seen as recycled carbon rather than fossil carbon. Biofuel crops (rapeseed, sunflower, wheat, sugar beet, etc) can be grown in the EU, which adds to the security of energy supply. The European Community promotes the use of biofuels via a directive on support for biofuels production (2003/17/EC). It aims at a 2 % market share by 2005 and 5.75 % by 2010. Biofuels may be a way of lowering the environmental pressure from fuel consumption, though the impact on the environment of biofuel use is still being debated. There is an energy consumption associated with the cultivation of raw materials, use of fertiliser and pesticides, and fuel production. Furthermore, if significant areas of agricultural land were dedicated to biofuel production, there could be substantial pressure to intensify food production on the remaining land, with a possible negative impact on the biodiversity and landscape values of farmland. This is no different from other areas of agricultural production but, if biofuels production turned into major cash-crops, pressures on agricultural land could increase significantly.

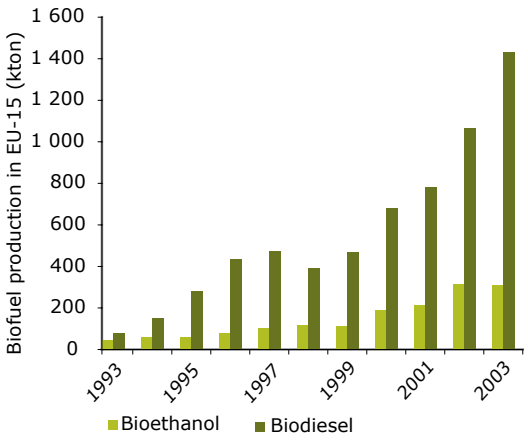
At present, producing biofuels in Europe on a large scale from food crops is not fully competitive. The rule of thumb is that it would take an oil price of USD 75 per barrel to compete. Therefore, the cost-effectiveness of the biofuels currently being used is a point of discussion, compared with other CO_2 reduction measures, such as co-firing biomass in coal power plants. To take better advantage of biofuels, advanced conversion technologies are being developed to convert cellulose to alcohol and synthetic diesel efficiently.

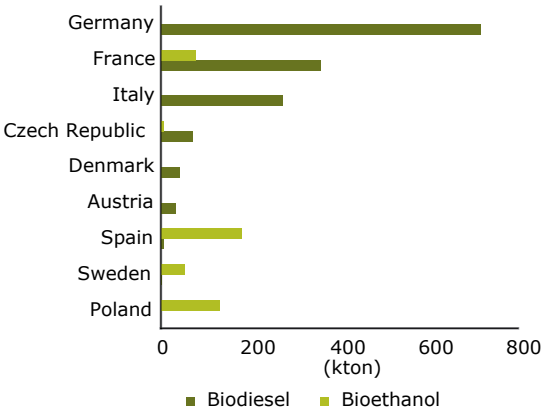
LPG and CNG offer a CO_2 emission advantage over gasoline, because the carbon content of both fuels is lower than that of gasoline. But the advantage depends on the engine calibration and is expected to decrease with the introduction of hybrid vehicles and direct injection gasoline vehicles. Compared with diesel, there does not seem to be any CO_2 advantage, due to the higher energy efficiency of diesel engines. No legislative targets have been set.

Biofuel production still limited in the EU-25

In 2003, biofuel production was only about 0.6 % of total energy consumption by road vehicles in the EU-25. But biofuel production has grown rapidly in the last decade, particularly the production of biodiesel.

Biodiesel and bioethanol are the two most important biofuels. Biodiesel is produced primarily from rapeseed and sunflower. Bioethanol is obtained by fermenting sugar beet, barley, corn and wheat. Most countries choose to focus on just one biofuel. To stimulate production and use, Member States are allowed to reduce excise duties for biofuels by up to 100 % (Directive 2003/96/EC). Some countries have introduced tax breaks for this reason. Germany is the leading biofuel producer, following its favourable taxation policy. Most other biofuel producing countries also have tax incentives (EC, 2004b).

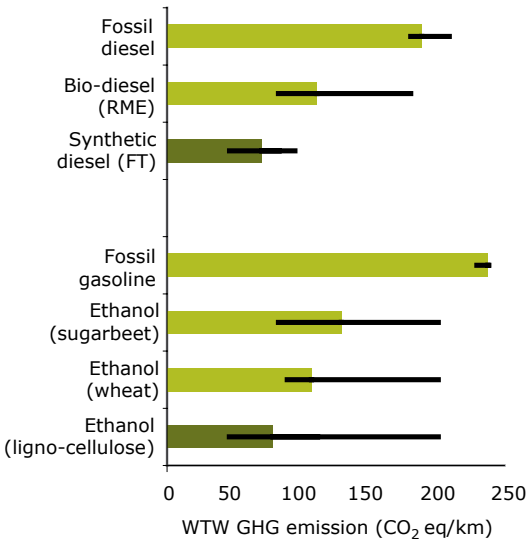




Well-to-wheel greenhouse gas emissions for different fuels

The graph shows the estimated greenhouse gas emissions associated with fuel production, transport, distribution and use, represented on an emission per kilometre scale. In the longer term, biofuels produced from ligno-cellulosic biomass have the potential for greatest reductions of greenhouse gases if the laboratory concepts of today can be converted to full scale production. In general, emissions under 50 g/km can be reached. Technological development and economy of scale effects may reduce the current high costs and improve the environmental benefits (Ecofys, 2003).

Note: The bars represent best estimates and the lines represent ranges from literature. Dark green bars represent future fuels and light green bars represent fuels currently available.



5. Market shares of road and air travel are continuing to grow

Contrary to the aim of the Common Transport Policy, the shares of aviation and road transport continue to grow, while the shares of rail, bus, and inland shipping are gradually decreasing. However, because the environmental performance of road transport is improving faster than other modes, the consequences of its growth are not as bad for the environment as might be expected. The rapid growth of air transport is a cause for concern because of its greenhouse gas emissions.

Currently, road transport of passengers and freight is dominant, while the shares of alternative modes such as rail, bus and inland waterways are much smaller and inclined to stagnate or decline. An exception is air travel. With an annual growth rate of 5 % or more, it is the fastest growing mode of transport.

The growth of road freight transport is driven by a combination of lower prices and increasing demand for flexibility and accessibility that road transport provides better than alternative modes (rail, inland waterways). In broad terms, the same applies to the position of the private car compared with public transport by bus or rail. Only in urban areas and on longer distances can public transport compete with the car.

Because of these characteristics, a shift from road towards rail, waterways and public transport is difficult to accomplish. In addition, a modal shift is only an option for small market segments where transport modes actually compete and serve the same type of goods or passenger needs. Modal shifting is one of the major goals of the Common Transport Policy. It proposes measures to revitalise alternative modes, in particular rail, as a means to reduce the environmental impact of transport.

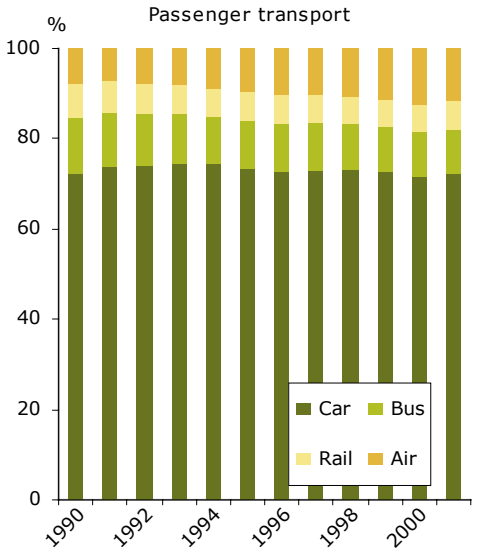
From an environmental perspective, a shift to alternative transport modes (rail, bus, etc) is generally beneficial, though not, in all cases, as positive as it may seem. For instance, while EU emission limits for trucks and cars have been substantially tightened since the early 1990s, such standards will only be introduced for locomotives and inland vessels from 2005 onward. In light of the positive experience with emission reductions in road transport a possibility therefore should be a more determined effort to improve further the environmental performance of all modes. Pricing policies to internalise the environmental and social costs of transport modes, as stated in the 1998 White Paper (EC, 1998), can provide incentives for improving environmental performance.

The renewed rapid growth of air travel, due to the influx of low-cost carriers, after a small dip in 2001/2002 (see chart text), is a reason for concern. Aviation is responsible for about 7 % of all global warming potential, as well as a significant part of noise nuisance. In addition, hardly any of the environmental and social costs of air travel are internalised in prices. Instead, air travel is stimulated by an absence of fuel taxes and value added tax (VAT) on ticket prices, as well as subsidies and state aid for airports and airlines. This ultimately leads to a growing pressure on the environment and on people living around airports. But in addressing this issue, subsidies for all modes should be considered against the impacts on the environment of each mode.

Car reigns and air travel gains

In passenger transport, the share of the car is relatively stable at 70–75 % of all transport . The dominant position is explained by qualities such as flexibility, accessibility and comfort, combined with stable real fuel prices. The combined share of rail and bus transport has stabilised at around 16 %.

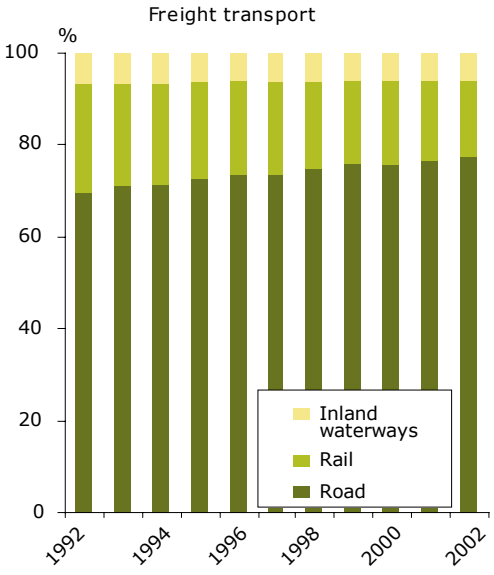
Air transport, on the other hand, is growing. 2001 saw a small dip, caused by the terrorist attacks on September 11. More recent data show that 2002 saw a further drop, mainly explained by the SARS epidemic and fallout of the war on terror. But, since 2003, air transport has returned to growth.



Road transport rolls on

In freight transport, road haulage dominates with a share of 75 % and continues to grow. Increased travel speeds and lower real transport prices over the past decades are key factors. In order to keep up with decreasing prices on the road, rail transport has had to lower its service level (frequency and network density). Consequently, the share of rail transport has declined and is now about 18 %. Lack of interoperability also hinders the success of rail transport and the use of clean electric locomotives.

Note: Maritime transport (which, in terms of volume, is as large as road transport) is not included in this graph. Airfreight and pipelines are also missing due to lack of data.



The impact of low-cost airlines on overall traffic growth

The market share (based on the number of operated flights) of low-cost operators in the western Europe excluding Scandinavia and Italy (CRCO88 area in Eurocontrol terminology) increased from 0.2 % in 1991 to 6 % in 2001. This growth is caused by the increasing traffic volumes that they generate, but is also due to reduced traffic by the traditional aircraft operators. Low-cost carriers introduced about 24 000 new flights between the first quarter of 2001 and the first quarter of 2002, whereas the number of flights operated by conventional carriers decreased by 2 % over the same period.

Low-cost carriers generally achieve larger load-factors, 80 % versus 70 % for traditional operators. An increase in passengers is thus achieved with reduced growth in traffic. On the other hand, low-cost carriers generate additional traffic because they offer tickets at lower prices. In the longer run, the overall amount of air traffic is therefore expected to grow because the low airfares make aviation affordable for more people (Statfor, 2002).

6. Access to many basic services is dependent on car use

The relatively high speed and flexibility of road passenger transport improves access to basic services — education, business, shopping and health services — but only for those with access to a car. As a consequence, many disadvantaged people do not enjoy the full benefits of transport.

Accessibility means the ease and ability to access basic services, such as education, work, shopping, and health and leisure services, using various transport options. Such access is an essential component of economic and social activities. Therefore, providing maximum accessibility at the lowest possible environmental and economic cost is a key objective of transport policy.

Historically, societies have worked to reduce barriers, often described as geographical friction, to allow the movement of persons and goods to the benefit of both individuals and society. Over the past century, cars and roads have played a leading role and societies have been transformed along the way. Shopping has, to a large extent, moved to shopping malls and workers have relocated to live further away from their place of employment. These opportunities have been exploited to gain a broader choice, but the price has been an increasing reliance on transport for many daily tasks. It is a process that is largely market driven, a manifestation of the sum of choices made by all individuals.

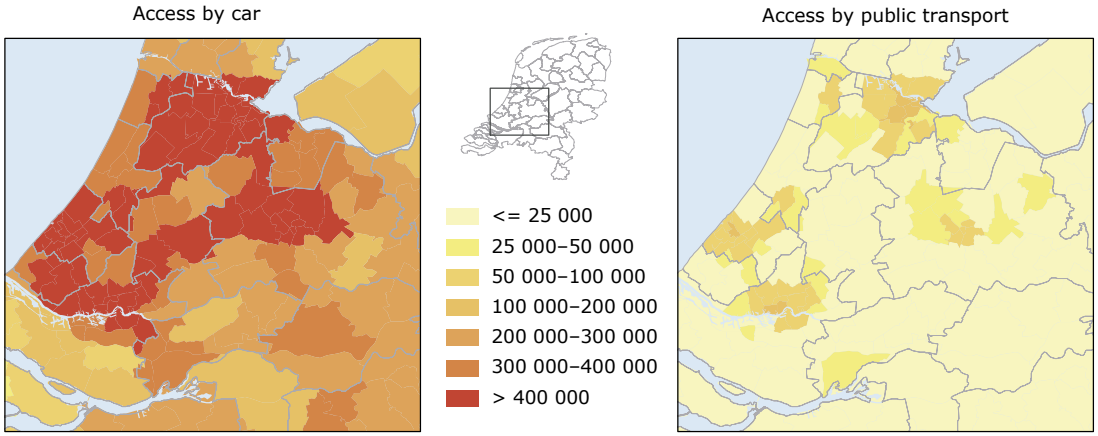
Some social groups benefit less than others in terms of accessibility, especially those who do not have access to a car or who have other difficulties such as young, elderly or disabled people. The decline in public transport, coupled with a shift of basic services from residential areas to the outskirts of major cities, threatens to reduce the quality of life of these groups and the liveability of neighbourhoods. For these people, accessibility is not a matter of transport mode choice but of the need to access basic services, which are increasingly premised on the availability of a car.

Public transport is often not able to compete with private vehicles in terms of accessibility. Public transport services in rural areas largely serve a social aim of allowing all segments of society a minimum level of access. The opportunities for public transport to play an important role in promoting accessibility are greatest over long distances and in large cities. In urban areas, transport demand and activities are concentrated and distances are small. A favourable travel time ratio between public transport or car can add to the potential. It can be improved further by measures that discourage the use of cars, such as car-free city centres, environmental zoning and parking policies.

A better integration of spatial and transport planning is key to achieving better accessibility for all. This includes, among other actions, an assessment of the financial benefits from greenfield development sites against the social impacts of withdrawing basic services from older residential areas.

Cars reign as public transport fails

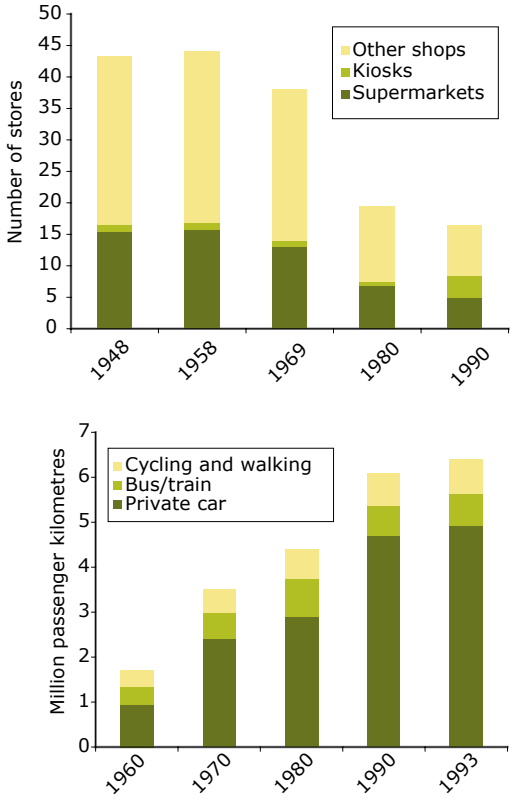
The two maps cover the southwestern part of the Netherlands, an area with four major cities (Amsterdam, Utrecht, Rotterdam, the Hague) located around a less populated central part. The colours show the number of jobs that can be reached within one hour by car and by public transport. Accessibility by car (left hand figure) proves to be an order of magnitude higher than by public transport (right hand figure). Only in connections between city centres and within dense urban areas can collective transport compete with road transport on accessibility. Thus, people dependent on public transport are much more restricted in their choice of where to live and work (RIVM, 2001).



Centralising services leads to car dependency

In Denmark, the number of convenience goods shops decreased by more than half (upper chart) between 1948 and 1990. At the same time, the need for transport to access convenience goods shopping almost quadrupled (lower chart) (DTU, 1996).

In the Netherlands, the number of hospitals decreased from 169 to 137 between 1990 and 1999, mainly due to consolidating services. The number is expected to diminish further in the near future (RIVM, 2003). The impact of this development is that access to these services has become more dependent on the car. For social groups that do not have access to a car the accessibility of these services effectively decreases.



7. Present price structures are favouring individual transport

Passenger fares in rail and bus services are increasing faster than the cost of private car use. This trend favours the private car over public transport. Transport prices for freight continue to fall, pushing transport demand higher and enabling more transport intensive economic activities and logistics. Both trends are moving away from the Common Transport Policy's target of revitalising rail transport.

Changes in transport prices have an indirect impact on the environment due to the way in which transport demand responds to price signals. Changes in the price of a particular transport mode at first have relatively small effects as people have limited short-term options to adapt to the new situation. In the longer term, effects are greater as the options for behavioural adaptations increase. As an example, a rise in automotive fuel taxes may, over time, lead to a wide spectrum of reactions, such as a shift to public transport, increased car sharing, decreased car use, a shift to more fuel efficient cars and eventually reduced commuting distances due to relocation closer to work.

In the EU-25, passenger transport prices have increased faster than other consumer goods and services, but still slower than the rise in real income. The exception to this rising trend is car purchase prices. These have declined, making it easier to afford a car and causing the total cost of passenger transport by car to have grown less than alternative modes. This provides a disincentive for people who could otherwise be interested in shifting mode of transport. In combination with rising incomes, this development has been an important driving force behind increased vehicle ownership and use in the EU.

The competition from and growing market share of low-cost air carriers seems to have led to a stabilisation of air fares, following a rise after the terrorist attack on New York and Washington DC of September 11, 2001. This reduction is a factor behind the fast growth in air travel — and the resulting emissions and noise nuisance.

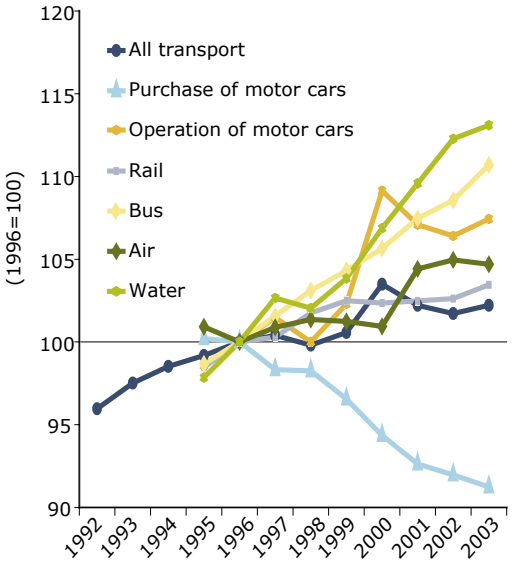
Freight transport prices have dropped over the past two decades. At the same time, road transport has been able to maintain its high level of service (door to door) with an increase in speed, due to improved and extended road infrastructure. To compete with road transport, rail freight transport (and to a lesser extent inland navigation) has been forced to focus on bulk transport over long distances with full train loads (shuttles). In this niche, the competition from road is limited. To compete in other niches, significant improvements in speed are needed.

The decline in transport prices has been beneficial to transport-intensive economic activities, bringing changes to logistical processes, such as allowing 'just in time deliveries'. This has resulted in benefits to supermarkets, for example, enabling them to reshape no longer needed storage areas into shopping space, as deliveries now come in small volumes twice a day instead of twice a week in larger volumes. On the downside, the increased transport intensity has led to an increase of environmental impacts.

Cheaper real purchase price favours the car

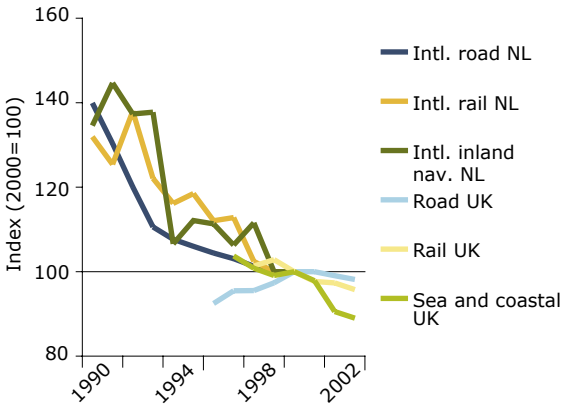
Vehicle purchase prices have fallen in real terms. Since the fixed costs of a car — mainly depreciation of the purchase value — form the majority of the total costs, the total costs of passenger transport by car have grown less than those of alternative modes.

Note: The price indices are adjusted for inflation. Operation of vehicles primarily covers fuel and maintenance prices. The 'water' category includes all passenger transport by sea and inland waterways.



Trend in freight prices encourages transport

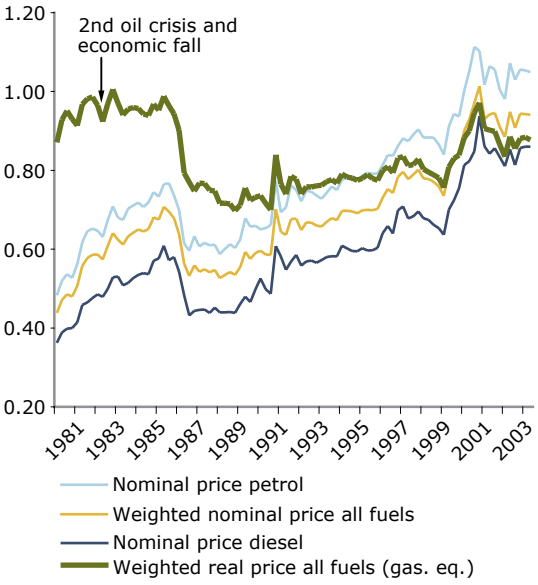
Unlike passenger transport prices, freight transport prices are not systematically monitored. However, data from the United Kingdom and the Netherlands clearly indicate that inflation adjusted freight prices have dropped over the past decade (and longer for the Netherlands). The increase of road freight prices in the UK during the late 1990s is mainly explained by the increase in fuel tax on diesel. Currently, the fuel tax on diesel in the UK equals that on petrol.



The myth about expensive fuel

The cost of fuel has not risen as much as many people think. During the 1990s, the inflation corrected price of fuel remained relatively stable. Since 1960, fuel prices have more than tripled whereas the price of bread rose by a factor of more than six and the average bus fare by a factor of 10. In 1960, a German industrial labourer earned one litre of regular petrol in about 13 minutes; today, it takes a little over four minutes. Thus, even the price spikes of the summer of 2004 have only partly corrected for the slower rate of rise in prices.

Note: Nominal and real fuel prices in Euro (2003 level).



8. Signs of promising developments for transport pricing

Progress is slow in restructuring transport charges towards better internalisation of external costs. The framework regulations being put in place for rail and road transport are positive developments towards fair and efficient pricing and a more sustainable transport system. However, air and water transport are still not covered.

Transport gives rise to a variety of negative external effects, such as climate change, air pollution, accidents and congestion. The burden of these effects lies with society as a whole, not just with the transport users. Fair pricing means that transport users should pay for the burden by paying a fee comparable to the costs. In theory, this would make the transport system more efficient as users would have an economic incentive to use cleaner, quieter, more fuel-efficient and safer vehicles running on cleaner fuels in off-peak periods, instead of driving in more polluting, noisy and unsafe vehicles in peak periods. Fair and efficient pricing may also lead to a reduction of demand, considering that transport is currently under-priced. Full internalisation would therefore maximise the transport system's contribution to society's welfare.

The heavy duty vehicle kilometre charging scheme in Austria (soon to be followed in Germany) and toll roads in several countries reflect the cost to society more closely than a general annual road tax or vignette system. But only in a few cases is the environmental performance of vehicles taken into account in the pricing structure. The upcoming amendment of Directive 1999/62/EC on the charging of heavy goods vehicles for infrastructure use is expected to allow for a differentiation of charges based on environmental performance. There are also a growing number of initiatives aiming to internalise the costs of congestion around cities. The London congestion charge has shown promising results, and Stockholm will start an experiment with an environmental charge to enter the city centre. However, a fully dynamic scheme with a charge differentiated with respect to time and place, depending on the actual congestion level, has not been introduced anywhere.

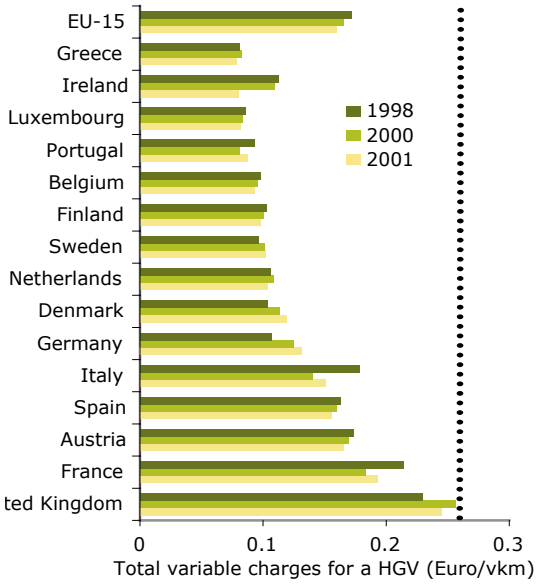
Directive 2001/14/EC on charging on use of railway capacity has been an important instrument for the restructuring of rail infrastructure charges. It allows the charges to be based on environmental performance provided that a comparable charge is levied on competing modes. Several Member States have developed charging systems that provide incentives for better use (in socio-economic terms) of the infrastructure by differentiating the charge based on environmental performance and the scarcity of capacity. But the charge levels and structures still vary widely across Member States.

There are only limited charges tied to external effects of air transport because international aviation is exempt from both fuel taxes and VAT. However, almost all countries have noise surcharges at airports and higher landing fees during the night, thus encouraging airlines to fly during the day in quiet aircraft, reducing the noise nuisance to people living nearby. So far, only Sweden and London Heathrow have introduced emission surcharges. Economic incentives for clean transport in inland shipping and sea transport are rare as both are exempted from fuel taxes. This leads to higher consumption and a higher burden on society than the benefits justify.

Distance related charges for trucks are decreasing

The use of variable charges in goods transport on roads decreased in the EU-15 as a whole, and in many member countries, between 1998 and 2001. This is partly a result of the fuel price protests in 2000 by hauliers, farmers and fishermen against rising fuel prices. Several Member States are introducing distance based charging schemes and therefore trends may change in the (near) future.

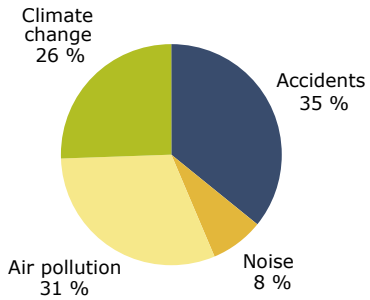
Note: The dotted line represents an estimate of external costs per vehicle km where they are lowest (in rural areas where exposure of people is low).



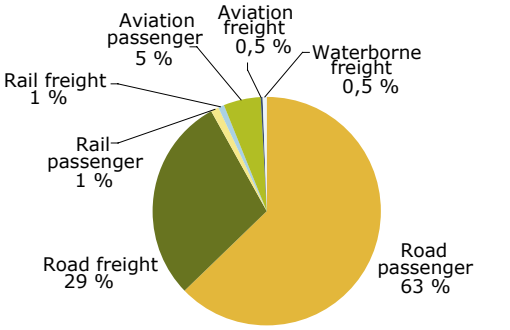
Breakdown of external cost of transport

The external costs of transport are highly dependent on the mode of transport and the specific circumstances. At night time, a noisy truck within a city limit has high noise cost, while its contribution can be small when the road is congested. Estimation methods are still under development and valuations differ between countries. Therefore, results should only be seen as indicative. Estimates of external cost (excluding infrastructure and congestion cost) vary from 4 to 8 % of GDP in the EU-15 up to 14 % of GDP for the new Member States. The latter group has a lower valuation for climate change costs but estimates a high cost for accidents and other environmental problems (Infras, 2000; OECD 2003b).

External cost of transport for 22 EU countries and Norway in 1995



Contribution of modes to external cost of transport for 22 EU countries and Norway in 1995



London congestion charge very successful

In February 2003, a congestion charge was introduced in central London. Users are obliged to pay GBP 5 daily for driving on public roads within the charging zone between 7 am and 6.30 pm on weekdays, public holidays excluded. Congestion within the charging zone has been reduced by 30 %, and traffic volume by 15 %.
This has led to gains in environmental amenity and reductions in road traffic emissions and fossil fuel consumption within the charging zone. Furthermore, journey times have become more predictable and reliable. There are now plans to expand the charging zone to include a larger part of the city area (TfL, 2004).

9. Infrastructure investment needs to balance economic and environmental needs

? Infrastructure — in particular road and high-speed rail — continues to expand. Extending transport infrastructure is the most common policy response to the need for improved accessibility and capacity. But optimising the use of existing infrastructure through road pricing or congestion charges offers a means of meeting demand with fewer new infrastructure developments.

EU transport policy is concerned with providing transport infrastructure and services to support the development of the internal market and, more generally, with ensuring the proper functioning of the Community's transport system. Transport infrastructure investments are also seen as an important tool to help reduce disparities between regions. On the one hand, transport infrastructure investments bring tremendous benefits, mainly in the form of reduced travel times. On the other hand, significant environmental and, in part, social costs can be imposed on society via external effects.

In the recent past, investments in the EU Trans-European Network (TEN) have focused on rail (mainly high-speed) and roads. Filling gaps in the transport network, especially across borders, has been a priority. The TEN road programme is well ahead of the corresponding rail programme. As a result, the length of highways and high-speed rail is increasing fast, while conventional rail and inland waterways are slowly diminishing.

The construction of transport infrastructure impacts upon the environment through habitat fragmentation, as well as stimulating transport growth and associated air emissions, noise, etc. Therefore, meeting both the accessibility and environmental objectives of the Common Transport Policy requires balancing skills.

Studies have shown that introducing road pricing based on the 'user pays principle' contributes to optimising use of existing infrastructure. It will favour traffic that has the largest added value to the economy and give incentives to drive at times and places of low congestion, increasing the efficiency (load factors) of vehicle use (ECMT, 2003).

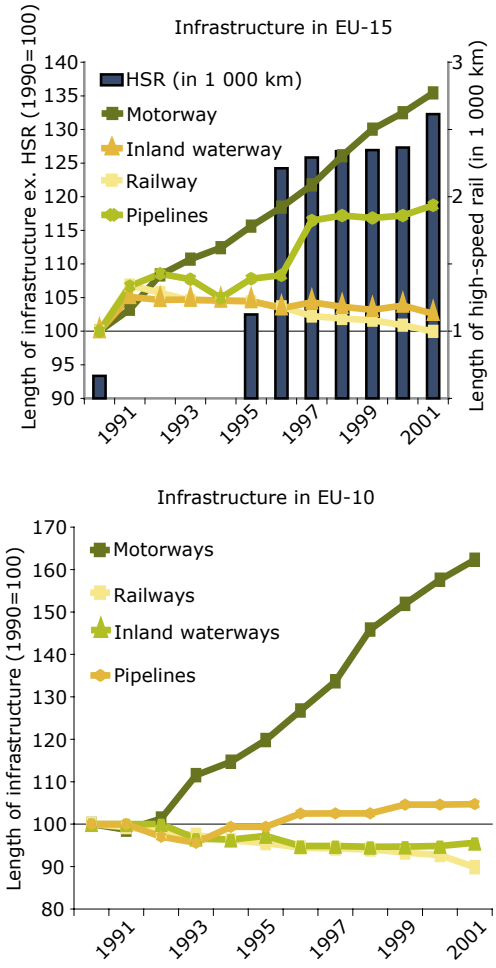
Several evaluation methods exist to weigh the costs and benefits of infrastructure projects, such as strategic and environmental impact assessment (SEA and EIA) or socio-economic cost benefit analysis (SCBA). In the recent extension of the list of priority transport projects, the need for a priori evaluation was particularly stressed. But there is currently no harmonised, accepted or uniform methodology to value adequately many of the negative impacts, such as land fragmentation, perceived risk, visual intrusion, etc. This skews conventional evaluation methods because the benefits, on the other hand, are largely included and priced.

Motorways and high-speed rail networks are growing, while the length of conventional rail networks and waterways is in decline

The two graphs show the evolution of transport infrastructure length in the EU-15 and EU-10 between 1990 and 2001. The length of transport infrastructure, notably motorways, continues to expand. The motorway network in the EU-10 grew by 62 % (1 045 km) between 1990 and 2001, while, in the EU-15, it grew by 35 % (12 606 km). High-speed rail is also growing rapidly in the EU-15.

Most of the new Member States still have significantly higher railway densities (in particular when expressed per capita) than the old Member States. But the trend is a change in favour of road. Pipeline networks show a moderate growth, while the length of waterways and conventional rail networks is gradually decreasing.

Note: Oil pipelines in the EU-10 are based on the Czech Republic, Hungary, Latvia, Lithuania and Poland.



Improvements of infrastructure are not always beneficial: the two-way road argument

The Standing Advisory Committee on Trunk Road Assessment (SACTRA) in the UK has studied the link between transport systems and economic growth. It concluded that there are theoretical reasons for transport system improvements having a positive effect on the economy, but also found that the empirical evidence was limited. SACTRA also analysed several case studies, and concluded that 'improved accessibility between two countries (and similarly between cities, areas or regions) may sometimes benefit one of them to the disadvantage of the other'. Urban areas too may become marginalised as a result of better accessibility, i.e. people living in the city finding jobs, shops, etc. outside the city (DETR, 1999).

The study programme on European spatial planning (EC, 2000) has a similar observation. 'Increasing accessibility has the double effect of enhancing centrality, on the one hand, while increasing the marginalisation of more remote rural areas, on the other. A strengthened centrality also promotes a diffused pattern of urbanisation originating from larger urban poles, which generate pressure on rural areas'.

10. Transport infrastructure is fragmenting natural habitats

Transport infrastructure networks are generally seen as a benefit but their expansion, traffic growth, and urban sprawl pose a significant threat to habitats and biodiversity. Proximity to disturbances, land fragmentation and isolation of habitats create new barriers to natural migration and movement of animal populations.

Human activities have an impact on their surroundings, and fragmentation is the yardstick which measures the segmentation of the landscape by motorways and major railroads. Fragmentation creates significant barriers to the movement of animals, but the impact is dependent on the nature of the infrastructure, the surrounding landscape structures and habitat patterns, species and their wandering habits, and on seasonal changes including climatic conditions. The different ecological zones of Europe — the Arctic, temperate and alpine regions, and the dry south — all have their own vulnerabilities and susceptibilities. What amounts to serious fragmentation in one region may not be so debilitating in another.

Land fragmentation by infrastructure is closely linked to population density and is therefore greatest in western and central Europe. In these high-density regions, with mature infrastructure networks, the landscape has been strongly fragmented for a long time and many species requiring much space disappeared long ago. In the more remote and less fragmented areas, such as Arctic Europe, fragmentation is growing because of increasing construction infrastructure. For the Arctic region, this has severe impacts due to its heightened sensitivity, but other parts of Europe are also seeing increasing pressure on the landscape from infrastructure.

Roads consume by far the largest amount of land for transport. The road network (all types) occupies 93 % of the total area of land used for transport in the EU-15, and 85 % in the EU-10. Between 1990 and 1998, it is estimated that 30 000 ha of land (about 10 ha every day) were taken for motorway construction alone in the EU-15. Rail takes only 4 % of land used for transport in the EU-15 and 10 % in the EU-10. The remaining infrastructure includes pipelines, access roads, forestry tracks, harbours and canals.

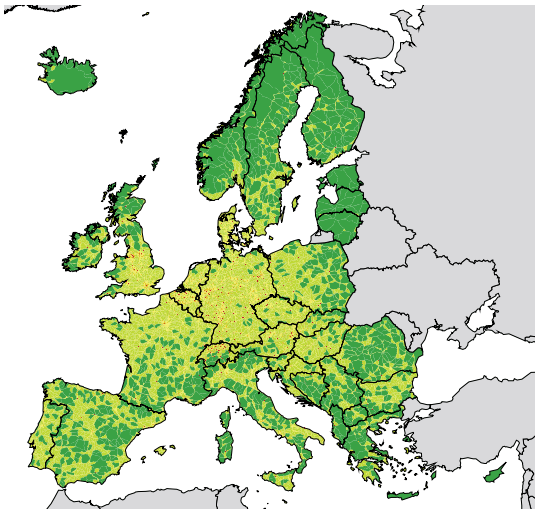
Fragmentation is extremely difficult to reverse and there is a need for balanced policies concerning infrastructure development. These policies need to take into account all modes of transport as well as alternative location choices. The principal policy question is how to enjoy the benefits of high quality transport access while, at the same time, preserving large enough land parcels for biodiversity and social and recreational functions. In this regard, powerful tools such as strategic and environmental impact assessments (SEA and EIA) do not yet fully provide the guidance they otherwise could. The evaluation of land fragmentation and its impacts and effects on biodiversity, habitats and communities requires further developing.

Map of Europe's fragmentation

Designated nature areas are under pressure from transport infrastructure in countries with a dense transport network. On average, about half of designated areas in Europe are affected by transport.

Germany is an example of a country with a highly developed transport infrastructure impacting upon almost every designated area. Finland, on the other hand, has about 90 % designated areas remote from any type of transport influence. The correlation with population density is clearly visible in the map.

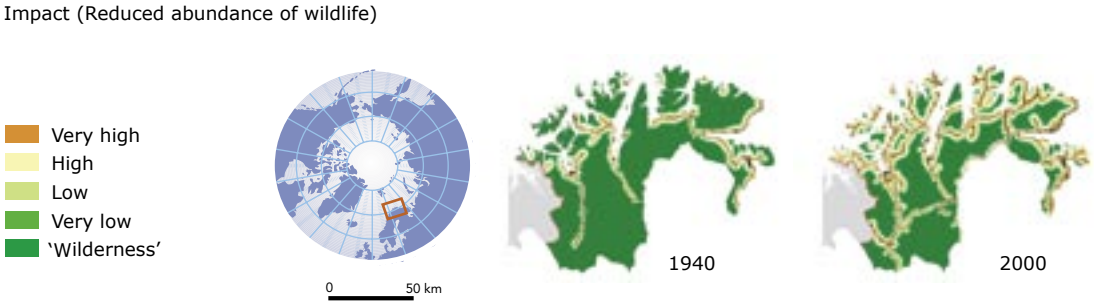
Note: Infrastructure data from Estonia, Latvia and Lithuania are incomplete.



Road developments in the northern Arctic

Fragile areas in the Arctic are extremely vulnerable and reduced size of natural habitats is a growing problem. For example, roads up to five kilometres away may affect reindeer. Many birds and predators require large home ranges and travel over long distances in their hunt for food. The Saami communities in northern Scandinavia are increasingly unable to practise traditional reindeer husbandry. The use of traditional homelands for hunting, gathering and fishing conflict with infrastructure development directly, and indirectly too as areas are opened up to other development possibilities. In northern Norway, undisturbed areas have been reduced from 48 % in 1900 to only 11.8 % in 1998.

The impact of transport infrastructure on biodiversity depends on the type, intensity, location and mode of the infrastructure elements. It can be direct, in the form of land take by the infrastructure, or indirect, in the form of vehicle emissions, run-off substances, oil discharges, traffic noise, light, etc. (EEA, 2004).



Source: UNEP and www.globio.info

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