Member States in Top Gear

Opportunities for national policies to reduce GHG emissions in transport

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Summary

Long term climate goals: the main challenge for the transport sector

The EU has set an ambitious target for reducing its greenhouse gas (GHG) emissions: 80% reduction in 2050 compared to 1990 levels. The reduction target for the transport sector is 60% over the same period. Meeting this target is expected to be challenging and requires action from all types of stakeholders and at all administrative levels, ranging from the UN, the EU up to local authorities. Also national governments pay a key role in meeting the targets set.

The Dutch Advisory Council for the Environment and Infrastructure (RLI) has chosen the decarbonisation of the transport sector as a central topic for the annual conference of the network of European Environmental and Sustainable Development Advisory Councils (EEAC) in October 2012. As part of the preparation for this conference, the RLI commissioned CE Delft to carry out a study on the national policies for the decarbonisation of transport. The results of the study will be presented at the conference and will also be used as input for a book that will be published on the occasion of the conference.

Approach

This study provides an overview of the main trends regarding transport in EU Member States as well as an in-depth analysis of relevant policies. Both existing policies and national studies and visions on long term decarbonisation strategies have been assessed. The analysis was based on various EU wide data sets from EEA, the European Commission and other stakeholders and also a literature review. Furthermore more detailed data on existing and planned policies has been gathered for ten selected Member States with the support of national experts.

Member States have to play a key role in decarbonisation

EU Member States have a key role to play in the decarbonisation of transport. For this, they can apply a broad range of policies. Economic instruments can support the uptake of energy saving and low-carbon technology. Examples are vehicles taxes and fuel taxes that are (partly) based on CO_2 emissions. The strongest selling-argument for low-carbon innovations is that saving carbon results in saving money. Furthermore Member States can stimulate (certain types of) biofuels, low-carbon transport modes, including cycling and public transport policy and all types of innovations. Also speed policy and spatial and infrastructure policies are relevant from the perspective of reaching long term climate targets.

The analysis made in this study shows that long term decarbonisation targets are generally not yet well integrated in the existing national transport policies. Climate objectives are reflected in certain policies, such a CO_2 differentiation of vehicle taxes in some Member States. However, in none of the Member States achieving 60% GHG emission reduction in transport in 2050 is realistically achievable with the current policy strategy.

Various Member States have in response to the EU Roadmap developed a study or vision on the climate policy till 2050. These scenarios are not translated into concrete policy instruments. Policy instruments are needed to bring technologies to the market and to push behavioural changes. Furthermore, these studies generally rely very much on technical reduction options and EU regulation. However, the risks and uncertainties of the GHG reduction potential of biofuels, electrification and other technologies like hydrogen are not well addressed and taken into account in these strategies.

Opportunities for Member States

There are many opportunities for Member States to contribute to GHG emission reduction in transport. Most of these policies have one thing in common. To be effective, they need to be consistent, regularly updated and tightened (e.g. to keep pace with innovation) and provide continuously, predictable incentives to the market.

By differentiating vehicle taxation and company car taxation, incentives for low-carbon technology and energy saving can be provided. This supports EU instruments such as CO_2 regulation of vehicles and regulation of energy carriers. Many Member States have some type of vehicle taxation (purchase taxes and/or annual taxes), but levels and structure vary enormously. The current taxes do not always provide the incentives needed for GHG reduction.

Increasing fuel taxes for both road and non-road transport modes can provide an additional incentive for a more energy efficient vehicle fleet. In addition it provides incentives for more efficient use of vehicles and curbing transport growth. Fuel taxes should be annual adjusted for inflation to remain effective.

Road charging for all vehicles can also contribute to GHG emission reduction as it improves the efficiency of the transport system and limits transport growth rates. It helps to reduce road congestion and the need for additional infrastructure capacity. Other economic incentives can be provided by ticket taxes for aviation (preferably differentiated to flight distance as is already the case in the UK) and the abolishment or reduction of commuter tax advantages.

Spatial policy, infrastructure policy, the level and enforcement of speed limits are also important instruments for influencing transport growth rates, the modal split and the efficiency of the transport system. However in most Member States these policies are not developed in a direction that makes them contribute to GHG emission reduction. Raising speed limits and significant increase in road infrastructure capacity is happening in various Member States and induces further transport growth and so results in increasing GHG emissions. Integrating of climate impacts in these policy areas is an important opportunity for long term GHG emission reduction.

Last but not least stimulating and supporting all types of innovation is important. The aforementioned economic instruments can be supported by specific measures, e.g. the development charging infrastructure of electric vehicles. In the case of biofuels, it is important to focus on biofuels with real well-to-wheel GHG emission reduction, such as biofuels from waste and residues.

When designing specific policies for stimulating low-carbon modes or technologies, it is important to take care that rebound effects are limited and net emissions reductions can be achieved. Policies to stimulate cycling and walking (particularly in urban areas) can be regarded as no-regret and have significant GHG reduction potential.

1 Introduction

1.1 Background

The Dutch Advisory Council for the Environment and Infrastructure (RLI) organises the annual conference of the network of European Environmental and Sustainable Development Advisory Councils (EEAC) in October 2012.

As part of the conference, an open debate will be organised on sustainable mobility. As part of the preparation for this conference, the RLI commissioned CE Delft to carry out a study on the national policies for the decarbonisation of transport. The results of the study will be presented at the conference and will also be used as input for a book that will be published before the conference. The conference, the book and the research report will be used to develop recommendations to governments.

The conference and this study take place against the background of the 2050 Roadmap[1] and the 2011 White Paper on Transport[2]. The 2050 Roadmap is a strategy that seeks to define the most cost–effective ways to reduce GHG emissions based on the outcome from modelling to meet the long term target of reducing overall emissions by 80% domestically. The Roadmap considers the pathways for each of the sectors, identifying the magnitude of reductions required in each sector in 2030 and 2050. For the transport sector (which includes CO_2 from aviation but excludes CO_2 from marine shipping), the targets for 2030 are between +20 and -9%, and the 2050 targets are -54 to -67%.

In the 2050 Roadmap, the European Commission requested the Member States to develop a roadmap 2050 as well. Various Member States have developed such long term plans or visions on decarbonisation of transport. Although most of these plans do not have a formal status, they help to get a view on what policies and reduction options Member States focus on as well as potential gaps with respect to the long term reduction targets.

The Transport White Paper presents the European Commission's vision for the future of the EU transport system and defines a policy agenda for the next decade to begin to move towards a 60% reduction in CO_2 emissions by 2050. As part of this it defines ten aspirational goals as indicators for policy action.

1 EC (2011a) A Roadmap for moving to a competitive low carbon economy in 2050, COM(2011) 112 final, European Commission. Brussels. Available at: http://ec.europa.eu/clima/policies/roadmap/documentation_en.htm

2 EC (2011b) Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 final, European Commission, Brussels. Available at: http://ec.europa.eu/transport/strategies/2011_white_paper_en.htm

1.2 Objectives

The research question of the study is:

*What are the existing **national** sustainable mobility policies in the EU Member States and how is the EU roadmap 2050 operationalised? What are the main coherences and differences?*

The study focuses on **climate mitigation**. Both the national objectives for decarbonisation of transport and the strategies and existing transport policies of Member States in relation to the potential contribution to decarbonisation are investigated and compared. Furthermore these are compared with the current trends in the various Member States as reflected by various indicators on transport. The assessment will not be limited to policies that are directly aimed at reducing GHG emissions of transport but also policies that have indirectly effects on the emission levels and so can help to increase or decrease the distance to the long term reduction targets.

1.3 Approach and demarcation

The project methodology is based on three pillars:

1. **Development of an indicator set on the main trends in the transport sector in all EU Member States**
   This illustrates the current situation in all Member States and makes clear what is really happening 'on the ground' in the Member States. Data for this first pillar has been based on data from statistics and the TERM framework, developed by the European Environment Agency.
2. **An in-depth analysis of existing policies in ten EU Member States**
   Information on the policies implemented and planned on the shorter and longer term were gathered by means of a literature review and by information provided by specialised transport policy experts from the selected Member States. The resulting overview makes clear how Member States (try to) influence transport, how climate change is integrated in the current policies and how this relates to the EU and national long term strategies for decarbonising transport.
3. **Analysis of national 2050 studies/visions for the same ten Member States (if existing)**
   This makes clear what ambitions Member States have for long term GHG mitigation in transport and what strategy they develop for realising their ambition. Data on this has been gathered by the same questionnaire, supplemented by an analysis of the 2050 plans themselves.

This three step approach makes it possible to compare policy objectives, current trends, existing and planned transport policies and national studies or visions for meeting the 2050 GHG reduction targets. In a final integrated assessment these various elements are brought together and policy recommendations are developed. To what extent the current policies and national strategies are likely to result in meeting the 2050 reduction targets and, if not, how they could be further developed to do so, is also addressed.

Mobility trends and policies can be partly described on the basis of statistics. However for more detailed information about the specific situations in Member States and policy instruments in place, more specific data gathering is required. Therefore, the data for Step 2 and 3 has been gathered using a questionnaire which was filled out by national transport policy experts from the selected member States. The questionnaire is included in annex A and has been filled out for the following countries by national experts listed in Table 1.

Table 1 Overview of countries included in the in-depth study

Country	Data gathering by	National study/vision available on decarbonisation of transport?
Netherlands	CE Delft	yes
Germany	CE Delft	yes
UK	TEPR	yes
France	Alenium	yes
Poland	Agnieszka Markowska (CE Delft associate)	no
Sweden	Nilsson Produktion	yes
Denmark	Nilsson Produktion	yes
Spain	University of Madrid	no
Italy	TRT, Milano	no
Hungary	REC, Budapest	no

Moving towards sustainable transport comprises more than decarbonisation. However, solving issues such as traffic fatalities and injured, noise and air pollution and congestion are also important preconditions for a more sustainable transport system. As the scope of this study is limited to decarbonisation of the transport sector, which is among experts generally considered as challenge that is generally the most persistent and difficult to solve, the other aspects of sustainability are not part of the analysis.

1.4 Structure of the report

In the next chapter we provide an introduction to GHG emission reduction options and policies for transport. How can emissions be reduced and what instruments can be applied ate the national level? Next, Chapter 3 summarises the main trends in the GHG emissions of transport and provides also an overview of trends in transport demand. Chapter 4 contains the more detailed findings on policy targets and instruments applied in the ten selected Member States, based on the literature review and the information provided by the national transport policy experts. Chapter 5 focuses on the scenarios for meeting the 2050 reduction targets. A summary of the main national studies or visions for meeting the 2050 reduction targets are discussed and put in perspective to the existing policies and the overall GHG reduction scenarios, such as the ones developed in the EU Roadmap and White Paper on Transport. Finally, Chapter 5.1 summarises the conclusions and recommendations of this study.

2 Greenhouse gas mitigation: reduction options and policies

2.1 Introduction

Climate policies aim at the reduction of GHG emissions, in the case of transport mainly CO_2 emissions[3]. There are many options and policies that can contribute to GHG reduction. Some policies that are primarily aimed at other objectives can deliver significant GHG emissions while the net GHG emissions of some climate policies are much less than expected and some cases even negative. Before analysing the trends and policies in EU Member States, this chapter discusses more in general how GHG emissions of transport van be reduced and what type of policies may be expected to contribute.

First we briefly summarise the strategy laid down in the White Paper.
Next, to put this strategy in a broader perspective, an overview is given of all main GHG reduction options and policies for transport. Finally we focus on the role of national policies, being the main subject of this study.

2.2 GHG reduction strategy from the 2011 White Paper

The Transport White Paper (EC, 2011a) presents the European Commission's vision for the EU sustainable transport system and defines a policy agenda for the next decade to move towards a 60% reduction in CO_2 emissions and comparable reduction in oil dependency by 2050, in comparison with 1990.
As part of this it defines aspirational goals as indicators for policy action.
These goals can be categorised as (EC, 2011b):
– developing and deploying new and sustainable fuels and propulsion systems;
– optimising the performance of multimodal logistic chains, including by making greater use of more energy efficient modes; and
– increasing the efficiency of transport and of infrastructure use with information systems and market-based incentives.

Key goals are presented in Table 2.

3 CO_2 is by far the most important type of GHG emission from transport. Other types include methane from LNG or CNG vehicles (mainly from leakage), substances like N_2O from air conditioning systems in vehicles and non-CO_2 emissions from aircraft at high altitudes. There is increasing evidence that also particulate matter ('black carbon') can have climate impacts. In this study, however, the focus is on the most important GHG emission from transport, CO_2.

Table 2 Ten goals from the 2011 White Paper on Transport

White Paper goals	
1.	Halve the use of 'conventionally-fuelled' cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO_2-free city logistics in major urban centres by 2030.
2.	Low-carbon sustainable fuels in aviation to reach 40% by 2050; also by 2050 reduce EU CO_2 emissions from maritime bunker fuels by 40% (if feasible 50%).
3.	30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors. To meet this goal will also require appropriate infrastructure to be developed.
4.	By 2050, complete a European high-speed rail network. Triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all Member States. By 2050 the majority of medium-distance passenger transport should go by rail.
5.	A fully functional and EU-wide multimodal TEN-T 'core network' by 2030, with a high quality and capacity network by 2050 and a corresponding set of information services.
6.	By 2050, connect all core network airports to the rail network, preferably high-speed; ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway system.
7.	Deployment of the modernised air traffic management infrastructure (SESAR) in Europe by 2020 and completion of the European Common Aviation Area. Deployment of equivalent land and waterborne transport management systems. Deployment of the European Global Navigation Satellite System (Galileo).
8.	By 2020, establish the framework for a European multimodal transport information, management and payment system.
9.	By 2050, move close to zero fatalities in road transport. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport.
10.	Move towards full application of 'user pays' and 'polluter pays' principles and private sector engagement to eliminate distortions, including harmful subsidies, generate revenues and ensure financing for future transport investments.

2.3 GHG reduction options and policies

A very broad and in-depth analysis of the decarbonisation of transport has been made two studies commissioned by the European Commission DG CLIMA, the first one called 'EU Transport GHG Routes to 2050' which was carried out by AEA Technology, CE Delft and TNO in 2009-2010 and the follow-up project with the same title which was carried out in 2011-2012[4]. Those studies distinguished:

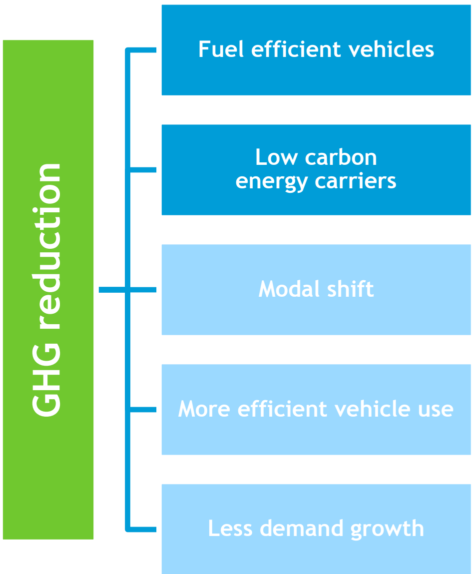
- GHG reduction **options**: changes that physically deliver GHG reductions;
- **policies**: interventions from governments that may help to stimulate these changes on the other.

In Figure 1, all possible **options** for reducing the GHG emissions of transport are summarised. These fall apart in:

- technical reduction options, related to energy efficient vehicles and low-carbon energy carriers;
- non-technical reduction options, related to modal shift, efficient use of vehicles (e.g. improved logistics or ITS) and limiting the growth of transport demand.

4 See website: www.eutransportghg2050.eu

Figure 1 Options for reducing the carbon intensity of the transport system



Based on: AEA, 2010.

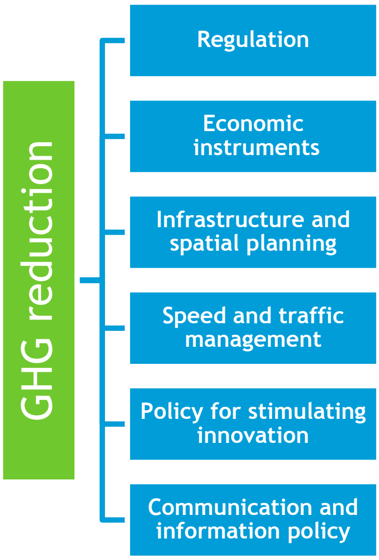
These various reduction options can be stimulated by a broad range of policies at various levels (global, EU, national, regional, local). Figure 2 provides an overview of the main types of policy instruments that can be used for reducing GHG emissions of transport.

Each of these policies can contribute directly or indirectly to several of the GHG reduction options. Although there is no simple mapping of GHG reduction options to policies instruments, some instruments trigger particular reduction options more than others. So does CO_2 regulation of vehicles particularly stimulate energy efficiency improvements. However, also a shift to low-carbon energy carriers (such as electricity) may be stimulated. Furthermore the price effects of tight vehicle standards can affect modal split, occupation rates and long term demand growth. A measure like lower speed limits affects the fuel efficiency of vehicles but has also an impact on modal split and long term impacts on the growth of transport demand. Furthermore, one could argue that speed limits might indirectly even affect the fleet, when they would discourage the sales rates of fuel guzzling cars.

Technical reduction options (energy efficient vehicles and low-carbon energy carriers, see Figure 1) play a key role in all long term GHG reduction scenarios. However, in many long term scenarios including the one developed for the impact assessment of the EU White Paper and the aforementioned ‘EU Transport GHG Routes to 2050’ projects), also the other types of reduction options are required for achieving the 2050 target.

The strategy set out in the 2011 White Paper on Transport focuses among others on modal shift while, some other studies, including the ‘EU Transport GHG Routes to 2050’ projects showed that also the fourth and fifth reduction options (more efficient use of vehicles and limiting transport growth) may contribute significantly to meeting the 2050 reduction target.

Figure 2 **Main categories of policy instruments that can contribute to GHG reductions in transport**



Based on: AEA, 2010.

2.4 Role of Member State policies

The policies presented in Figure 2 cover all administrative levels. Although each administrative level can contribute to and is even required for delivering the long term GHG reduction targets, the policies and contributions of each level differs.

Table 3 summarises the role of the various administrative levels. It shows that national governments have a wide range of instruments for available.

Table 3 **Main types of policies for reducing GHG emissions of transport, per administrative level**

Administrative level	Main policies
Global	– Regulation regarding maritime shipping and aviation
EU	– Vehicle and fuel regulation – TEN-T infrastructure policy – Frameworks for pricing (e.g. energy taxation and infrastructure pricing) – Emissions Trading Schemes (ETS) – Subsidies and R&D
National	– Spatial policies – Infrastructure policies – Economic instruments: fiscal policies, infrastructure charging – Subsidies and R&D – Fuel and energy regulation and support – Policy for stimulating specific modes, including public transport policy – Traffic management and speed policy on national roads
Local/regional	– Local/regional infrastructure and spatial policies – Local/regional public transport policy – Cycling policy – Traffic management – Local speed policies – Parking policies – Local congestion charging schemes – Subsidies and R&D

Based on Skinner et al., 2010.

Figure 3 provides a simplified overview of how the main national policies are linked to the transport system and to the GHG reduction options indicated in Figure 1. From Figure 3, it seems that policies that can be deployed at the national level to reduce the GHG emissions of transport consist of a mix of instruments that regulate, incentivise and support the development of sustainable mobility.

Figure 3 Policies to improve the sustainability of passenger transport in relation to the transport system

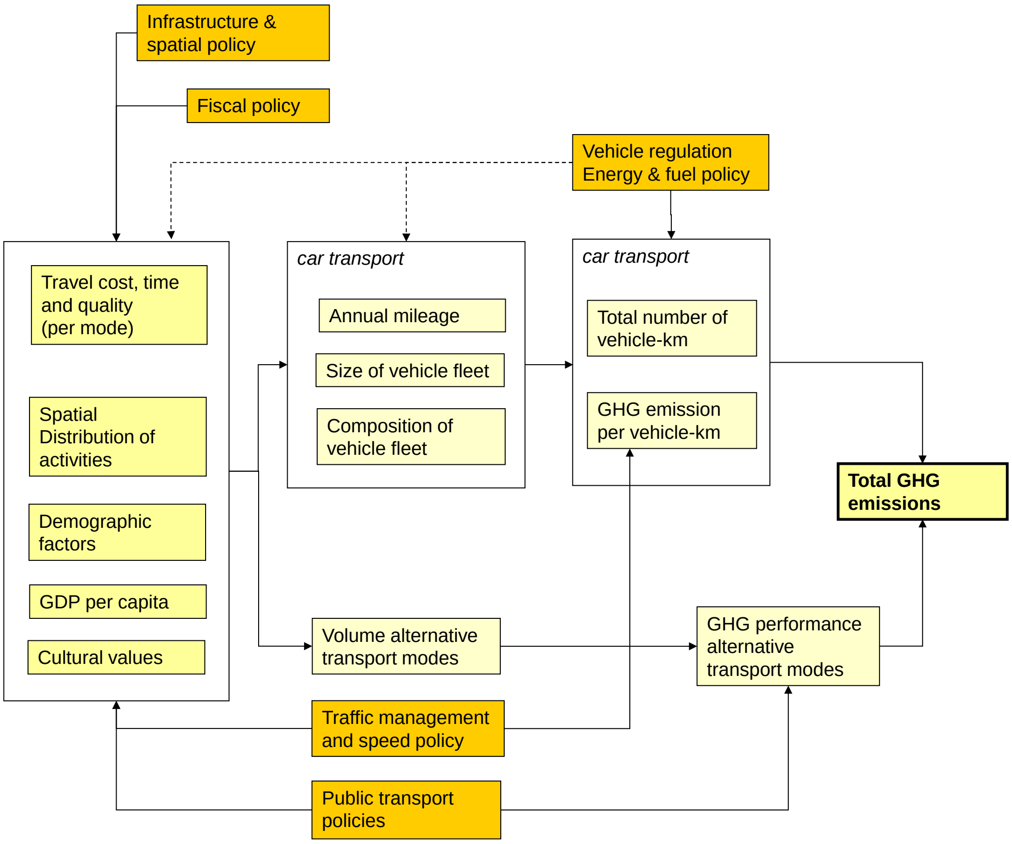


Table 4 provides a summary of the way that the instruments identified in Table 3 can contribute to GHG reduction (based on Skinner et. al, 2010). These policies and the way they could contribute to GHG emissions reduction are the starting point for the assessment of trends, objectives, policy visions and policies of the different Member States, in Chapter 3, 4 and 5.

Besides the way these polices can contribute to GHG reduction in transport, also main risks for not delivering significant GHG reduction or even increasing emissions are listed for each policy instrument. Furthermore, it should be noted other (types of) transport policies could have opposite effects: result in increasing GHG emissions. Examples are expanding road network capacity or airports, stimulating the use of tar sands, spatial policies that stimulate urban sprawl, lowering fuel taxes or raising speed limits.

Table 4 Overview of national policy instruments and their potential contributions to GHG emissions reduction

Policy instruments for reducing GHG emissions in transport	Potential contributions to GHG emission reduction as well as some main risks for not delivering significant GHG reduction or even increasing emissions
Spatial policy Urban densification, reduced distances between key functions	– Modal shift to low-carbon modes – Reduction of demand (growth) because of reduced need for travel and reduction of the average trip distance – *Risk: effectively changing transport behaviour by spatial policy is generally very difficult to achieve and may take many years*
Infrastructure policy Development of transport infrastructure for low-carbon modes, limiting expansion of capacity of roads and airports, carbon rating of new infrastructure projects	– Modal shift to low- carbon modes – Low-carbon ways of constructing and maintaining transport infrastructure – *Risk: additional demand growth from induced traffic, for effective modal shift also other market drivers are required*
Infrastructure charging Road charging, tolls, congestion charging, infrastructure charging for non-road modes	– Modal shift to low-carbon modes – Increased vehicle utilisation (e.g. higher load factors or occupation rates) – Reduction of demand (growth) – *Risk: for effective modal shift also other market drivers are required*
Fiscal policies Energy taxes, vehicle purchase taxes, circulation taxes, ticket taxes, company car taxation, value added tax	– Increased energy efficiency and uptake of low-carbon energy carriers (particularly from charge differentiation) – Modal shift to low-carbon modes (e.g. because of reduced car ownership) – Reduction of demand (growth) – *Risk: cross-border effects when differences between countries are too large (e.g. fuel tourism)*
Subsidies/R&D E.g. for electric vehicles, retrofit measures, certain low-carbon technologies or modes	– Breakthrough of innovative technologies – *Risk: unintended shifts (e.g. from cycling to public transport) or additional demand growth*
Fuel and energy regulation and support E.g. regarding shares and sustainability of biofuels, electricity, charging infrastructure for Electric Vehicles, etc.	– Uptake of low-carbon energy carriers – *Risk: unintended well-to-wheel effects such as Indirect Land Use Change (ILUC) effects of 1st generation biofuels*
Policy for supporting specific modes: E.g. policies for stimulating rail transport, inland waterways, public transport policy	– Modal shift to low-carbon modes – *Risk: unintended shifts (e.g. from cycling to public transport) or additional demand growth*
Speed policy and traffic management Lower speed limits and stricter enforcement, optimisation of traffic management (e.g. by favouring low-carbon modes)	– Improved energy efficiency of vehicles because of lower and/or more constant speeds – Reduction of demand (growth) because of relation between travel times and travel distances – Modal shift to low-carbon modes – *Risk: higher emissions per vehicle-kilometre because of reduced flow-through and increased stop & go traffic*[5]

[5] The demand effects are generally dominant, see Snelder et al (2010) and Smokers et al (2012b).

3 Trends in transport demand and GHG emissions

3.1 Introduction

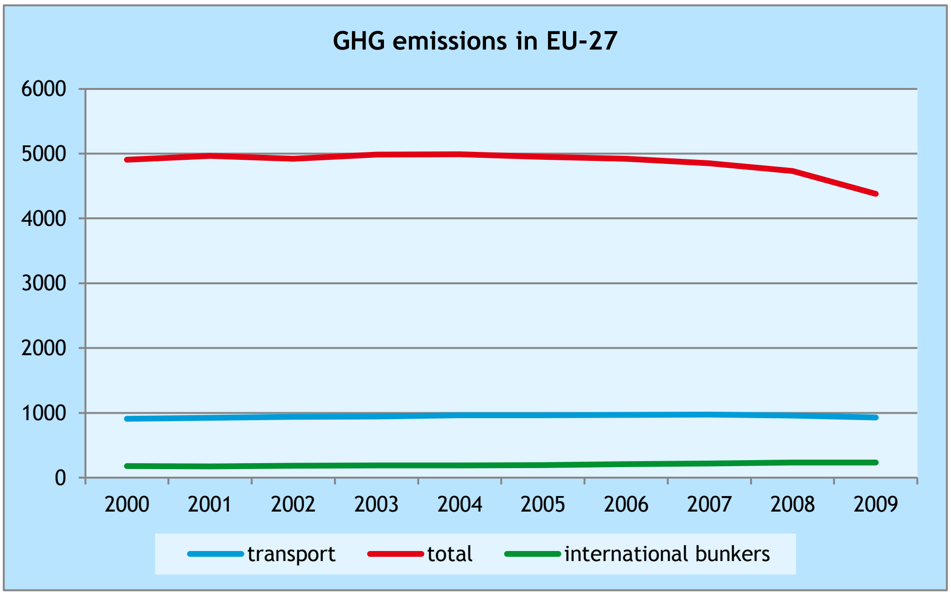
In this chapter we provide an overview of the major trends in the past ten years for the EU-27 as a whole and the individual Member States. We discern between EU-15 countries and EU-12 countries. The first group includes all fifteen EU Member States before the 2004 extension. EU-12 refers to the countries that joined the EU between 2004 and 2007.

The database accompanying this report contains a large set of national data on a wide range of indicators. In Annex B, the table of contents of the database is included.

3.2 Overview of development of GHG emissions in the EU

Figure 4 shows the trend in the GHG emissions of the EU-27. Both the total GHG emissions as well as the GHG emissions from the transport sector are shown.

Figure 4 Total and transport GHG emissions in EU-27 (Mtonne per year)



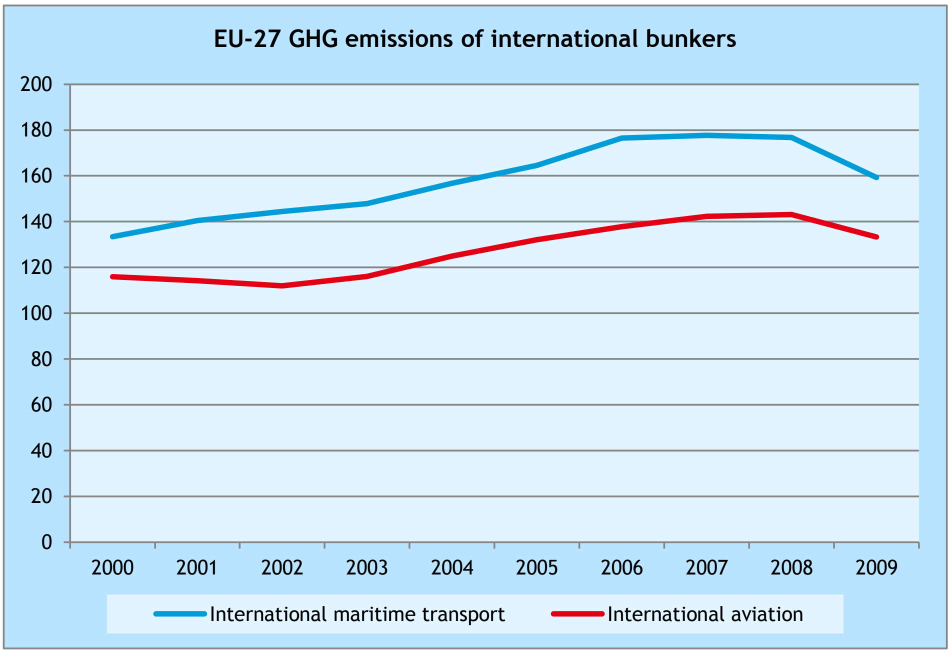
Note: International bunkers are not included under 'transport' and 'total'.
Source: EEA.

The total emissions in the EU-27 remained more or less constant over the last decade. In the 2008-2009 period, a relatively strong decline in emissions can be observed which can be partly explained by the financial and economic downturn since then and the sustained strong growth in the use of renewables (EEA, 2011a).

The figure illustrates the slight increase of the share of transport in total GHG emissions from 18 to 20% in the 2000-2009 period. This is mainly due to a decrease of emissions outside the transport sector. International bunkers have shown the largest growth over the period mentioned. Taken all international bunkers together, their increase amounted 17% over the 2000-2009 period.

Road transport was responsible for 96% of all transport related GHG emissions in 2009 (excluding bunkers). Rail transport (electric rail not included), inland navigation and mobile machinery were responsible for the remaining 4%.

Figure 5 **GHG emissions of international bunkers on basis of fuel sales (Mtonne per year)**

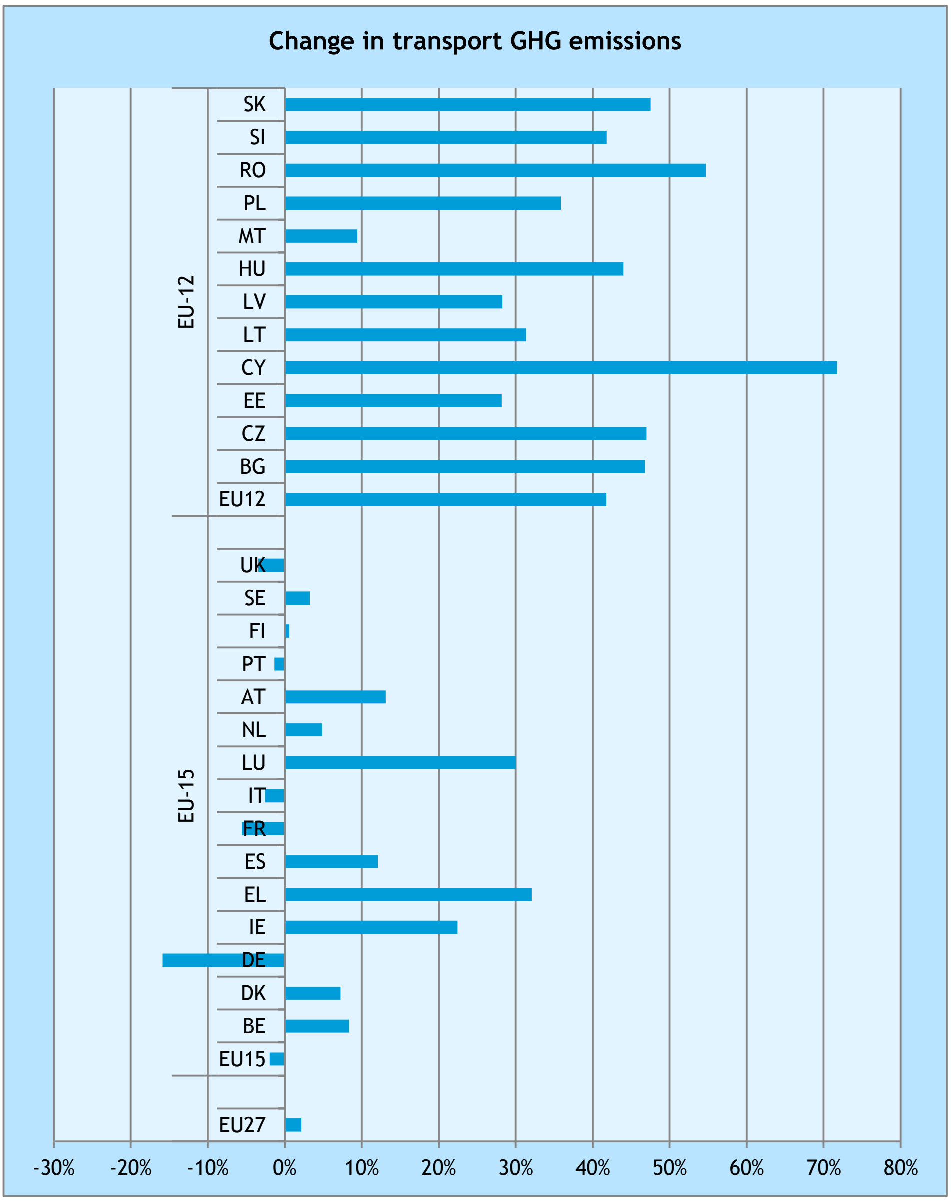


Source: EEA.

Figure 6 shows the change of transport emissions in the various EU Member States between 2000 and 2009. Most of the countries show significant growth over the past decade. Only few of the EU-15 countries show a decline of GHG emissions: Germany, France, UK, Italy and Portugal. This results in a slight decrease for the EU-15. The GHG emissions from transport in the EU as a whole increased because of the net increase in the EU-12 countries.

The reduction of GHG emissions in some of the EU-15 countries may be explained by saturation of passenger car transport, a reduction of the share in international road transport, more efficient road freight transport due to HDV tolling and more fuel efficient cars (UBA, 2009).

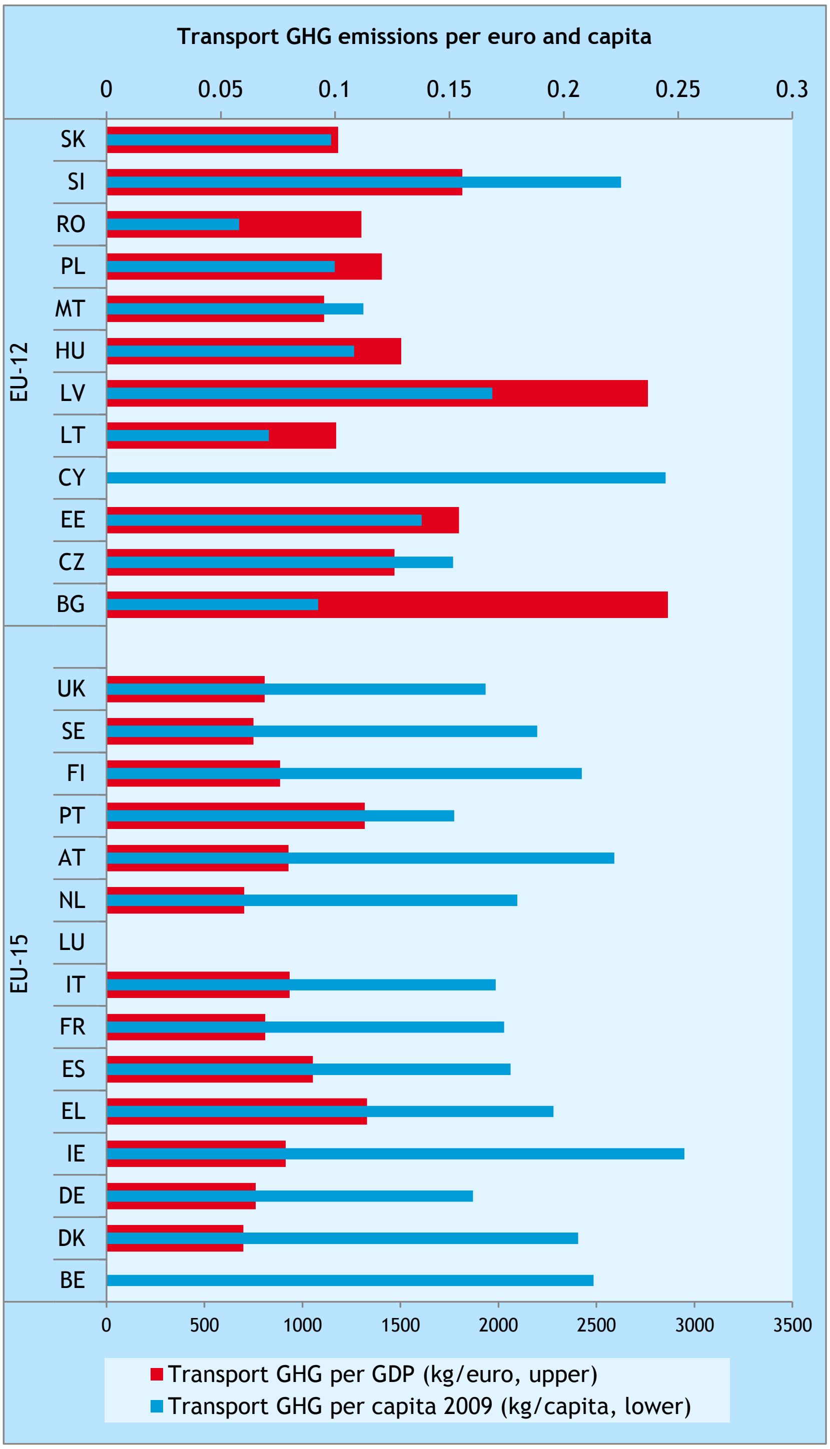
Figure 6 **Development of the emissions of transport over the 2000-2009 period (excluding air and maritime transport)**



Note: International bunkers not included.
Source: EEA.

The transport emissions per unit of GDP and per capita are depicted in Figure 7. It shows that the GHG emissions per unit of GDP are higher in the EU-12 countries, reflecting the high transport intensity of the economy as a whole. This can be explained by the large share of heavy industry in these countries. However, EU-15 countries show a higher GHG emission per capita, reflecting the higher passenger transport volumes in these countries, in comparisons with the EU-12.

Figure 7 GHG Emissions per capita (kg/capita) and per € of GDP (2009)

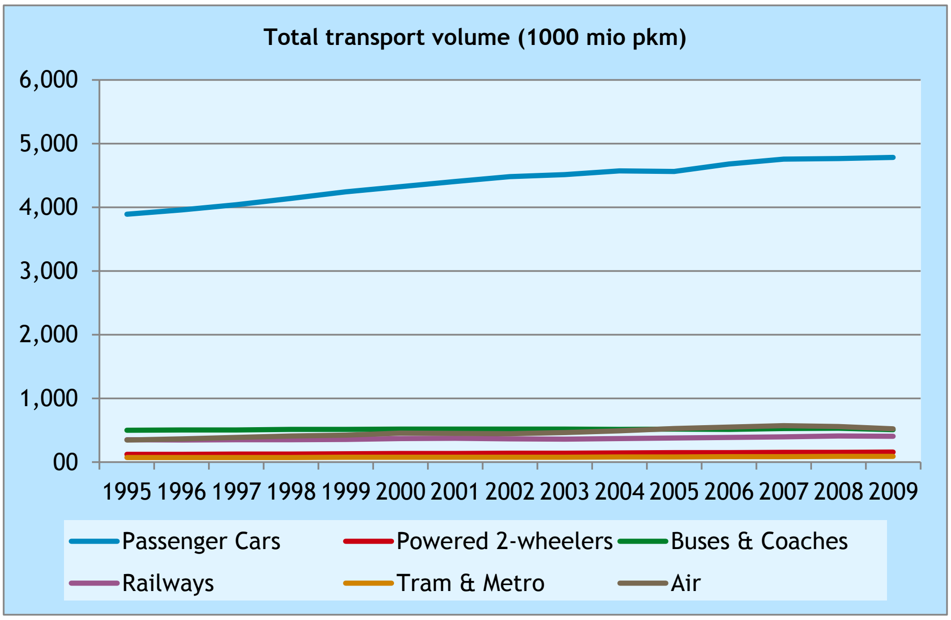


Note: International bunkers are not included.
Source: EEA/Eurostat.

3.3 Passenger transport

Figure 8 shows the trends in passenger transport volume since 1995 for the various motorised transport modes. As the volume of car transport is much higher than the other modes, different scales are used. The graph shows that passenger car transport and air transport show the greatest growth over the past decade. Those are exactly the two modes with highest emissions per passenger-kilometre. Also for the future, passenger car and particularly air transport are expected to have the highest growth rates. These past and future growth of transport demand make that the GHG emission reduction rates compared to a business as usual scenario are far more than the 60% reduction compared to 1990 level. Furthermore the higher the growth of transport, the more is needed from other reduction options.

Figure 8 Development of passenger transport in EU-27 (in 1,000 million passenger-km per year)

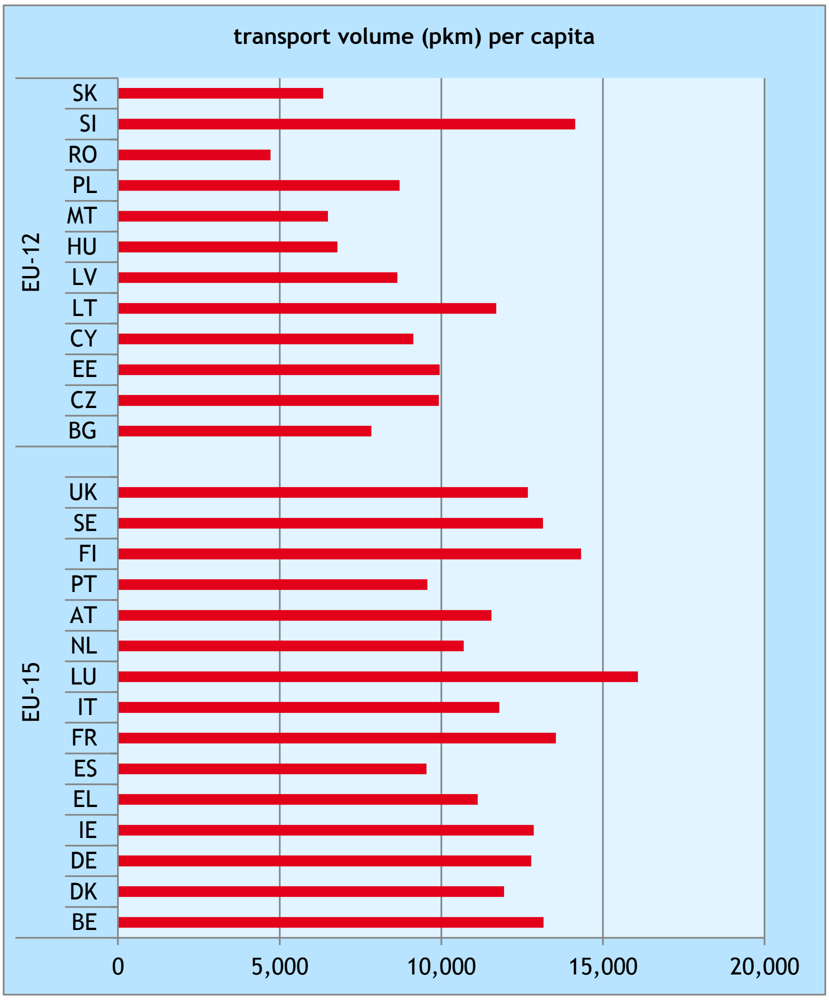


Note: The graph shows passenger-kilometres, not vehicle-kilometres. Changing vehicle utilisation can increase or decrease the number of vehicle-kilometres travelled. Available data suggests that passenger car occupancy rates are generally stabilising in Western Europe, but declining - from a higher baseline - in the Eastern European countries.

Source: DG MOVE Pocketbook (European Union, 2011).

The per capita per annum travel distance shows great differences between the EU Member States. Differences in income and the quality of the transport system explain the difference between Western and Eastern Member States. The average annual distance travelled by car by EU-12 citizens has increased by around 50% between 1999 en 2009, and it is expected that the growth will continue. In the EU-15 this growth rate has been much lower, only 3%. The explanation is that, until a certain point of saturation, increasing income level result in increased car ownership and allows for faster and farther travelling. Also increasing road congestion may partly explain the lower growth rates in the EU-15. Furthermore the fast growth of aviation is partly at the cost of car transport (e.g. for holiday trips). According to EEA (2011b) saturation of car travel can be observed for some of the EU-15 countries. However the curbing down of passenger car transport coincides for the larger part with the economic crisis, making it uncertain whether this saturation is likely to persist or that a renewed growth in passenger car travel could be expected when economic growth picks up.

Figure 9 Average travel distance per capita in 2009 (km/year)

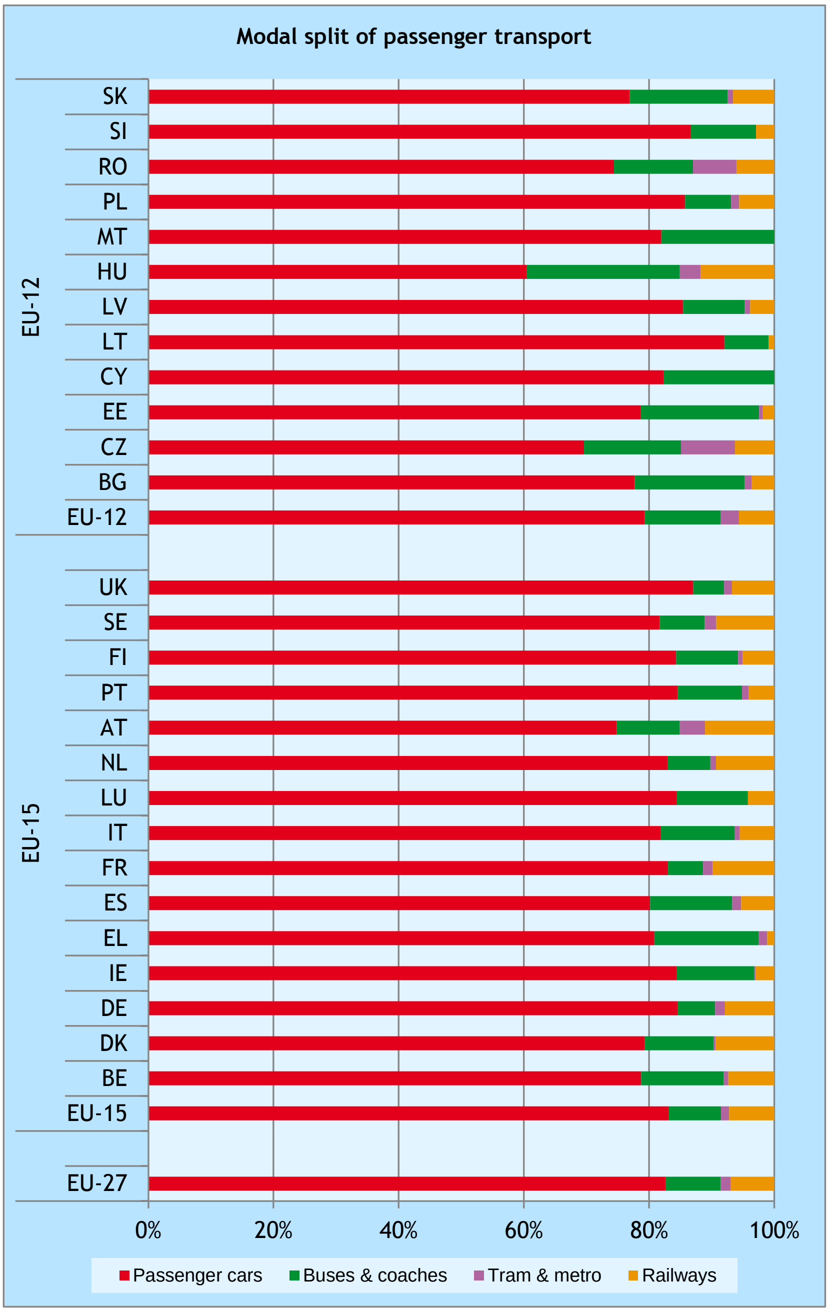


Note: The data shown is based on people's nationality. This implies that the data comprise both domestic travel and travel abroad by citizens.

Source: DG MOVE Pocketbook (European Union, 2011/Eurostat.

Although passenger cars have the largest share in all EU Member States, the modal split shows significant difference over the countries. The modal split has developed strongly in favour of air transport and private car transport.

Figure 10 Modal split of motorised passenger transport (shares in passenger-kilometres in 2009)



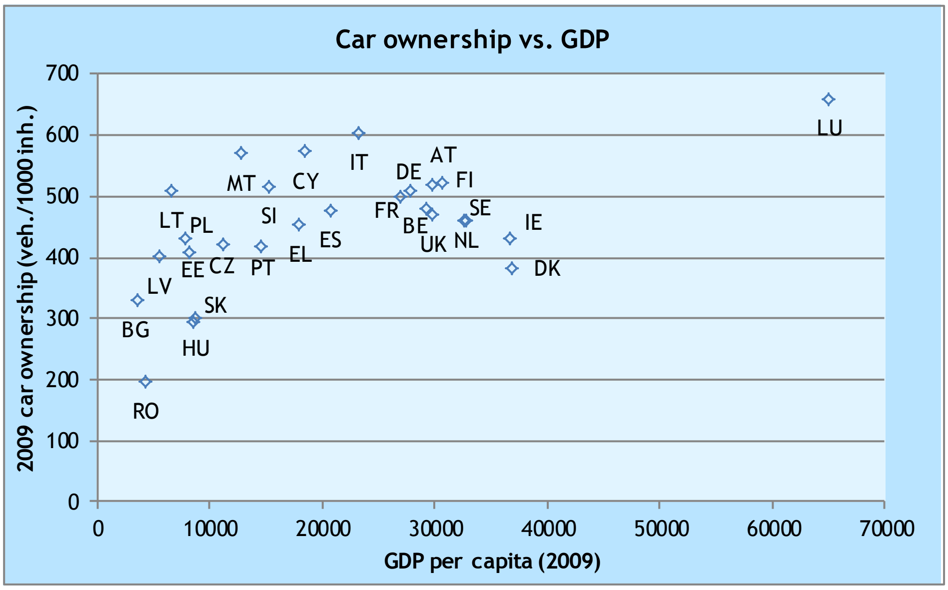
Source: DG MOVE Pocketbook (European Union, 2011).

For the EU-12, rail transport declined considerably in most countries. This is potentially due to the poor upkeep of the rail network in the new Member States, which is suffering from years of underinvestment. Another factor may be the increase in car-ownership and resulting uptake of private car use in those countries. Bus transport has a relatively large share in Hungary. This may be explained by the long distance bus services, and relatively low vehicle ownership in that country (about 300/1,000 inhabitants).

Car ownership, linked to income levels, has shown significant growth in the EU-12 over the 2000-2009 period. EU-12 countries have shown 49% growth in car ownership, while this figure is only 14% for EU-15 countries. Absolute figures are however still significantly lower: 360/1,000 inhabitants for EU-12 versus 473/1,000 inhabitants in 2009 for EU-15.

Figure 11 shows the relationship between GDP and vehicle ownership. At first sight there is only a modest relationship between GDP and car ownership. However, it should be noticed that all three countries with relatively high GDP levels (€ 30,000-40,000 per capita) and a relatively low level of car ownership includes just the countries with the highest vehicle taxation levels (Denmark and the Netherland, see Section 4.3.2). The third country is Ireland which is not covered in Chapter 4 but which has also relatively high vehicle taxes. Also Hungary has a relatively low motorisation rate of around 300 cars per 1,000 inhabitants compared to its level of GDP and again also high vehicle taxes.

Figure 11 Comparison of per capita GDP (in €) and vehicle ownership (in cars per 1,000 inhabitants)



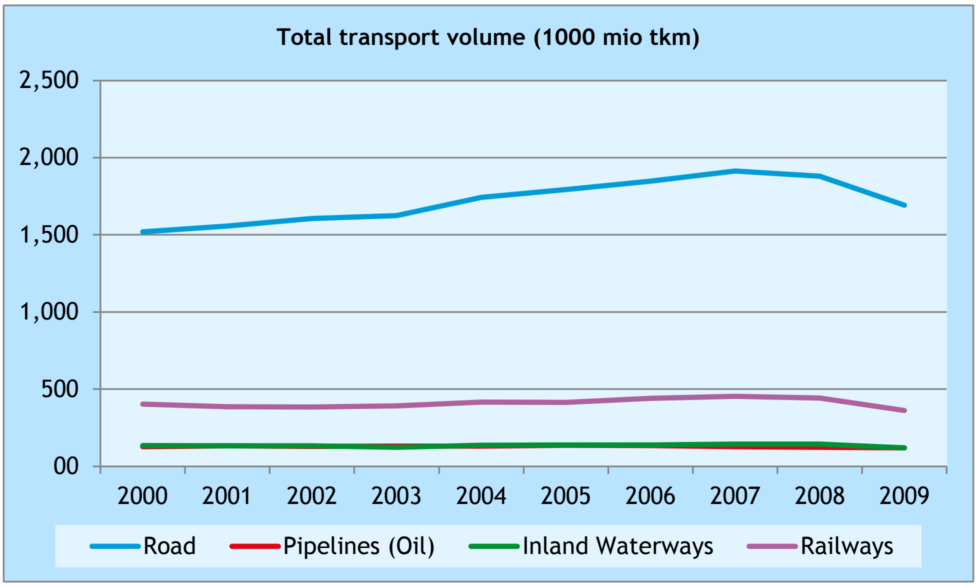
Source: DG MOVE Pocketbook (European Union, 2011)/Eurostat.

Several business as usual (BAU) scenarios regarding EU passenger transport growth have been summarised by Rijkee (2010). The study concludes that BAU demand is expected to increase by 112, 135 and 200% for 2020, 2030 and 2050, respectively, compared to 1990. For aviation, the study cites a growth figure of 450% in 2050. It should be noted that most of the scenarios on which this analysis was built were made before the economic crisis. Therefore, lower growth rates seem more realistic now. For comparison, the Impact assessment behind the 2011 EU White Paper assumes almost a doubling of passenger transport demand between 1990 and 2050 and about 330% growth for aviation.

3.4 Freight transport

Overall, freight transport has increased over the period 2000-2009 despite of the economic downturn in 2008-2009. Road transport has shown the strongest growth. Between 2000 and 2008, road transport showed a growth of 23% (measured in tonne-km). Inland waterway transport and rail transport grew with 7 and 10% respectively over this period, resulting in a decrease of the modal share of these modes.

Figure 12 **Development of freight transport in EU-27 (1,000 million tonne-km per year)**



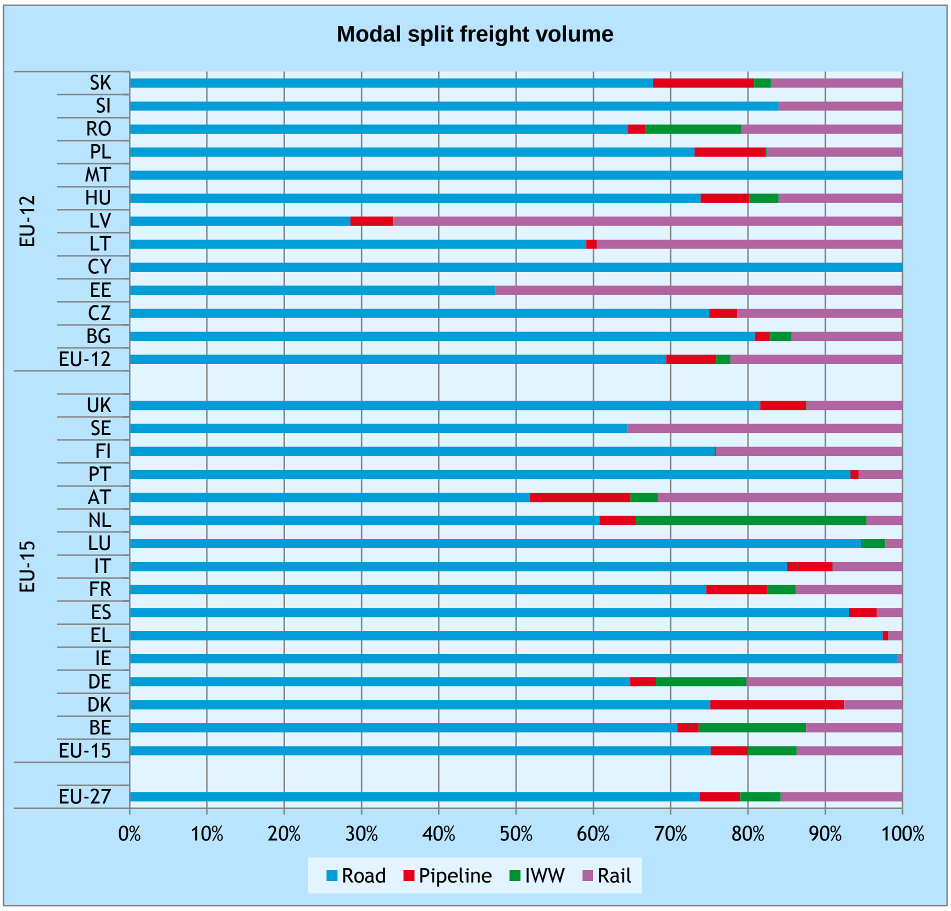
Note: Pipelines are not discussed in this report. Pipeline transport is relatively energy efficient, especially for fluids and already pressurised gases. If there is a need for pressurisation of gases for transport, the energy efficiency is considerably higher and can even be higher than that of comparable modes.

Source: DG MOVE Pocketbook (European Union, 2011).

Figure 13 shows the modal split in the various Member States. The modal split between road and rail freight in the EU-15 stayed relatively constant over the 2000-2009 period, with a slight shift towards rail in the second half of the period. The share of rail was 11% in 2008.

In the EU-12, however, the share of freight moved by road has strongly increased, from around 50 to over 70%. A change in the geographic orientation of the markets for the EU-12 (from east to west) has contributed to the shift because the new markets are not well connected by rail infrastructure and offer the much more adaptive road transport as an alternative. The Baltic States show high rail shares in the modal split, reflecting their strong linkage with the Russian railway system.

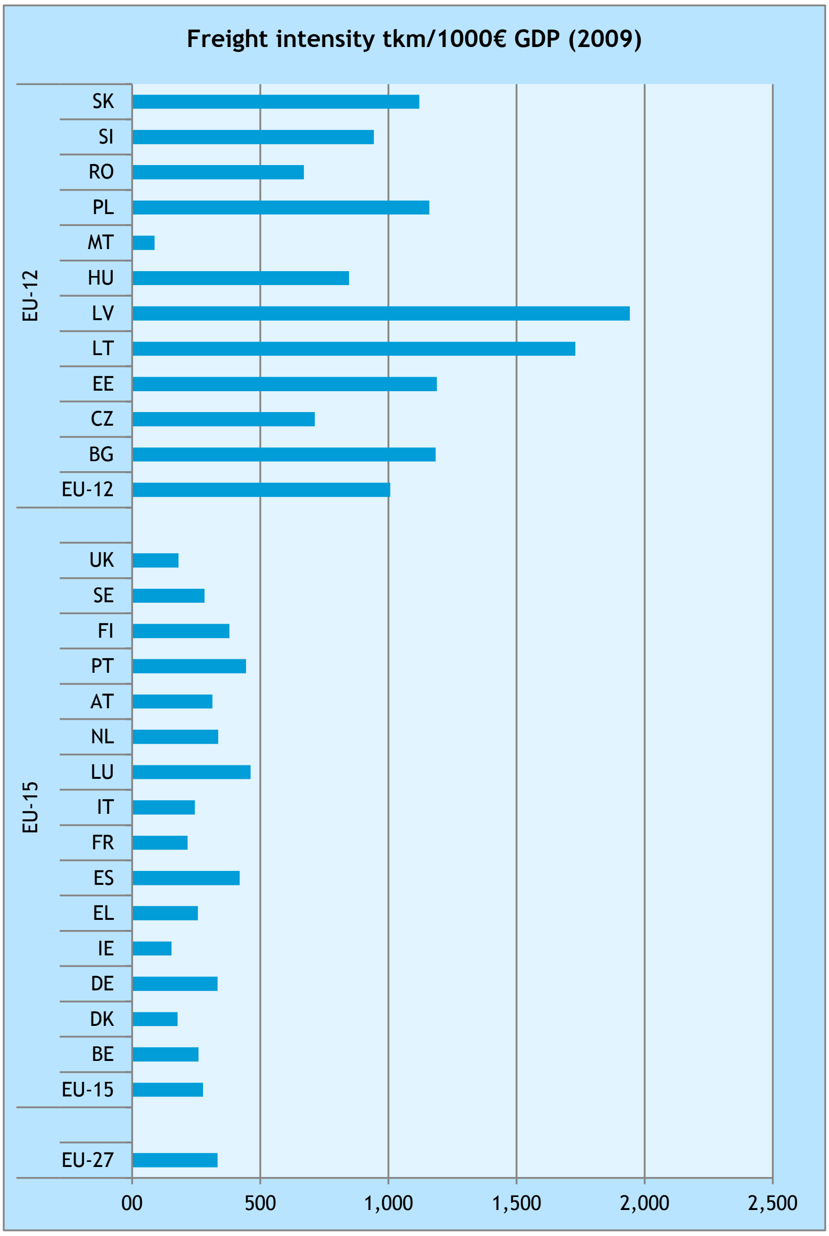
Figure 13 Modal split of freight volume (shares in tonne-kilometres in 2009)



Note: Transport volumes are allocated by origin of transport company.
Source: DG MOVE Pocketbook (European Union, 2011).

The freight transport intensity of the different economies shows significant differences, as Figure 14 illustrates. Especially in the EU-12 countries, the freight volume is relatively high compared to the GDP. This can be explained by the structure of economic activity. The economies of the EU-15 Member States are dominated by the service sector to a much larger extent than in the EU-12 Member States. The economies of Denmark, the UK, Ireland and Malta have the lowest transport intensity.

Figure 14 Freight transport volume relative to GDP, in 2009 (tonne-km per €)



Note: Transport volumes are allocated by origin of transport company.
Source: DG MOVE Pocketbook (European Union, 2011)/Eurostat.

The expected growth figures for freight transport are even higher than that of passenger transport. Rijkee (2010) cites BAU demand increase of 120, 143 and 255% for 2020, 2030 and 2050, in comparison with 1990. Just like for passenger transport, it should be noted that most of the scenarios on which is this analysis was built were made before the economic crisis. Therefore, lower growth rates seem more realistic now.

For comparison, the Impact assessment behind the 2011 EU White Paper assumes about a doubling of freight transport demand between 1990 and 2050 (about 110% growth). Interestingly enough, this scenario shows a strong decoupling of freight transport growth from GDP growth, starting around 2010. The underlying transport demand projections were based on estimates provided by Member States. This raises the question why the strong coupling between economic growth and freight transport growth which has been observed over the last decades would right now change so drastically. As also concluded by CE (2012) there are no clear signs that such a decoupling can be expected. Therefore one could argue that the freight transport demand scenarios behind the White Paper are likely to be an underestimation. At the other hand, the uncertain economic perspectives might result in lower GDP growth rates over the coming decades than assumed in the White Paper. In that case, although there would be no decoupling, the freight transport growth may still be lower than what previously was expected.

4 Reduction targets and policy instruments in Member States

4.1 Introduction

In this chapter we discuss the state of the art of transport policy in the ten selected Member States with respect to decarbonisation. First an overview is provided of the GHG emission reduction targets in these Member States (Section 4.2). Next the current and planned policies that could contribute to reducing the GHG emissions of transport are presented and discussed in Section 4.3 until Section 4.10. This is done for each of the categories of national policy instruments as presented in Section 2.4. Finally, the overall approach per Member States is summarised in Section 4.11.

To identify the contributions of national policies, ex-post evaluation studies for these policies would be the best data source. However, such studies are only very seldom available. An alternative approach would be to carry out a quantitative assessment and comparison of the impacts of the policies in the various Member States. The problem with such an econometric approach is that the various transport policy instruments are among many other factors that have an influence. Many other variables like the per capita incomes, GDP, but also geographical, industrial, demographic and cultural characteristics play a role ad should then be included in the analysis. The development of such an econometric model is far beyond the scope of this project.

The assessment of the policies is therefore based on the more general literature of impacts of the types transport policies that are considered and on the broad and in-depth overview of GHG reduction options and policies developed in the EU Transport GHG Routes to 2050 projects.

4.2 National GHG reduction targets

In 2009, the EC agreed to achieve at least a 20% reduction of GHG emissions by 2020 compared to 1990. The commitments are laid down in Decision 406/2009, also known as the 20/20/20 Strategy. Sectors and companies that take part in the ETS need to reduce the GHG emissions by 21% over the 2005-2020 period.

For most of the countries, the reduction percentage for goal of the national climate policy of the non-ETS sectors is set equal to the obligations laid down in the Decision. Transport is one of these sectors. None of the countries has specified a specific goal for transport. Table 5 provides an overview of the EU and national targets.

Table 5 **EU agreed and national goals for sustainable mobility**

Country	EU goal for 2020 emissions relative to 2005 (Decision 406/2009)	Additional National goal 2020[6]	National goal for transport
Germany	-14%	-40% relative to 1990 (35% relative to 2005)	--
Denmark	-20%	-40% relative to 1990 (36% relative to 2005)	--
France	-14%	--	--
Hungary	+10%	--	--
Italy	-13%	--	--
Netherlands	-16%	--	--
Poland	+14%	--	--
Spain	-10%	--	--
Sweden	-17%	-40% relative to 1990 (36% relative to 2005)	In 2030 independent of fossil fuels
UK	-16%	-80% **in 2050** relative to 1990 (76% relative to 2005)	

4.3 Fiscal policies

In this section, an overview of a broad range of fiscal policies in the selected Member States is presented:
- energy taxation (Section 4.3.1);
- vehicle taxation (Section 4.3.2);
- total taxation of passenger cars over the vehicle lifetime (vehicle plus fuel taxes) (Section 4.3.3);
- company car taxation (Section 4.3.4);
- taxation of commuter travel (Section 4.3.5);
- air ticket tax (Section 4.3.6).

4.3.1 Energy taxation

Energy taxes provide a price incentive that is very closely related to the emission of CO_2. Where other financial instruments stimulate only a subset of GHG reduction options, energy taxes provide an incentive to all reduction options.

Road fuel

Taxes on road fuels influence the types of vehicles bought, the annual distance travelled and the driving style. An illustrative example of this is the difference in fuel consumption between USA and EU vehicles. Americans burn more than twice the amount of transport fuel per head as Europeans, according to T&E (2011). In the long run, 10% higher fuel prices reduce the overall fuel consumption of cars by 6 to 8%, and of lorries by 2 to 6% (Significance & CE, 2010; PBL & CE, 2010).

All EU Member States have fuel taxation for road fuels. Directive 2003/96/EC requires minimum fuel taxes, see Table 6. In 2011, the European Commission presented a proposal to revise this Directive in such a way that both CO_2 emissions and energy contents are taken into account. Existing energy taxes would be split into two components that, taken together, would

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6 For the UK, the goal is for the year 2050.

determine the overall rate at which a product is taxed. The resulting minimum levels are shown in Table 6.

Table 6 **Current and proposed minimum levels for energy taxation in the EU**

Energy product	Current minima	Minima proposed in current ETD units to be reached by 2018
Gasoline (€ per 1,000 l)	359	360
Diesel (€ per 1,000 l)	330	390
LPG (€ per 1,000 kg)	125	500
Natural gas (€ per GJ)	2.6	10.7

Source: http://ec.europa.eu/taxation_customs/resources/documents/taxation/minima_explained_en.pdf.

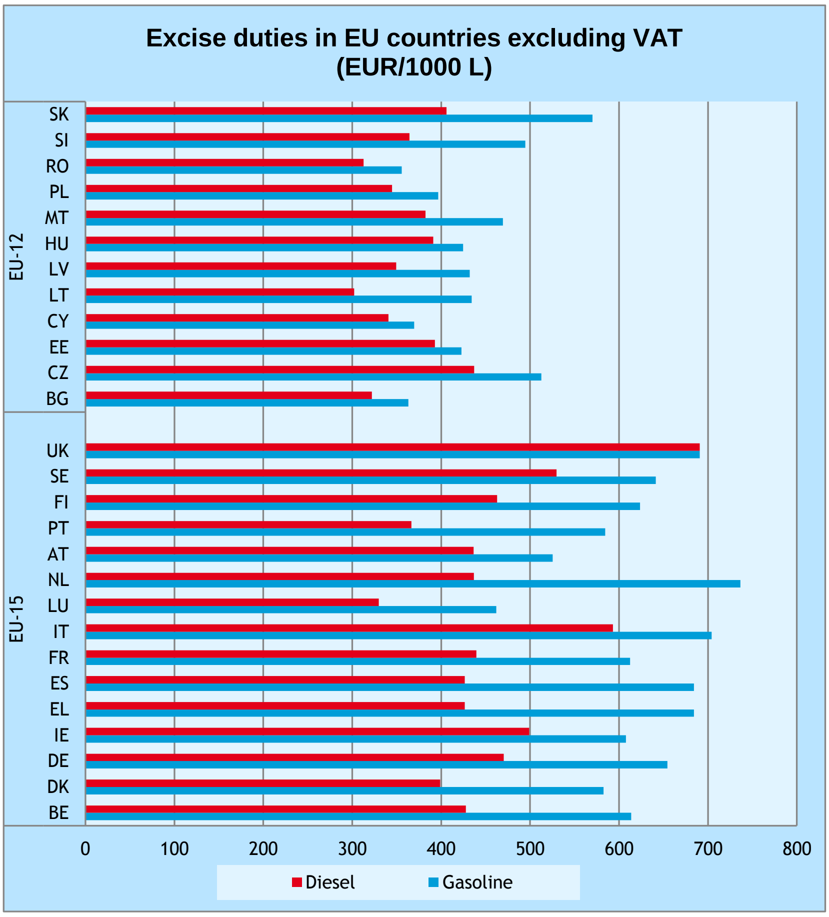
Figure 15 provides an overview of the fuel excise duties applicable in the different EU Member States. There are considerable differences between Member States. Most Member States have excise duties above the minimum levels. Diesel taxes are highest in the UK and Italy. Also Sweden and Ireland have relatively high diesel taxes. Lithuania, Bulgaria, Luxembourg and Romania have the lowest rates.

Excise duties for gasoline are higher than those of diesel. From the perspective of GHG mitigation one would expect this to be the other way around because of the higher carbon content of diesel. The Netherlands, Italy, the UK and Greece have the highest taxes on gasoline. Bulgaria, Romania, Cyprus and Poland have the lowest ones. In the EU-15 countries, particularly Luxembourg and Portugal have relatively low taxes on gasoline.

Raising fuel tax levels, particularly for Member States with relatively low fuel taxes, would be a very effective policy for reducing GHG emissions in transport. It would speed-up the uptake of all types of decarbonisation measures. Also increasing the diesel taxes to levels that are comparable or even higher than gasoline (as done by the UK), can be regarded as an effective measure.

Sweden introduced a carbon based element in its fuel taxes, which was raised a few times since then. This approach is very much in line with the EC Proposal for Revision of the Energy Taxation Directive.

Figure 15 Road fuel excise duties in EU Member States (in €/1,000 litre, excl. VAT; in January 2012)

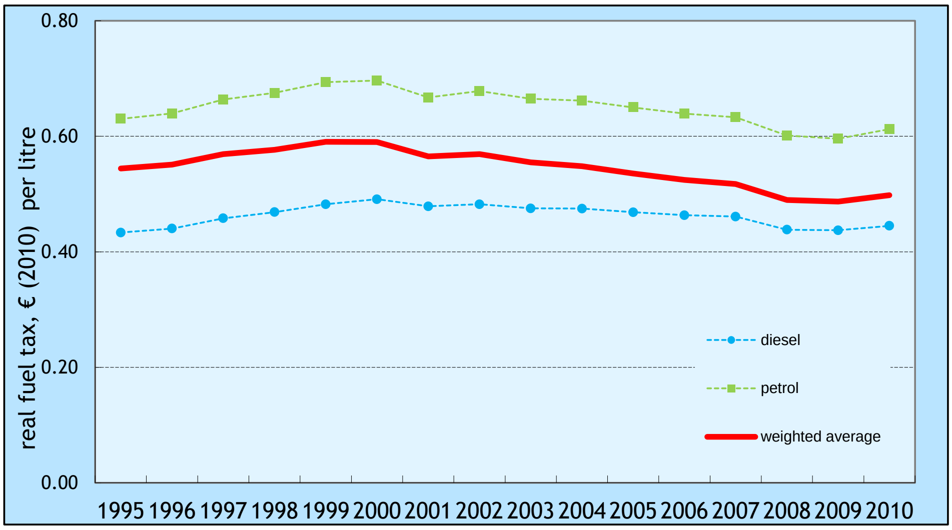


Source: DG Energy Oil Bulletin.

Unlike what is often argued, the average level of fuel taxes (in terms of the real price level) did not increase but decrease over the last decade. Between 2000 and 2010 sales-weighted, inflation-corrected fuel taxes in the EU-15 have gone down. They peaked in 2000 at € 591 per 1,000 litre of fuel; in 2010 they were € 93 lower at € 498 per 1,000 litre. This decline was the result of a limited inflation correction of the fuel tax levels and the introduction of diesel rebate systems for commercial vehicles. Another reason is an increase in the share of diesel use (which has lower tax rates), as a result of increased diesel vehicle sales.

Corrected for inflation, the excise duties in the 12 countries that joined the EU in 2004 or 2007 show a decreasing tendency as well. Specific data for these countries is not available for the entire 1995-2010 period. Between 2004 and 2010, real fuel taxes in the EU-27 decreased with 11%, and in the EU-15 with only 9%. This implies that the real fuel excise duties in the EU-12 declined by about 12%.

Figure 16 **Development of EU weighted average road fuel excise duties in EU-15 countries, corrected for inflation (all years in price level of 2010)**



Source: DG Energy Oil Bulletin.

Spain, France and Hungary have a rebate scheme for commercial vehicle fleets. In France the rebate is € 45 per 1,000 litre and in Spain € 29 and in Hungary € 25 per 1,000 litre. Germany has an energy tax relief for fuel used for short-distance (<50 km) public transport. The relief is € 54 per 1,000 litre.

The above trends suggest that correcting fuel tax levels annually to correct for inflation and abolishing rebate schemes would be proper measures to avoid a decline in the fuel tax levels in real terms. Therefore this would fit well in a strategy for long term GHG emission reduction.

Non-road fuels and electricity for transport

Fuels for non-road vehicles are often subject to lower fuel taxes than road fuels. However, also for these other modes a fuel tax provides incentives for GHG reduction. Although too high fuel taxes for non-road modes might induce some ‘reverse’ modal shift (e.g. to private car or road freight transport), the net impact will still be a reduction of GHG emissions because of the incentive to reduce emissions in the non-road modes themselves, e.g. by taking fuel efficiency measures and avoid empty trips. Higher fuel taxes makes that more energy reduction options become profitable for the operator. The same is true for electricity taxes.

Table 7 provides an overview of the fuel taxes for non-road modes and the electricity taxes that apply to rail and road transport in the ten selected Member States. Inland navigation (except France) and maritime shipping are not listed in the table because these modes are exempted form fuel taxes in all countries.

The fuel tax on rail diesel is usually much lower than that of road transport. Only in German rail diesel is taxed the same way as road diesel. Poland and Hungary have rates that are relatively close to the rates for road diesel. In Spain and Sweden rail diesel is exempted. In Germany, the rail energy taxes are the highest, while Sweden has the lowest taxes.

Table 7 **Overview of non-road fuel taxes and electricity taxes**

Country	Rail electricity	Rail diesel	Diesel for non-road machinery
	€/MWh	€/l	€/l
Germany	11.4	0.48	0.26/0.28
Denmark	0.85	0.06	0.11
Spain	2.5		0.078
France	n/a	0.056	0.056
Hungary	0	0.32	0.32
Italy	0	0.18	0.13
Netherlands	1*	0.25**	0.25**
Poland	4.76	0.31	0.31
Sweden	0	0	0.31
UK	0	0.14	0.14

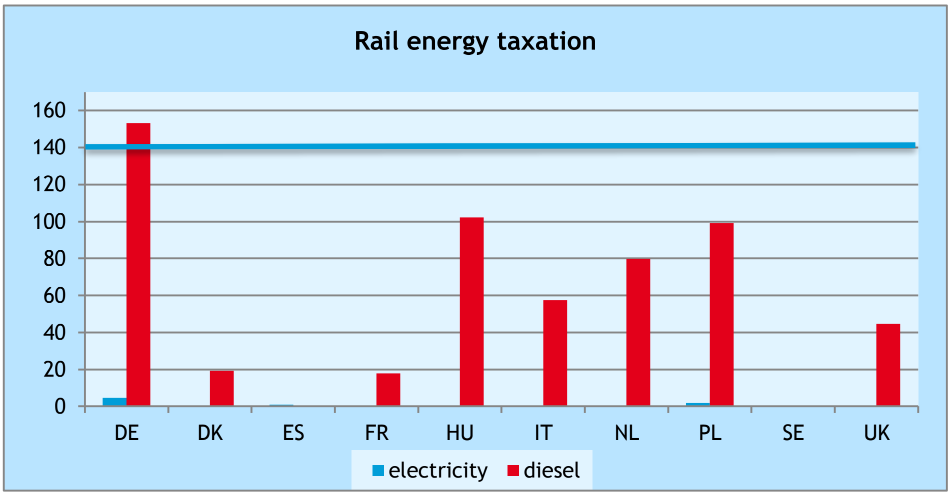
* The Netherlands has a digressive system. The tax level reduces with increased use of electricity.

** In 2013, the diesel tax in the Netherlands for non-road use will be increased to the level of road diesel.

n/a = information not available

In Figure 17 the energy taxes for rail diesel and electricity are compared, both expressed in Euro per ton of CO_2. It shows that the taxes on rail diesel are much higher than on electricity, but generally lower than on road diesel.

Figure 17 **Taxation of rail energy (€/tonne CO_2)**



Note: The blue horizontal line represents the average EU tax level for road diesel fuel. For the CO_2 emissions of electricity generation 400 g/kWh is assumed for all Member States.

For home-charged electric vehicles, the tax levels are higher in a few countries, since consumers pay a higher electricity taxes than rail companies. This is the case in Denmark and The Netherlands. In Germany, rail traffic benefits from a tax bonus.

From the perspective of decarbonisation, introducing or increasing energy taxes for non-road fuels and electricity would be an effective way to improve energy efficiency in these modes and so reduce GHG emissions. Higher energy taxes would make energy saving measures more profitable. To avoid a reverse modal shift this could be accompanied by other measures such as raising fuel taxes of road fuels or adapting infrastructure charging schemes.

4.3.2 Vehicle taxes

The structure and level of these taxes differs considerably. We distinguish two types of vehicle taxes: registration taxes (for buying or registering new vehicles[7]) and annual circulation taxes (for owning a vehicle).

Both registration and annual vehicle taxes can be differentiated to fuel efficiency or CO_2 emissions per km. Such differentiation provides incentives for vehicle buyers. Differentiating motor vehicle registration taxes according to the fuel-efficiency or the CO_2 emissions of the vehicle gives vehicle purchasers an immediate incentive to buy a vehicle with a relatively low CO_2 emission factor. Annual circulation taxes provide the same incentive in principle, but somewhat less directly than differentiated one-off purchase taxes. For both registration and annual vehicle taxes, replacing the existing taxes with purely and directly CO_2 related taxes that are sufficiently differentiated, provide the largest reductions (COWI, 2002).

Table 8 gives an overview of the current types of differentiation of registration and annual circulation taxes in each of the ten selected Member States. This overview shows that six of the ten Member States have both registration and circulation taxes, while two have only a registration tax and two others only an annual circulation tax. Of the sixteen types of taxes, nine are differentiated to the CO_2 emission factor or fuel efficiency, often in combination with another type of differentiation (e.g. list price of engine power). All ten countries except Hungary, Italy and Poland have at least one type of vehicle tax differentiated to CO_2 or fuel efficiency. The Netherlands is transforming the registration tax from a list price based system to a CO_2-based system in several steps during several years.

Vehicle taxation systems need to be ‘automatically’ revised over time to remain effective. Currently, several of the vehicle tax systems have cut-off values at the moment for stimulating fuel efficient cars (120 g/km in Sweden and France). However, a considerable part of the vehicles sold nowadays is already below 120 g/km resulting in a limited incentive and a high share of free riders. This problem can be overcome by reducing the boundaries for applying different tax rates or providing certain bonuses or penalties annually on the basis the average improvement of the fuel efficiency of the vehicle fleet. The best solution is to change to a continuous tax base based on the g/km rating of the vehicle, including regular update of the rates.

The high share of countries differentiating vehicle taxes to CO_2 or fuel efficiency is also true for the entire EU and has even increased over the last decade. In 2002, the European Commission stated that the majority of the EU-15 countries levied registration taxes on an engine capacity basis. Nowadays, eighteen EU Member States apply CO_2-related differentiated tax schemes to reduce the emissions of passenger vehicles (Rubik & Mityorn, 2011).

[7] This includes sales taxes.

Table 8 **Structure of vehicle related taxes in the ten countries (2010/2011 situation)**

Country	Registration tax (private)	Annual circulation tax (private)
Germany	--	CO_2 and engine displacement
Denmark	List price and fuel efficiency (km/l)	Fuel efficiency (km/l)
Spain	List price and CO_2 (g/km)	Engine displacement
France	Engine power, CO_2 (g/km) differentiated	Only for companies, based on CO_2 (g/km)
Hungary	Engine displacement	Engine power
Italy	Engine power	Engine power
Netherlands	List price and CO_2 (g/km)	Weight, differentiated to CO_2 (g/km)
Poland	Engine displacement	--
Sweden	--	CO_2 (g/km)
UK	CO_2 (g/km)	--

Note: List price refers to the gross price of the vehicle, sales price is the gross price including taxes.

Source: ACEA, 2011.

Apart from the structure of vehicle taxes, also the level of these taxes is relevant from the perspective of decarbonisation. Generally one can state that higher vehicle taxes lower car ownership. Vehicle costs appear to have a significant effect on car ownership, and indirectly on car use (vehicle-kilometres). The elasticity of total vehicle costs on car ownership is estimated to be -0.4 to -1.0, meaning that a 10% increase in total vehicle costs reduces vehicle ownership by 4 to 10%[8]. Furthermore Wootton (1999) shows that accessibility to cars leads to large increases in travel demand. Finally, high vehicle taxes may also give an incentive to buy relatively small or low-price vehicles.

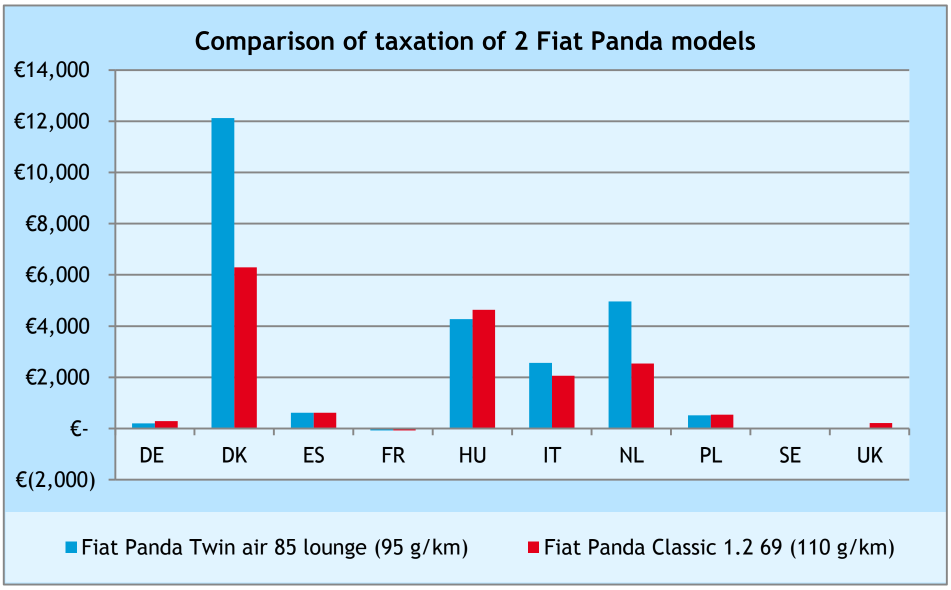
Overall it is clear that higher vehicle taxes result in GHG reduction. However the relationship is indirect and car ownership in a country depends also on many other factors, such as income, geographical, demographical and cultural factors, quality and price of other modes, fuel taxes, etc. Therefore, it is not possible to find a simple correlation between car ownership and vehicle taxes.

In Figure 18 to Figure 20, the vehicle taxes (registration taxes and annual circulation taxes) over an assumed lifetime of fourteen years have been calculated for various typical small, medium and large cars. Relatively fuel efficient vehicles (blue) have been compared with less fuel efficient variants (red) of the same vehicle model. The tax levels are corrected for differences in disposable income and purchase power.

The graphs show that some countries (like Denmark) have much higher vehicle taxes than others. Furthermore it shows to what extent vehicle taxes are related to CO_2 emissions. Particularly for the small cars (Fiat Panda) in Figure 18, the vehicle taxes do generally not provide an incentive to buy the most fuel efficient model. This is particularly because of the vehicle tax is often linked to the purchase price. For the medium size cars (Ford Focus) the more fuel efficient models have lower tax levels than the less fuel efficient ones.

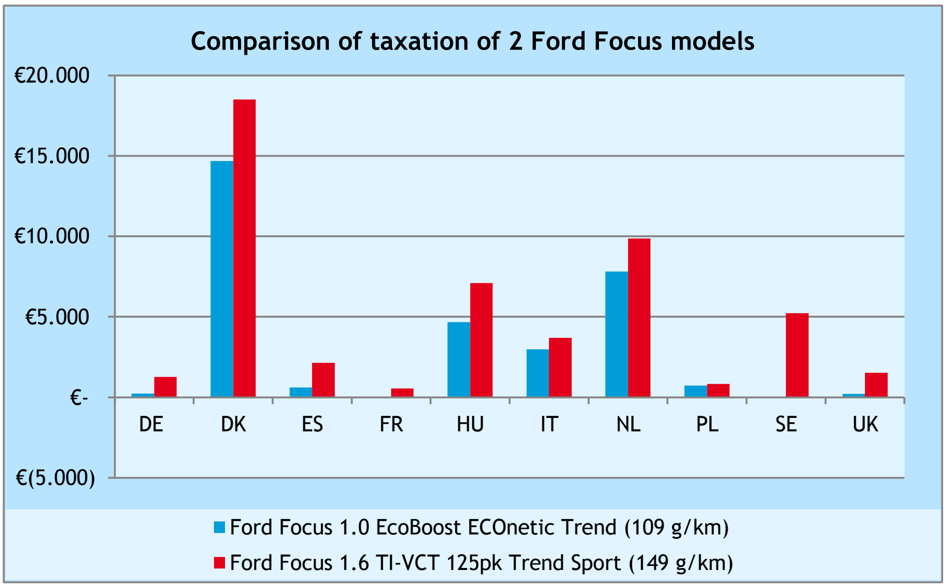
8 This is based on various studies, including analysis by Goodwin et al. (2003) showing that a 10% increase in fuel prices reduces vehicle ownership 1.0% in the short-run and 2.5% over the long-run, and fuel represents about 25% of total vehicle costs. Glaister and Graham (2000) conclude that the long-run elasticity of vehicle travel with respect to income is 1.1 to 1.8, with lower short-run values.

Figure 18 Comparison of taxation of a Fiat Panda in ten EU Member States (2012 price level at EU-27PPP)



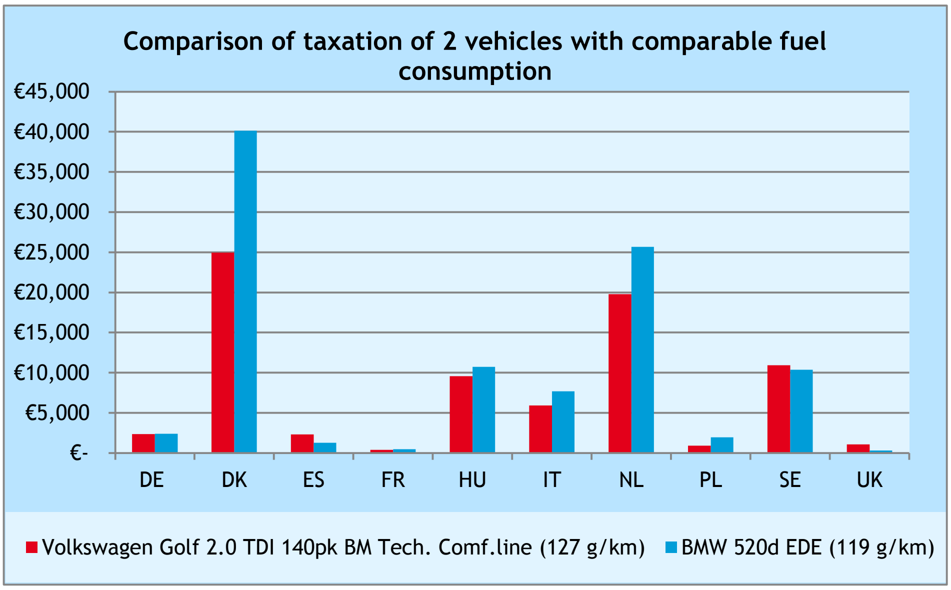
Note: For illustration, the Dutch pre-tax price for these vehicles is € 10,478 (Twin air) and € 5,874 (classic) respectively. Pre-tax vehicle prices differ strongly over Europe.

Figure 19 Comparison of taxation of a Ford Focus in ten EU Member States (2012 price level at EU-27PPP)



Note: For illustration, the Dutch pre-tax price for these vehicles is € 17,307 (1,0) and € 18,277 (1,6) respectively. Pre-tax vehicle prices differ strongly over Europe.

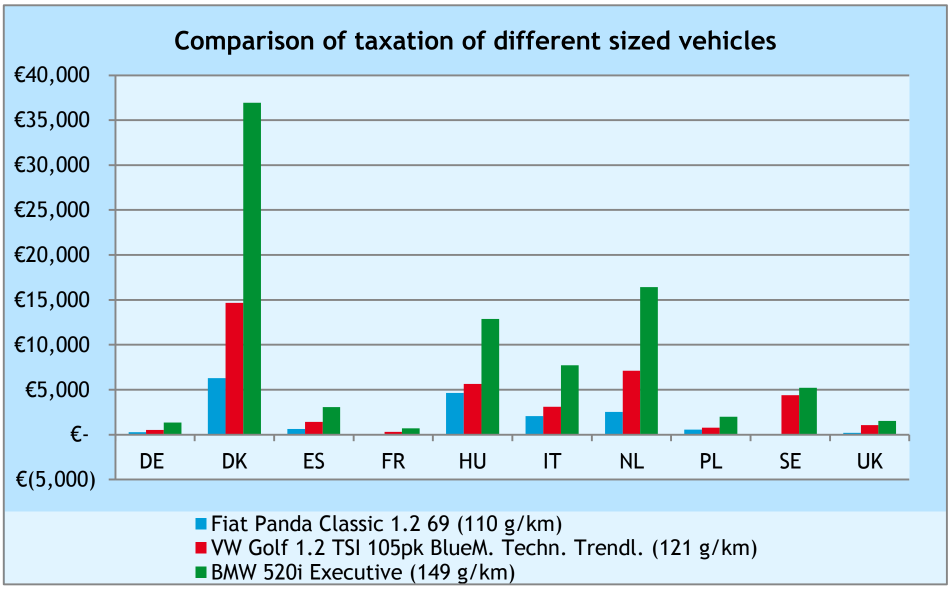
Figure 20 Comparison of taxation of different cars with comparable CO_2 emissions (2012 price level at EU-27$_{PPP}$)



Note: For illustration, the Dutch pre-tax price for these vehicles is € 21,235 (VW) and € 33,623 (BMW) respectively. Pre-tax vehicle prices differ strongly over Europe.

In Figure 21, the vehicle taxes of a small, medium sized and large car are compared. It shows that in most countries tax levels are higher for larger (and more expensive and powerful) cars. As on average larger and more powerful cars have also a higher CO_2 emission factor, this provides an incentive to emission reduction. However, as we saw before, vehicle taxes directly based on CO_2 emissions or fuel efficiency have a stronger correlation with CO_2 emissions and therefore provide more precise incentives.

Figure 21 Comparison of taxation of different size classes (2012 price level at EU-27$_{PPP}$)



Note: For illustration, the Dutch pre-tax price for these vehicles is € 5,874 (Fiat Panda) and € 33,623(VW Golf) and € 36,782(BMW 520i) respectively. Pre-tax vehicle prices differ strongly over Europe.

The figures show that vehicle taxation levels strongly differ over the EU Member States. Denmark has by far the highest levels. Also Hungary, Italy, the Netherlands and Sweden have relatively high vehicle taxes compared to the other countries (Germany, Spain, France, Poland and the UK) which all have relatively low vehicle taxes).

As can be seen from the graphs, the vehicle tax system provides incentives for purchasing of fuel efficient cars in some countries, but not in all countries and not in all cases. Denmark is an example of a country that has based the purchase tax on the vehicle list price. This makes that some relatively fuel efficient cars have a higher vehicle tax than cheaper vehicles with higher fuel consumption (see Figure 20).

From the perspective of decarbonisation, there are various options for further improving the vehicle taxation schemes. For countries with low vehicle taxes, raising those taxes to discourage a further increase in car ownership could be considered. In addition, in many countries the structure of vehicle taxes could be improved by linking them more directly to CO_2 emissions in order to provide incentives to buy the most fuel efficient, low-carbon cars.

In the next section, a further assessment is made of the taxation schemes in the various Member States, combining vehicle taxation and fuel taxes.

4.3.3 Total taxation of passenger cars over the vehicle lifetime

On the basis of the ACEA tax guide 2011 (ACEA, 2011), an illustrative estimate of private car transport related taxes has been made, by calculating the fuel taxes and the vehicle taxes over the vehicle lifetime. The calculations have been made on the basis of the following assumptions:

- average tax calculated from a mix of 7 popular car models[9];
- vehicle taxes for these specific vehicles (registration taxes and annual circulation taxes)are based on the national rules for calculating these taxes;
- vehicle lifetime of fourteen years and 20,000 km annual mileage;
- fuel consumption figures based on the NEDC driving cycle;
- correction for differences in purchase power and GDP/capita between countries: expression of taxes in EU-27_{PPP};
- VAT is not included.

In Figure 22, the resulting average lifetime vehicle taxes are shown for the ten selected Member States. The total taxation rate of private car transport is highest in Denmark, Hungary and the Netherlands and lowest in France and Spain.

The graph shows also that over the vehicle lifetime the total fuel taxes that are paid are higher than the vehicle taxes. Only in Denmark and the Netherlands, the vehicle related taxes are higher than the fuel taxes.
The variation in fuel taxation is much more limited, compared to the differences in vehicle taxation. This can be partly explained by the EU minimum values for excise duties. Such minimum values do not exist for vehicle taxes. Furthermore, differences in tax levels between countries are not associated with the problems like tank tourism.

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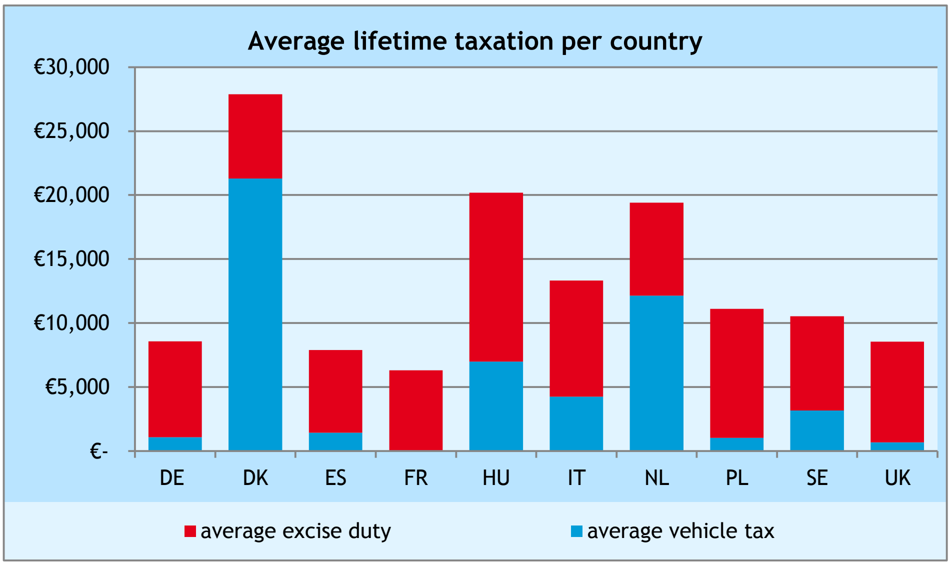
9 The vehicles included are: Fiat Panda Classic 1.2 69, VW Golf 1.2 TSI 105pk BlueMotion Technology Trendline, VW Golf 1.6 TDI 105pk BlueMotion Technology Trendline, Toyota Prius 1.8 HSD Comfort, Ford Focus 1.0 EcoBoost ECOnetic Trend, Peugeot 508 Allure 2.0 HDi 163pk, BMW 520i Executive.

Figure 22 Average lifetime vehicle taxation for passenger cars (2012 price level at EU-27PPP)

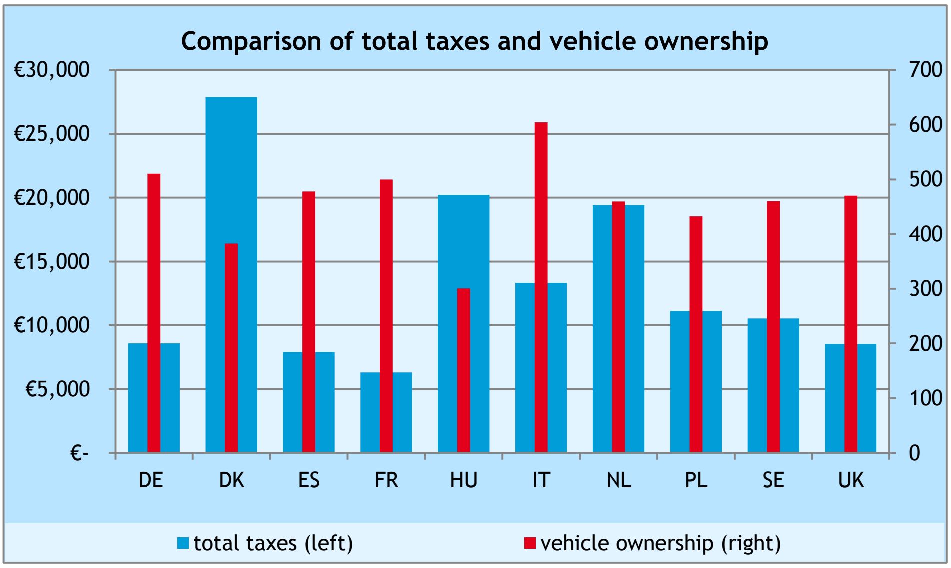


In Figure 23 the energy and vehicle taxes over the vehicle lifetime (from Figure 22) in the various countries are compared with the level of car ownership (number of cars per 1,000 inhabitants). The graph makes clear that most countries with relatively high taxes have a relatively low level of car ownership (particularly Denmark and Hungary).

The level of vehicle taxes has an impact on vehicle ownership, as shown above in Section 4.3.2. With 383 vehicles per 1,000 inhabitants, vehicle ownership in Denmark is significantly lower than the EU average of 503 vehicles per 1,000 inhabitants. Also in the Netherlands, the vehicle ownership is relatively modest compared to the relatively high GDP/capita level.

Countries with lower tax levels such as Germany, Spain, France, the UK and Sweden have all relatively high vehicle ownership rates. At the same time the graph makes clear that other factors play important role as well, as the level of car ownership in the Netherlands and particularly Italy are relatively high compared to the high tax levels in those countries. For the Netherlands, the high income level could play a role (car ownership in the Netherlands is much lower than in Germany), but for Italy other factors play a role, like cultural factors and the fact Italians buy relatively small cars.

Figure 23 **Comparison of vehicle ownership (cars per 1,000 inhabitants) with vehicle and fuel taxes over a vehicle lifetime (in €)**



There may also be a link between the vehicle taxation level and the CO_2 emission factor of new cars sold in a country. High vehicle taxes make that consumers buy cheaper cars which are on average more fuel efficient. Denmark has both the highest vehicle taxes and lowest CO_2 emissions of new vehicles in the EU. At the other side of the spectrum, Germany is an example of a country with a relatively high average CO_2 emission factor of new cars (151 g/km). This can be partly explained by the relatively low vehicle taxation.

At the same time, vehicle taxation is certainly not the only factor that plays a role. Vehicle taxation in France is also mild, but the average new vehicle CO_2 emission is significantly lower (131 g/km) than in Germany. This implies that also other factors than vehicle taxation play a key role, like the treatment of benefit in kind, the level of vehicle tax differentiation, and perhaps also the type of vehicles produced by the national industry. Furthermore cultural, geographical or demographical factors may also play a role.

4.3.4 Company car taxation

Forgone tax revenues due to the favourable income taxation of private use of company cars can be considered as a (implicit) subsidy to users of company cars.

Based on Copenhagen Economics (2010), Table 9 gives an overview of the company car taxation schemes in the ten countries. In three countries (the Netherlands, France and the UK) the company car taxation provides an incentive for CO_2 efficient cars.

Like for vehicle taxes, both the structure and the level of the company car taxation are important. The last column of Table 9 shows rough estimates of the net fiscal losses[10] shows, as a measure for the implicit subsidies. The subsidies are in some countries very significant, particularly in Germany, Hungary and Italy. Poland is an example of no fiscal subsidies, since Poland tax

10 Fiscal losses are the difference between the value of the benefit-in-kind received and the taxable base on that benefit.

authorities in Poland use leasing prices observed in the market as proxies for the value of the benefit-in-kind.
As mentioned by Copenhagen Economics these should be considered ball-park estimates rather than precise numbers.

Revision of company car taxation schemes can contribute to GHG emission reduction in three ways:
- Differentiation can give an incentive for relatively energy efficient and low-carbon cars. Examples such as the scheme in the Netherlands show how successful this can be.
- Raising taxation levels can reduce or even delete the indirect subsidies to company cars, which is sound from both a fiscal, economic and environmental perspective.
- Currently users of company cars generally pay a fixed fee for their car, irrespective of the kilometres driven. Linking the user costs and/or taxation to the kilometres driven (for other than business use) could take away this perverse incentive.

As about half of all new cars sold in the EU are company cars, the impact of a smart revision of company car taxation can be very significant.

Table 9 **Structure of company car taxation and estimate of net indirect subsidy in the ten countries**

Country	Taxation of private use of company car (annual, 2010/2011 situation)	Rough estimate of direct fiscal losses in 2008 (billion €)	Rough estimate of direct fiscal losses per company car in 2008 (€)
Germany	1% of list price+0.03% of list price per km of distance between home and office per month	22.9	3,100
Denmark	20-25% of list price, depending on vehicle list price.	0.6	2,500
Spain	20% of sales price	4.0	1,900
France	€ 2-19 per g/km, depending on the CO_2 (g/km)	n.a.	n.a.
Hungary	€ 285-610, depending on engine displacement.	0.8	3,300
Italy	Italy: 30% of 'average cost of use' based on 15,000 km annual mileage, determined according to fixed km-rates	8.2	2,900
Netherlands	14, 20 or 25% of sales price, depending on CO_2 (g/km); cars with CO_2 emissions of 50 g/km are exempted	1.5	1,400
Poland	Based on leasing costs of comparable cars	0.0	0
Sweden	Yes[1]	1.1	1,800
UK	5-35% of sales price depending on CO_2 (g/km)	5.9	1,200

Source: ACEA, 2011.
n.a. = Not available.
Note: List price refers to the gross price of the vehicle, sales price is the gross price inclusive of taxes.
1 The taxable amount is calculated as follows: 31.7 % of the base price amount (€ 5,350 in 2011), + 75 % of the government loan interest rate at the end of November the year before the income year multiplied with the new car price, + 9 % of the new car price.

The government loan interest rate was 2.84% at the end of November 2010. Information for Italy and Poland is from (Copenhagen Economics, 2010) and applies to the year 2008. The estimate of losses per vehicle has been calculated on the basis of the number of registrations per country and an estimated use of registered vehicles as company car for four years.

4.3.5 Commuter travel and business travel taxation scheme

In various countries reimbursements of commuter travel costs can be deducted from income tax. Although there may be good reasons for this (related to the labour market or social reasons), tax deduction for commuter travel is not favourable from an environmentally perspective. Workers tend to choose jobs further from home in case of a tax deduction scheme, since travel costs are fully covered. When differentiated to transport mode, a tax deduction scheme on commuter travel might increase the share of cycling and/or public transport for especially this type of travel. In this respect these schemes may have a positive environmental impact.

Table 10 provides the details of the tax deduction schemes in the different countries.

Table 10 Approach of tax deduction for commuter travel in the different countries

Country	Deductible amount	Comment
Germany	0.15 per km	No differentiation towards mode
Denmark	Under 24 km: -24-120 km: 0.28 >120: 0.14	No differentiation towards mode
Spain	Public transport trips and up to a maximum of € 1,500 per year	Only public transport can be deducted
France	Above 200 Euro per year taxable. Rates subject to negation with employer	Private car costs only reimbursed outside Ile de France and if public is not available within a certain perimeter
Hungary	0.03 per km	Only if public transport is not available, or, with disproportionately long travel time
Italy	No	A 250 Euro deduction for public transport passes was applied for the year 2008 and 2009.
Netherlands	0.19 per km	No differentiation towards mode
Poland	Standard fixed amounts 318-478 Euro per year	If the costs higher than these standard deduction amounts then the full actual costs of travel may be deducted, but requires full documentation
Sweden	Only above € 1,100 per year	Commuting by car is deductible if: a The commuting distance (one direction) is at least 5 km. And b The time gained compared to public transport is more than two hours per day (both directions).
UK	No	

Note: In the Netherlands, it was agreed to abolish tax deductions for commuter travel from 2013 on.

The examples show that the way commuter travel is treated in the different countries is very different. The Netherlands and Germany have relatively high tax deductions for commuter travel reimbursements, without any differentiation to transport mode. France, Hungary, Italy, Spain and the UK have no or very limited tax deduction for commuter travel by private car.

Several countries use the opportunity to incentivise the use of public transport or cycling for commuter travel, in particular France, Hungary, Spain and Sweden.

Business travel with private vehicles can be reimbursed free of income tax in most countries up to a fixed rate per km or public transport ticket rates. However, in the UK, the reimbursed amounts decrease with increasing mileage. The rates are 45 pence for each of the first 10,000 business miles and 25 pence for each additional business mile. This reflects the lower fixed costs of miles travelled above a certain threshold.

From the perspective of GHG emission reduction, lowering or even completely abolishing tax deduction for commuter travel can be effective, particularly in countries with relatively high tax deductions. It can help to reduce commuter distances and stimulate teleworking. Differentiating tax deduction schemes for commuter travel can also be used to stimulate the use of low-carbon transport means such as cycling or public transport. This may well reduce car-dependency and so contribute to GHG emission reduction.

4.3.6 Ticket tax for aviation

Aviation is exempted from fuel excise duties and VAT. To partly compensate for this, some EU Member States have introduced a ticket tax for aviation in recent years. The ticket taxes were mainly introduced for environmental reasons. The ticket taxes apply to departing travellers.

Table 11 Ticket taxes for aviation

	Ticket tax?	Details		
Germany	Yes	Intra EU: € 8	Intercontinental: € 25 (up to 6,000 km) € 45 (more than 6,000 km)	
Denmark	No			
Spain	No			
France	Yes	*Economy class:* € 1 (intra EU) € 4 (intercontinental)	*Business class:* € 10 (intra EU) € 40 (intercontinental)	
Hungary	No			
Italy	No			
Netherlands	No	Ticket tax was introduced in 2008 and discarded in 2009		
Poland	No			
Sweden	No			
UK	Yes		*Economy class*	*Business class*
		0 to 2,000 miles	€ 15	€ 30
		2,001 to 4,000 miles	€ 75	€ 150
		4,001 to 6,000	€ 93	€ 187
		over 6,000 miles	€ 106	€ 212

Note: Intra EU is differently defined by the different countries. Germany also includes, EU candidate countries, EFTA Member States and countries that lie in comparable distance range (like Turkey, Russia, Morocco, Tunisia, Algeria). France refers to the European Economic area (EEA).

The UK government has explored the option of replacing the ticket tax with a per airplane duty, but has not managed to obtain consensus amongst stakeholders. Hence, it has decided not to introduce a per plane duty at this time.

France has introduced the air ticket tax as a 'Taxe de solidarité', the revenues are used to fight for development and health projects in poor countries, particularly for drugs against pandemics like AIDS, malaria, and tuberculosis. The Netherlands also introduced a ticket tax mid 2008, but abolished the tax after one year.
As most Member States do not yet have a ticket tax, introducing such taxes (or raising the level of an existing ticket tax) can help to curb down the very high growth in aviation. Particularly because of the absence of fuel taxation and VAT, ticket taxes are one of the few pricing instruments that can help to discourage excessive air travel. A ticket tax that is differentiated to flight distance can provide an incentive to limit flight distances and is therefore even more effective in reducing GHG emissions.

4.4 Road infrastructure charging

Distance based road infrastructure charges provide an incentive to reduce the number of kilometres travelled. In addition, there is an incentive to use other modes of transport and higher vehicle utilisation rates. There is much evidence that these systems reduce the number of kilometres travelled, affect the modal split, increase load factors and occupancy rates and reduce empty trips.

Figure 12 provides an overview of road infrastructure charges in the ten selected Member States.

Table 12 Overview of distance based road infrastructure charging schemes in the selected countries

Country	Trucks	Light vehicles	Comment
Germany	14-28 cents	--	Differentiation towards Euro class, 100% of motorway network
Denmark	Only for 2 bridges	Only for 2 bridges	
Spain	4.7 to 34 cents (3 axles) 5.7-54 cents (4 axles)	2.3 to 32 cents per km	Tariffs are determined by infrastructure operator and differ by concession contract. 21% of motorway network
France	20.6 cents on average	7.4 cents on average	77% of motorway network
Hungary			
Italy	16 cents on average	6.2 (cars)-7.5 cents (vans) on average	80% of motorway network
Netherlands	Only for two tunnels	Only for two tunnels	
Poland	6-13 cents	5 cents	Differentiation towards Euro class, 100% of motorway network, also applicable on other state roads.
Sweden	Only for two bridges	Only for two bridges	
UK	Only for one road (M6, a 27 mile stretch), and few bridges and tunnels	Only for one road (M6, a 27 mile stretch), and few bridges and tunnels	

Note: For Spain, the tariffs for one particularly expensive toll motorway including a long tunnel are left out.

Distance based road infrastructure charges are applied in five of the ten countries: France, Germany, Italy, Poland and Spain. Except for Germany these are road tolls on (part of the) motorway network for all users (both lorries and cars). The German scheme is a GPS-based kilometre charging system on motorways and applies only to lorries.
Road pricing can be differentiated to CO_2 emissions to provide incentives for fuel efficient and low-carbon vehicles. However a fuel tax is better as a generic pricing instrument for decarbonisation as that provides incentives to all types of GHG emissions reduction options, including fuel efficient driving, which cannot be stimulated by a kilometre charge. Furthermore road pricing is usually regarded as the most appropriate instrument to charge for infrastructure costs and costs of air pollution, noise and congestion. Unlike fuel taxes, kilometre charge can be differentiated to vehicle type, location and time of the day. Therefore differentiating a kilometre charge to fuel efficiency is not common and generally not to be preferred.

This does not mean that road pricing cannot be an element in a GHG policy strategy. Kilometre charges make that users get an incentive to reduce travel distances and can help to reduce road congestion without the risk of inducing additional traffic.

There are various opportunities for the application of road pricing. Member States that have already road tolls or kilometre charges could expand the scheme to the entire network and/or to other road users (e.g. charge not only heavy duty vehicles but also passenger cars). For the few Member States without a toll or kilometre charge the obvious first step would be to introduce either tolls or electronic kilometre. Starting with certain road users or parts of the network could be considered when a nationwide scheme for all road users is too risky.

4.5 Infrastructure policy

Infrastructure construction is an important element in the transport policy of EU Member States. A reliable and sufficiently developed transport infrastructure network is regarded as a precondition for economic development and the European the single market.

In the short term, users may react by changing to other routes or to different modes for certain trips, e.g., from airplane to high-speed train, from train to car or from car to bicycle – depending on the infrastructure project concerned. They may also decide to make more trips (i.e., travel more) or change their destinations, for example go shopping in a city or shopping centre further away than usual, as travel times are reduced. Shippers and hauliers may be able to reduce travel time and transport costs of their product, perhaps increasing their market share in the longer run. Any of these changes will have both environmental and economic impacts – positive or negative, depending on the specific infrastructure project and circumstances.

In the longer long term, the impact may even be more significant. People may choose to move houses further away from their work or family, for example to a more pleasant area, if the new infrastructure results in acceptable travel times from their new home. Alternatively, they may also accept jobs further away from their home. Companies may change their location, logistics or distribution patterns as the new infrastructure provides new opportunities for both commuters and goods transport (Kampman, 2009).

The impacts of infrastructure development depend therefore on the type of infrastructure and the resulting traffic impacts. Constructing new or extending existing **road infrastructure** or **airports** will generally induce additional traffic and potentially result in some reverse modal shift from rail, waterborne and public transport modes and for short distance transport even cycling and walking. Therefore, the net effect of this will generally be an increase of GHG emissions, unless potential demand effects are compensated, e.g. by road pricing.

In the case of **rail or waterway networks or public transport systems**, the net impacts depend on the precise effects and cannot be generalised. In some cases a true shift from road or air transport to well-used low-carbon alternatives can be accomplished. However, in other cases, the additional demand induced by the new non-road infrastructure capacity more than compensates the potential saving of modal shift.

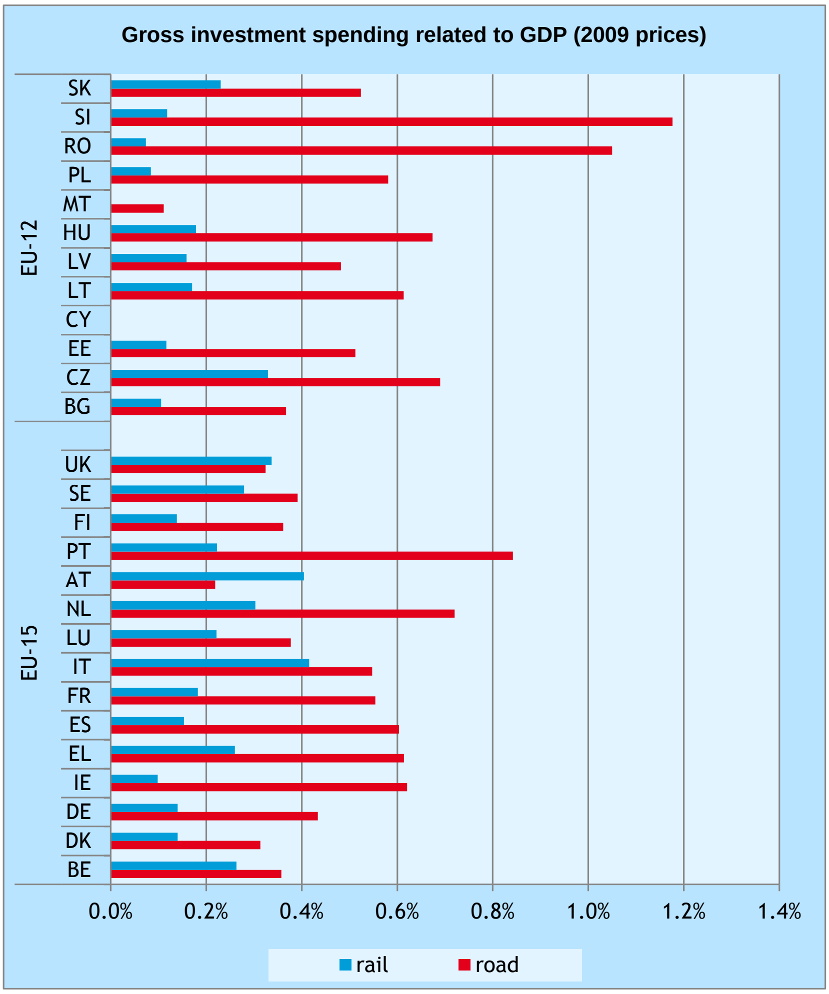
A specific element with respect to infrastructure policy in relation to GHG reduction is the way how GHG emissions play a role in the project appraisal process. For most infrastructure projects Strategic or Environmental Impact Assessments (EIA/SEA) as well as Cost Benefit Analysis (CBA) are carried out. They should help decision makers to make a choice that takes into account the environmental and economic impacts of a project or a plan, e.g. for new transport infrastructure or spatial development. The economic valuation used for CO_2 emissions is a parameter that provides some information on the weight of climate aspects in the project appraisal process.

Both the investments in infrastructure and the evaluation of infrastructure projects (including the economic valuation used for CO_2 emissions) have been analysed. They are discussed in the next two subsections.

4.5.1 Level of investments in new infrastructure

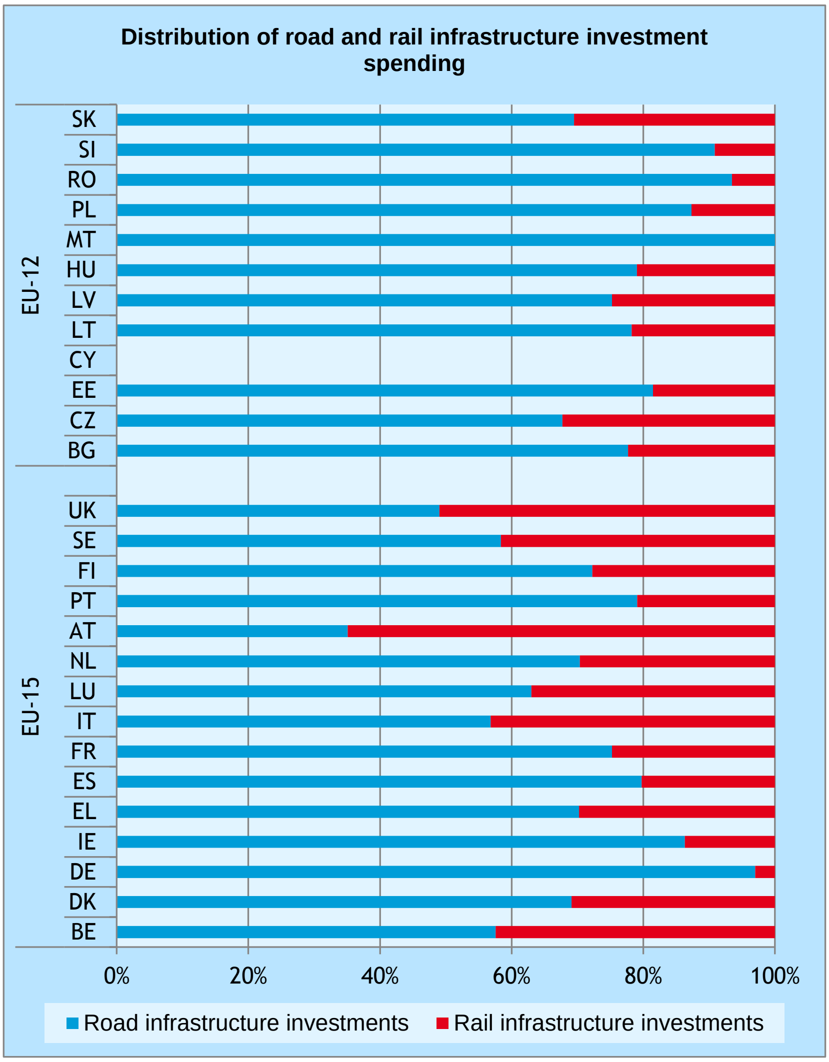
Whereas Western European countries have increasingly directed their investments in new transport infrastructure towards rail, Central and Eastern European countries are investing more heavily in roads (ITF, 2011). This is illustrated by the two figures below.

Figure 24 Average investments in road and rail infrastructure over the years 2000-2009 (in % of GDP)



Note: No data available for Cyprus and limitedly for Malta.
Source: ITF.

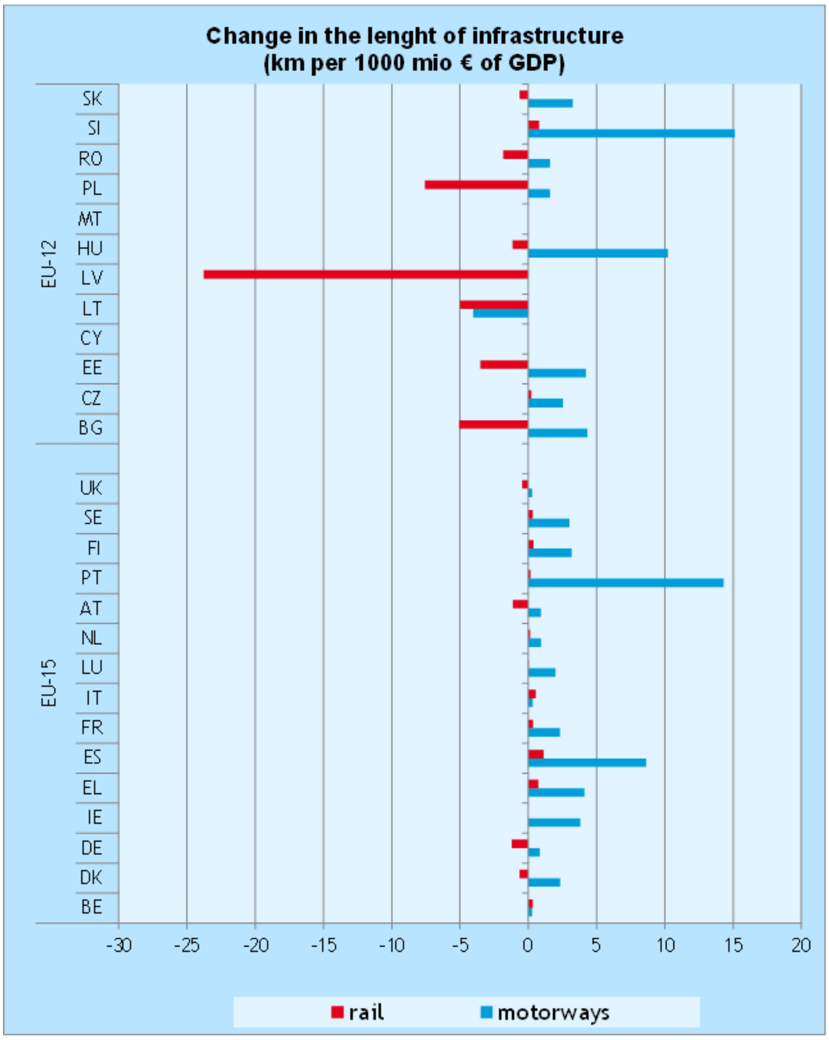
Figure 25 Share of road and rail in total infrastructure investments over the years 2000-2009

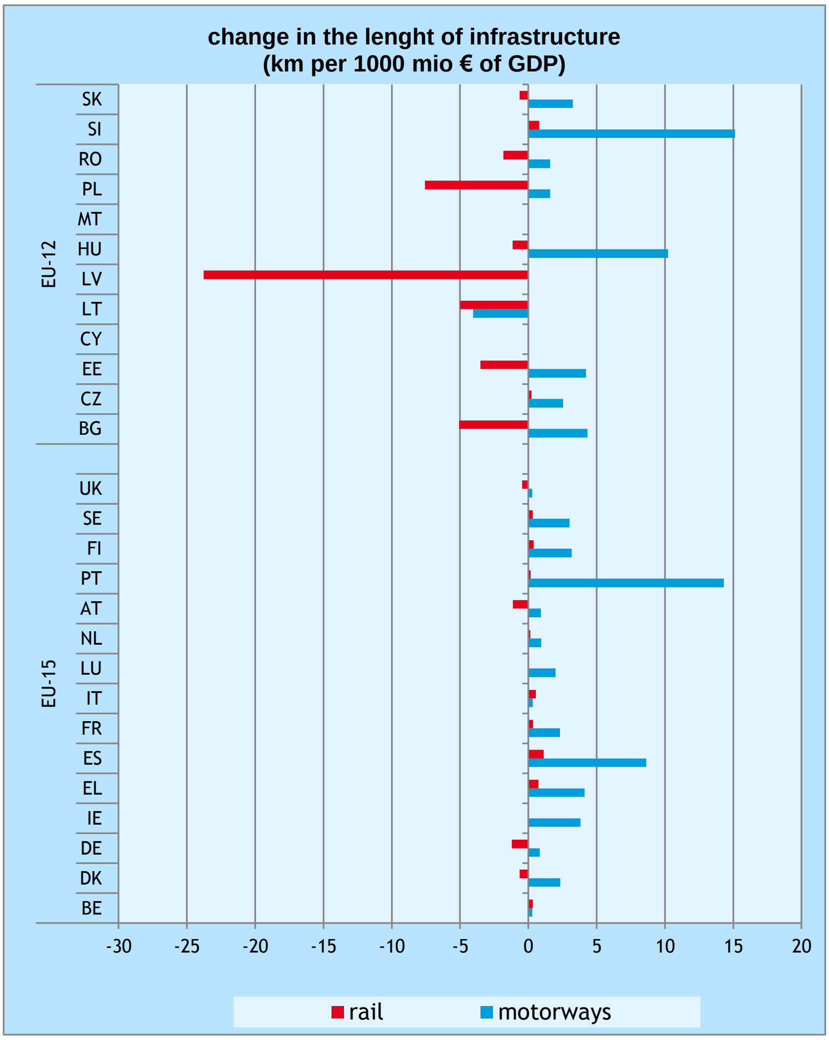


Note: No data available for Cyprus and limitedly for Malta.
Source: ITF.

Figure 24 and Figure 25 illustrate that the distribution of investments over rail and road infrastructure is rather well in line with the modal distribution over the modes (roughly 70 to 80% is invested in road and 20-30% in rail). However, this does not result in a balanced development of the infrastructure, since the costs for rail infrastructure are much higher than for road infrastructure (CE, 2004a). While the major road infrastructure has been increased over the 2000-2009 period, the rail network only increased in a few countries, while the network degraded in most of the countries, especially eastern European countries, see Figure 26.

Figure 26 Change in the length of motorways and rail infrastructure 2000-2009 (in km per billion € GDP)





Source: DG MOVE Pocket (European Union, 2011).

It must be said that the distinction between major lines and secondary lines cannot be made from this graph, which is based on ITF statistics. Most of the degraded lines may be secondary lines. However, the figure shows that the road network is improving in terms of density, while the rail network is developing adversely.

Expanding road infrastructure networks or airports or increasing the capacity of existing infrastructure has on the long run a clear risk of inducing new traffic. Therefore, a key element in long term GHG emissions strategy for transport would be to limit such investments and capacity increase.

Investments in rail or inland waterway networks can contribute to decarbonisation as long as they result in a true shift to low-carbon transport and the amount of induced traffic is limited.

In all Member States, infrastructure policy is mainly driven by economic arguments and aimed at reducing road congestion. In none of the Member States it is regarded as a central element in their decarbonisation strategy.

4.5.2 Evaluation of infrastructure investments

In infrastructure and spatial planning processes, various instruments are used in most countries to assess the environmental implications of decisions, namely Environmental Impact Assessments (EIA) and Strategic Environmental Assessments (SEA) and cost-benefit assessments (CBA). However, (Kampman (2009) concludes that further integration and improvement of GHG impacts in these environmental assessments is needed, and can have a significant impact on the GHG emissions of transport. These improvements may not have a short term impact, but they can be effective in the long term.

In cases where climate change impacts are included in EIAs or SEAs, they usually play no or just a minor role in the final assessment. Improvements should aim to put more weight to GHG reduction in environmental assessments. The following potential policy instruments for doing this were identified (Kampman, 2009):

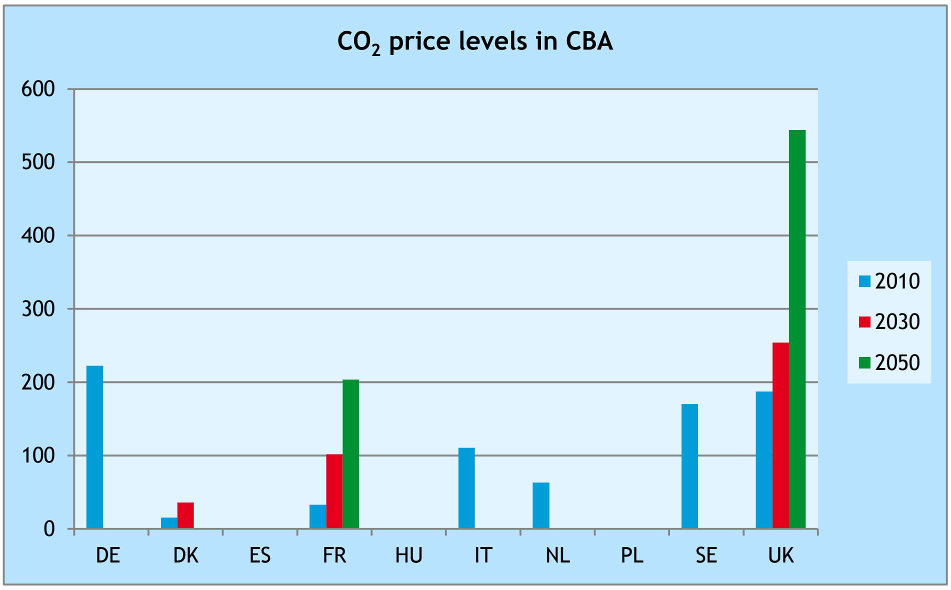
- ensure that all (very) long term impacts on GHG emissions are included in EIAs, SEAs and CBAs;
- apply higher CO_2 prices for the long term emissions of CO_2 in CBAs, in order to better reflect the risks for possible long term dramatic changes;
- introduce specific conditions or requirements to the overall impact on GHG emissions.

In Figure 27, national guideline values for CO_2 prices to be used in CBAs are presented, published by government bodies. The overview shows significant difference between the countries. The higher the CO_2 prices are, the higher the estimate of the social cost of a project that results in an increase in GHG emissions and the sooner such a project will show a net cost (instead of a net social benefit which is usually required).

Spain, Hungary and Poland do not provide an instruction of a set of figures to use. Although it is difficult to assess, the questionnaire answers suggest that these are the countries with the least developed EIA practise.

Only France and the UK apply a higher CO_2 price for future years. The other countries have not published future figures, and implicitly assume the costs of CO_2 emissions to remain constant over time in real terms.

Figure 27 CO_2 price levels in cost benefit analysis (in €, price level 2010)



Van Essen (2011) has outlined a methodology for 'carbon rating': an approach for assessing the climate impacts of transport infrastructure project. Such an approach could help to steer investments towards infrastructure that contribute to GHG reduction instead of projects that just contribute to a further increase of GHG emissions. Furthermore also applying high CO_2 prices can be an effective way put more weight to climate objectives in the infrastructure project appraisal process.

4.6 Policy for supporting or stimulating specific modes

Both in passenger transport and freight transport, modal shift to low-carbon modes can contribute tot GHG emission reduction. Several studies show that rail and waterborne transport have on average higher energy efficiency than road, in terms of MJ/tonne-km (CE, 2010; IEA, 2009). For passenger transport rail transport, coaches and non-motorised modes can have lower GHG emissions per passenger-kilometre than private cars or aviation. However, not only the difference in energy efficiency plays a role, but also the question whether new transport volumes of the low-carbon modes are the result of a modal shift, or mainly the result of additionally induced transport.

In passenger transport, the construction of high-speed railway infrastructure in France for example not only attracted people that travelled by less energy efficient modes before, but also attracted people travelling by conventional train and people. OECD (2009) concludes that 24-26% of the high-speed rail transport volumes has been induced by its construction. Nevertheless, CE (2011) evaluated high-speed rail as having a potential to reduce GHG emissions, taking the induced travel demand into account. At a local level similar considerations play a role. The improvement of the quality of local public transport networks may also attract additional travellers or cyclists.

On the other hand, there are also policies that make non-road modes more attractive, and have no or little rebound effects. Stimulation of the use of public transport by limiting commuter travel deduction for cars on the basis of the availability of public transport is an example that has no rebound effects.

The potential of modal shift policy should therefore be carefully evaluated, taking the design of the stimulating policy into account. Policies aimed at a modal shift to zero-emissions modes as cycling and walking can be regarded as no-regret as these do not have the risk of any significant rebound effects.

There are various policies for supporting or stimulating modal shift. Policies can make cycling, walking, public transport, or rail or inland waterway transport more attractive or may make the use of road transport or aviation less attractive. In the first case, policies result in lower resistance to use the non-road (non-air) modes. This can be both in price, travel speed and quality terms. Secondly road transport or aviation can be made more expensive e.g. by vehicle taxation, infrastructure charges, ticket taxes or higher fuel taxes. The modal split in a country is the result of a broad range of policies (fiscal system, infrastructure availability, quality of services) as well as geographical or demographical characteristics.

Policy instruments for stimulating modal shift being used by Member States include the construction of infrastructure, traffic management and subsidies. At the EU level, the TEN-T policy and Marco Polo programme are policies that are aimed at (or at least designed to contribute to) modal shift.

In most of the countries, public transport benefits from a reduced VAT rate which is usually around 6-8%, while the VAT level of private car transport is around 20%. Furthermore, the taxation of traction energy is significantly lower for rail and zero for inland waterway and maritime transport, as shown above.

4.6.1 Public transport policy

Most of the countries do not have any targets for an increase of the share of public transport. Only Hungary, a country with reducing shares of public transport, has objectives for significant increase of the share of public transport. For 2020, the goal for the share of public transport is 15% for rail traffic (10 % in 2008) and 15% for bus traffic (21% in 2008). For urban transport, the share of public transport should reach 50%.

In Sweden, an informal agreement has been signed to double the share of public transport. Other countries like Denmark and Germany acknowledge the need for future increase of public transport, but did until now not draw any formal objectives and consequently did not develop a coordinated package of policy measures.

In many countries, regional transport has been deregulated to the local level. The role of the national government is therefore often limited and a coordinated approach aimed at increasing in the use of public transport could be difficult to realise at the national level.

In the UK, encouraging the use of public transport is undertaken through the Local Sustainable Transport Fund (worth €698 million by 2015[11]). An interesting element from this programme is that it aims to change the behaviour of people by local programmes. A green bus fund is part of the programme.

[11] This is not only linked to investments in public transport.

4.6.2 Policy for the support of walking and cycling

Several of the respondents indicated that walking and cycling is stimulated in their countries by the construction of infrastructure and organisation of public campaigns aimed at increasing the share of walking and cycling in the modal split. At the same time, respondents indicate that walking and cycling is the responsibility of local governments.

In the UK the use of public transport is encouraged by the Local Sustainable Transport Fund (see also Section 4.6.1). Trough this programme, low-carbon commuting, cycle hire facilities and home working are facilitated.

National policy strategies for cycling often refer to the objective of making cycling and walking more attractive. In many cases financial support is available for the development of biking infrastructure, bike sharing, bicycle storage facilities and facilities at railway stations. For Sweden, Netherlands, UK and Spain, the respondents made reference of available budgets to invest in cycling facilities. Mostly, budgets are used to co-finance local initiatives.

Furthermore, campaigns are being set up to promote walking and cycling. Examples of this are the so-called zero-emission-mobility project in Germany and the UK's Local Sustainable Transport Fund (see above).

In Table 13, national budgets allocated to the development of cycling infrastructure and services are shown. The figures are applicable to the period of four years before and from now. The overall budget for cycling in the ten countries is between 500 million and 1 billion Euro. Local budgets are not part of this estimate.

The table shows that particularly the national governments of Sweden, Denmark and the UK invest much in cycling.

Table 13 National budgets allocated for the development of cycling infrastructure and services (million €)

DE	DK	ES	FR	HU	IT	NL	PL	SE	UK
--	132	8	--	--	22	20	--	280	698

Note: The UK figure applies to the UK's Local Sustainable Transport Fund, and it not solely allocated to the development of cycling.

4.6.3 Policy for the support of non-road freight transport

Like for public transport, the main policy instruments deployed are the construction of infrastructure, creation and expansion of terminals, low infrastructure access fees and reduced energy taxation. In several countries subsidy programmes have contributed to the upgrade of inland harbours, rail terminals and private railway connections.

Few countries have added a grant scheme for modal shift to increase the share of rail and inland waterway transport. More specifically, Italy, France and the UK support intermodal transport with operational subsidies. In the Netherlands, a modal shift target has been defined for Maasvlakte II, the area of expansion of the Port of Rotterdam.

The UK Government has a grant scheme to support modal shift of freight to rail or inland waterways called the Mode Shift Revenue Support Scheme. This assists companies with the additional costs of operating freight services by rail (or inland waterways) compared to using roads. Grants are available up to a maximum rate related to each container moved between two specific zones (Great Britain is divided into 19 zones) and whether the trip begins at a port or elsewhere. Around £ 19 million (€ 24 million) in total has been made available annually until 2015 and a similar grant for maritime freight.

In Spain, a 7.5 billion Euro infrastructure programme has been launched in 2010 to revitalise rail transport. The main focus of the programme was modernisation and upgrading of rail infrastructure, modernisation of terminals and rail access to ports.

4.6.4 Opportunities of modal shift policy

From the perspective of GHG emission reduction, stimulating cycling and walking can be regarded as a no-regret measures as with these modes there is hardly any risk of significant rebound effects. Electric bicycles significantly increase the market potential of cycling. Although some countries, regions and cities have already cycling policies, there is still much potential in this respect.

In the case of public transport, rail and waterborne transport modes, not all policies deliver net GHG emission reduction. Modal shift policy that is aimed at contributing to decarbonisation of the transport sector should therefore be critically assessed on its true GHG reduction potential. The highest potential can be expected from public transport in dense urban areas and electric rail and inland waterway transport on main freight corridors, e.g. from maritime ports to the hinterland. Various Member States have policies for stimulating rail transport. This can be expected to deliver some GHG emission reduction, but for significant reductions a broader policy package combining infrastructure policy and pricing can be expected to be more effective.

4.7 Spatial policy

Spatial policies can have a significant impact on transport demand and thus on GHG emissions of the sector. Unlike most of the other policies discussed so far, the impacts of spatial policy take many years or even decades.

Transport demand is the result of many demand and supply side factors. As the average time spent on mobility is more or less constant over time (this is known as the law of constant travel time budget), average travel speed is key factor in transport growth. Spatial structures can make that key functions are closer by and can also be reached within available time budgets by slower (and low-carbon) transport modes.

In an urban environment with high population density and mixed functions, i.e., with schools, shops, medical facilities and employment within walking or cycling distance, or with high quality public transport, car ownership and car use is typically significantly lower than in urban areas were these functions are further away (CE, 2004b). Goudappel (2009) shows that urbanised regions have lower CO_2 emissions per resident than rural areas, and that there are substantial differences between similar sized cities (in terms of number of inhabitants), that can be explained by the structure of the city and the facilities and functions offered. Bart (2010) shows that sprawl occurs in the EU in close relation with a strong increase of transport-related CO_2 emissions.

Spatial planning can be used in the long term to reduce the need for transport movements, reduce travelled distances and stimulate the use of cycling, walking and public transport. In most countries, spatial planning is a responsibility of the local government. Germany, the UK and Demark have been cited as countries that provide guidance for local governments spatial planning acts. Respondents from Hungary and Spain referred to urban sprawl over the last decade through the absence of control instruments.

Clustering of different functions around public transport hotspots can be observed in most countries, however, these developments take place rather because of economic arguments than that they are the results of spatial policy. Only in the French and Danish questionnaire, reference was made to the creation of zones around public transport areas with increased occupancy ratios.

In the German sustainability strategy, one of the targets is to limit the usage of new surface area for housing and for traffic means by 30 hectare per day by 2020 (situation 2010: 87 ha./day). Instruments are not implemented yet.

An important element of spatial policy in the UK is to prevent urban sprawl through the designation of so-called Green Belts. This has been a long-standing policy and was re-confirmed in the most recent national planning document. Green Belts are effectively designated areas of undeveloped land around urban areas and need to be clearly set out and protected by local authorities' Local Plans; many Green Belts have already been established. One of the core principles in the new national planning framework included the protection of Green Belts around urban areas.

Denmark is a country that not only implemented instruments to control country side preservation, but policies developed in this country also provide an explicit instruments to limit the number of movements, shorten trips and to increase the use of public transport.

Spatial planning in Denmark

The Danish spatial development legislation ('Planloven') is minted by a clear ambition to prevent the physical expansion of the urban areas in order to preserve space both for agricultural, conservation and recreational purposes.

Within the larger Copenhagen area the development is governed by a specific legislation ('Fingerplan 2007'), explicitly mandating municipalities to avoid an expansion of the urban zones and to concentrate the development of the region to the Copenhagen centre ('the palm') and along the 6-7 'fingers' stretching out from the city centre and separated by 'green wedges' preserved for agriculture, conservation and recreation. An explicit aim is to limit the need for transport and to strengthen public transport.

For the larger Copenhagen area the policy to develop public transport hot spots is very explicit. The Fingerplan 2007 identifies some 50 train and metro stations in the larger Copenhagen area as hubs around which the establishment of offices, shops, public services and other activities of public character that generates a lot of passenger transport shall be concentrated. Two zones (within a walking distance of 600 and 1200 meters from a station respectively) are identified with specific rules concerning the localisation of for example larger offices, number of parking lots etc., all with the explicit purpose to limit transport and support public transport.

In the national legislation, the rules are less specific and do not target specifically the development of areas around public transport hot spots. In practice, the regional development plans as well as municipal plans include such ambitions, but that is less a result of any explicit national policy but rather a choice of the local decision makers.

The national spatial planning act includes a particular section regulating the localisation of shops. It is mandatory for all municipalities to secure that city centres are used for shopping and other service purposes with the expressed aim of limiting the transport distances. This policy is further strengthened by very concrete restrictions for the establishment of external shopping malls.

The Netherlands has had a nationally coordinated spatial planning policy (the so-called VINEX policy) aimed at concentrating new residential sites in or at the border of cities. The policy was aimed at concentrating living, working and facilities. It has been abolished as part of a tendency to deregulate policies, although is has been evaluated as positive (RPB, 2005).

Spatial planning to reduce transport growth can be an important element in a long term climate strategy. However, it requires a long lasting and consistent approach. In most Member States, there is hardly any policy in such a direction and so plenty of opportunities exist.

4.8 Fuel and energy regulation and support

Biofuels can contribute to reduced GHG emissions, as the GHG emissions over the fuel chain are lower than that of the fossil fuels. Besides energy security purposes and providing an incentive to the European agricultural sector, this has been the main reason for the EU to stimulate European biofuel consumption. In the so-called Biofuel Directive of 2003 the EU has prescribed a 5.75% market share of biofuels (based on energy content) in each Member State for the year 2010.

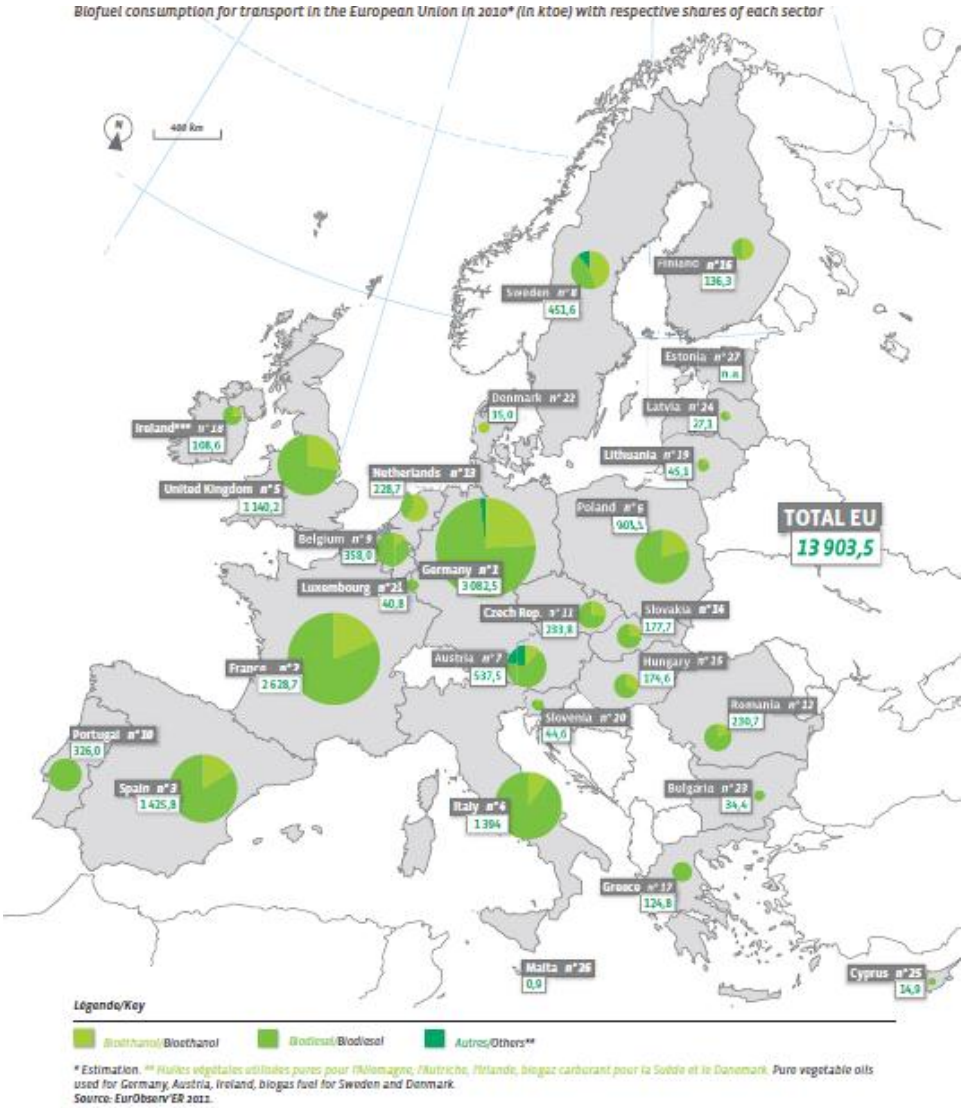
However, a large amount of studies has raised concerns on the sustainability of biofuels in the recent years. The GHG reduction of potential of biofuels strongly depends on the biomass sources used. In many cases, the cultivation of bio fuel crops leads to direct as well as indirect sustainability impacts. An impact being heavily debated is (direct and indirect) land use change as a result of biofuel cultivation (e.g. change from wood to agriculture). This land use change may even result in higher GHG emissions compared to fossil fuels. Other impacts related to the sustainability of biofuels are for example the impacts of biofuel production on food prices and a loss of biodiversity.

In order to ensure the sustainability, sustainability criteria for biofuels (and bio-liquids) are included in the Renewable Energy Directive (2009), which imposes Member States a 10% target for the use of renewable energy in the transport sector by 2020. In practise a large part of this target will be fulfilled by the use of biofuels. This implies that the biofuel policy is largely defined at EU level.

In the Renewable Energy Directive, biofuels produced from waste and residues count double towards the target to provide an incentive for the consumption of this type of biofuels. The GHG reduction potential of these biofuels is in general higher, because those biofuels are not directly land-based. Therefore, we monitor whether EU Member States have developed policy initiatives to increase the share of biofuels for waste and residues.

In Figure 28, the biofuel consumption for transport is depicted.

Figure 28 Biofuel consumption for transport per EU Member State



Source: Eurobserver.

In 2010, 77% of the EU's biofuel consumption was biodiesel, followed by 21% ethanol. Vegetable oil and biogas only contributed with minor share of 1.3 and 0.4% respectively. As the GHG reduction of particularly biodiesel is low and probably even negative, the net contribution of the current biofuel to GHG reduction use is very low (or maybe even negative).

A consequence of the implementation of the Renewable Energy Directive is that Member States must develop National Renewable Action Plans (NREAPs). In NREAPs Member States have indicated which actions will be taken at the national level to increase current biofuel consumption to the level needed to reach the 10% target.

Based on these NREAPs and national legislation Table 14 provides an overview reflecting the share of biofuels in road transport in 2010, whether or not the EU's 10% share and the double-counting of biofuels from waste and residues has been implemented and whether tax reduction or other incentives are used to promote biofuels from waste and residues. By monitoring these parameters, the biofuel policy can be evaluated in qualitative and quantitative terms.

Table 14 National biofuel policies in the selected countries

Country	2010 biofuel share (% of TOE)	10% share implemented?	Double counting implemented?	Tax advantages	Other incentives waste and residues?
Germany	6.1%	No	Yes	Partly	Yes*
Denmark	0.9%	No	Yes	Yes	No
Spain	4.7%	Yes	No	Yes	No
France	6.3%	Yes	No	Partly	Yes
Hungary	4.0%	Yes	Yes	No	No
Italy	3.8%	Yes	Yes	No	No
Netherlands	2.0%	No	Yes	No	Yes
Poland	5.8%	No	Yes	No	No
Sweden	6.1%	No	Unknown	Yes	Yes
United Kingdom	3.0%	Yes	Yes	No	No

* Germany provides tax breaks to the so-called second generation biofuels.

Note: The NREAPs were published already a few years ago and there might be changes since the publication of those NREAPs. Besides this, national legislation could have been published recently implementing Article 3(4) and Article 21(2) which is not yet included in this table.

Ten percent share

As can be seen in Table 14, not all Member States have already implemented the 10% target of the RED. It must be noticed that in some Member States, like Denmark, political agreement has been reached on the target, although the 10% is not included in national legislation.

Double counting implemented

Most of the Member States already have transposed double counting into national legislation. Only Spain and France did not do so yet (for Sweden it is unclear whether or not this is the case).

Tax advantages

In the early phase of national biofuel policies, tax reductions or exemptions were used as the main policy instrument to increase biofuel consumption. However, in most Member States quota obligations have become the dominant policy instrument, while tax advantages are only possible in case of high blends or second generation biofuels (including biofuels from waste and residues). For example, in Sweden and Germany, high blend biofuels (E85) are exempted from taxation.

There are, however, still countries that apply full tax exemptions for all fuel from bio-origin. This is the case in Sweden, Denmark and Spain. Biofuel policies are changing fast in EU Member States. Many of the countries only guarantee the tax breaks until 2012, 2013 or 2014.

Other incentives for biofuels from waste and residues

Besides tax incentives, also other incentives (like subsidies) can be provided to stimulate the consumption of biofuels from waste and residues. These subsidies can be related to different stages of the biofuel supply chain, like the actual production of biofuels or research and development schemes. For example, Sweden provides financial support for investments in biogas facilities. In the Netherlands a subsidy scheme was focussed on the realisation of filling stations for alternative fuels, like biogas or high blends biofuels. Germany and France provide tax breaks for 2nd generation biofuels.

Conclusion on biofuels
In order to contribute to GHG emissions reduction, the focus of biofuel policy in all Member States should be on the sustainability criteria in general and avoiding indirect land use change in particular, rather than on simply increasing the share of biofuels.

4.9 Innovation and subsidies

Subsidies for R&D and innovation programmes will not lead to significant short term GHG emission reductions, but they can help to solve chicken-egg problems, reduce the financial risk of technology development, speed-up the uptake of innovations and demonstrate the potential of sustainable technologies for the larger public.

In Table 15 the most frequently cited innovation policies highlighted in the questionnaires have been listed.

Table 15 Availability of national innovation policies and subsidy schemes

	DE	DK	ES	FR	HU	IT	NL	PL	SE	UK
Incentive for eco-driving		x	x	x			x		x	
Tax incentive for very fuel efficient vehicles	x	x	x	x		x	x		x	x
Subsidies for electric vehicles	x	x	x	x		x			x	x
Subsidy and demonstration programmes for electric mobility	x	x				x	x			x
Subsidy and demonstration programmes for hydrogen mobility	x	x	x				x			
Subsidy and demonstration programmes for CNG mobility		x				x				
Fuel efficiency improvement in public transport	x					x	x			x

Note: Eco-driving mandatory part of driver training.

Incentives for very fuel efficient vehicles
Both Poland and Hungary do neither have incentives for vehicles with relatively low fuel consumption, nor stimulate the uptake of fuel efficient vehicles by means of subsidy and demonstration programmes.

All the other countries included in the analysis have various types of stimulation programmes for innovation. Particularly Denmark, Germany, the Netherlands and Italy have a relatively extensive innovation policy that covers many different energy carriers.

Electric vehicles
Generally, electric vehicles benefit from lower fuel taxes. In most cases, the stimulation of electric vehicles is part of the generic framework to stimulate the purchase of fuel efficient vehicles.

Several countries stimulate the development of electric mobility through subsidies for demonstration projects. Investment in public charging stations is part of some of the demonstration projects. Most of the projects are collaborations with industry parties.

Overall, these programmes amount:
- UK: 37 million Euro;
- NL: 15 million Euro;
- IT: 60 million Euro;
- DE: 500 million Euro (for R&D in electric mobility and pilot programmes);
- DK: 13 million Euro (including support of hydrogen and natural gas).

All of the projects aim to result in a significant amount of electric vehicles in 2020. Germany and the Netherlands aim to have respectively 1 million and 200,000 vehicles operating in that year.

Electric vehicles are on a well-to-wheel basis clearly not zero-emission. Furthermore, the GHG impacts of vehicle production are for electric vehicles higher than for conventional ones. Nevertheless electrification can result in a net reduction in GHG emissions, as long as the electricity is sufficiently low-carbon. Therefore, the impacts of electrification of the vehicle fleet id narrowly connected with the decarbonisation of the power sector.

Although electric vehicles are currently entering the market, it is very likely that the market share of plug-in hybrid and full electric vehicles will even in 2020 be higher than few per cent. However, as electric mobility is likely to be key element in low-carbon passenger transport, further innovation in this direction is important, although it is hard to predict the GHG reduction potential.

Eco-driving
Many countries stimulate eco-driving through information exchange and awareness campaigns. However, only a few countries provide incentives other than providing information via driver training. Spain is the only country providing financial incentives for eco-driving training. In the Netherlands, Denmark, Spain and France, eco-driving is part of the driver courses for obtaining a driving licence. In France, professional road drivers (for both goods and passengers) are trained in eco-driving and this is rehearsed every five years. The training is obligatory and part of the French implementation of Directive 2003/59/EC[12].

Other specific incentives for innovation
In the Netherlands, there is a tax incentive for investments in energy saving devices by companies. 42% of the investment costs can be deducted from the fiscal yield of companies. The total budget (all economic sectors) is 151 million Euro in 2012. Every year, a list of selected technologies is compiled. Currently, among others side skirts for trucks, start-stop systems for truck and diesel locomotives and routing systems for inland vessels are on the list.

Spain subsidised fuel efficient tires in the year 2011.

Conclusion on innovation and subsidies
Subsidies on low-carbon technology and stimulating innovation are present in many Member States. They are important for achieving long term reductions. However, particularly subsidies can also disturb competition and some types of innovation that are not subsidised. Subsidies are mainly useful for (temporarily) removing certain market barriers.

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[12] Directive 2003/59 lays down the initial qualification and periodic training of drivers of certain road vehicles for the carriage of goods or passengers.

4.10 Speed policy

Lowering speed limits can be very effective in reducing GHG emissions. Kampman, et al. (2009) estimates the effect of reduced speed limits of 100 km/h for passenger cars on motorways in the order of 7-15%, depending on the initial speed limit (120, 130 or no limit).

Speed policies are an effective means to reduce vehicle GHG emissions, since it reduces both the energy consumption per vehicle-kilometre and also reduces at the long term the growth of road transport. Besides the limit themselves, also the level of enforcement is important.

Figure 15 provides an overview of the speed limits in various Member States. Several countries have increased the motorway speed limit in recent time. In The Netherlands, the maximum speeds on half of the network are currently (in 2012) being increased with 10 km/h to 130 km/h. In the UK, the government will launch a consultation in 2012 on increasing the motorway speeds from 70 to 80 miles/h. The argument of technological advances resulting in significantly safer cars then they were is put forward.

The Spanish speed limit has been brought down to 110 km/h in the period between March and July 2011, to temporarily reduce energy consumption in the face of the economic crisis.

Since July 2010, the Italian law allows the application of a limit of 150 km/h on motorways in special conditions. However, none of the motorway operators implemented this limit until now.

These developments illustrate that lowering speed limits and stricter enforcement is in none of the Member States part of the decarbonisation strategy. Most changes are even in the opposite direction and so in an increase in GHG emissions.

Table 16 **National speed limits on different road types (in km/h)**

	Built-up area's	Outside built-up area's	Motorways
BE	30-50	90-120	120
BG	50	90	130
CZ	50	90	130
DK	50	80	110-130
DE	30-50	100	(130)
EE	50	90-110	110
IE	50	80-100	120
EL	50	90-110	130
ES	50	90-100	120
FR	50	80-110	110-130
IT	50	90-110	130
CY	50	80	100
LV	50	90	110
LT	50	70-90	110-130
LU	50	90	130
HU	50	90-110	130
MT	50	60-80	-
NL	30-50-70	80-100	100-130
AT	50	100	130
PL	50-60	90-110	130
PT	50	90-100	120

	Built-up area's	Outside built-up area's	Motorways
RO	50	90-100	130
SI	30-50	90-100	130
SK	50	90	130
FI	40-50	80-100	100-120
SE	30-50	70-90	100-120
UK	32-48	96-112	112
HR	50	90-100	130
MK	60	80-100	120
TR	50	90	130
IS	30-50	80-90	-
NO	30-50-70	80	90-100
CH	30-50	80	120

Note: On little less than 50% of the motorway network in Germany, no speed limits apply. The figure between brackets is an advisory figure.

4.11 Comparison of approach of the countries

The approach for reducing the GHG emissions from transport significantly differs over the countries. Generally, it can be stated that the northern countries have most specific measures, including financial incentives for relatively fuel efficient and/or low-carbon vehicles. Southern countries tend to formulate the goals in a more generic way with limited focus on specific detailed policy instruments. Eastern European countries, not being held to a reduction of emissions, have the least focus on reducing GHG emissions from transport. These countries have room to increase their emissions within the framework of the European agreements.

A mix of both promoting good behaviour and discouraging bad behaviour can be observed. However, in most of the countries the 'carrot' is rather used than the 'stick' to reduce emissions, according to the questionnaire respondents. Examples are reduced taxation rates for fuel efficient company cars, tax exemptions for biofuels, infrastructure construction, modal shift operational subsidies and subsidies.

In Table 17 good practices have been identified. On the basis of selected indicators, policies in the selected Member States have been evaluated as good practice (yellow smiley), policy poorly developed, i.e. still large potential available (red, sad face) or average (white neutral face). Blank cells mean that not sufficient information is available.

For all policy areas discussed in the previous sections, the criteria used for these evaluations are shown in the last column. A few policy areas have been kept out of the analysis (innovation& subsidies and policies for supporting or stimulating specific modes of transport) since scoring these would be too arbitrary or because of lack of sufficient information.

The analysis shows that most of the countries have been labelled more often as a 'still large potential available' than as a 'good practice'. This implies that there are many options for policy development and improvement, even with policies implemented already. The UK has been considered as a 'good practice' most frequently, followed by Italy and Germany. In the UK most attention is paid to climate policies in transport in general.

Hungary and Poland, followed by Spain have most frequently been labelled as a 'large potential available'.

It should be noticed, however, that the number of good practices cannot be regarded as a measure for the GHG reduction that can be expected, as the GHG reduction potential of some policies are larger than that of others. Furthermore, the scoring is too simplified for drawing such far-reaching conclusions.

The overview should rather be regarded as a way to depict the main opportunities for policy development in each Member State. Particularly policy areas that are labelled as 'large potential available' (or neutral) could be further developed. The main options that exist in many countries are (not exhaustive):
- stronger CO_2 differentiation of vehicle and company car taxes;
- increase of fuel and vehicle taxes;
- introduction of distance based charging;
- limiting infrastructure construction of roads and airports;
- introduce or raise ticket taxes for aviation.

The Table 17 legend is shown below.

(green)	Best case, polices best developed and most effective from GHG perspective.
(yellow)	Policies not evaluated as best or worst case.
(purple)	Relatively poorly developed policy, large potential for policy improvement.

Table 17 Identification of good practices for reducing GHG emissions per policy area

	DE	DK	ES	FR	HU	IT	NL	PL	SE	UK	Evaluation criteria
Fiscal policies											
Fuel tax level diesel	yellow	yellow	purple	yellow	purple	green	yellow	purple	green	green	Best case: highest diesel taxes Large potential: lowest diesel taxes
Fuel tax level gasoline	yellow	yellow	purple	yellow	purple	green	green	purple	yellow	green	Best case: highest gasoline taxes Large potential: lowest gasoline taxes
Vehicle taxes - level	purple	green	purple	purple	green	yellow	green	yellow	yellow	yellow	Best case: three highest levels Large potential: three lowest levels
Vehicle taxes - structure	yellow	purple	yellow	yellow	purple	purple	yellow	purple	green	green	Best case: taxes based on gCO_2/km Large potential: weakest link with CO_2/unwanted incentives
Company car taxation - level	purple	yellow	yellow	yellow	purple	purple	green	green	yellow	green	Best case: Lowest fiscal loss per vehicle Worst case highest fiscal loss per vehicle
Company car taxation - structure	yellow	purple	purple	yellow	yellow	yellow	green	purple	purple	green	Best case: strongest CO_2 differentiation Worst case: no CO_2 differentiation
Rail diesel tax level	green	purple	yellow	purple	green	yellow	yellow	green	purple	yellow	Best case: highest rail diesel taxes Large potential: lowest rail diesel taxes
Electricity taxes	purple	purple	purple	purple	purple	purple	purple	purple	purple	purple	Worst case: electricity taxes significantly lower than tax rates for road diesel
Taxation of commuter travel	purple	yellow	green	yellow	yellow	green	purple	yellow	yellow	green	Best case: no commuter travel tax deduction Worst case: highest commuter travel tax deduction
Air ticket tax	green	purple	purple	green	purple	purple	purple	purple	purple	green	Best case: ticket tax applicable Worst case: no ticket tax
Infrastructure policy											
Road infrastructure charging	green	purple	green	green	purple	green	purple	green	purple	purple	Best case: road infrastructure charging on motorway network Worst case: no road charging.
Increase length of road network 2000-2009	green	yellow	purple	yellow	yellow	green	yellow	purple	purple	green	Best case: lowest growth of motorway network Worst case: highest growth of motorway network
Walking and cycling	purple	green	yellow	purple	purple	yellow	yellow	purple	green	green	Best case: largest budget for cycling infrastructure Worst case: no budget for cycling infrastructure
Spatial policy	purple	green	purple	purple	purple	purple	purple	purple	purple	green	Best case: policies for concentration of building areas Worst case: no policies aimed at concentration
Alternative fuels policy	green	purple	purple	yellow	purple	purple	purple	purple	purple	purple	Best case: fiscal incentives available for biofuels from waste and residues. Worst case: no incentives to improve biofuels
Speed policy	purple	yellow	yellow	yellow	yellow	yellow	purple	yellow	yellow	purple	Speed limit increases on the political agenda, speeds >130 km/h. Best case: Motorway speeds below 120 km/h
Total number of green	5	3	2	**3**	2	5	4	3	3	**10**	
Total number of purple	**7**	**7**	**9**	**5**	**10**	**6**	**7**	**10**	**8**	4	

5 Meeting 2050 targets

5.1 Introduction

As discussed in the previous chapters, Member States have a broad range of policies that directly or indirectly contribute to the decarbonisation of the transport sector. In this chapter we put this in the perspective of the 2050 reduction targets.

First we explore the main studies, visions or roadmaps that Member States recently developed. The key elements regarding GHG emission reduction in the transport sector in these documents are identified (Section 5.2). Next these studies are compared with the current policies, as discussed in Chapter 4, and also the changes needed for meeting the 2050 reduction targets (Section 5.3).

5.2 National outlooks to 2050

The Transport White Paper has set a goal of 60% GHG reduction in 2050, compared to the 1990 baseline for the transport sector. To achieve this goal, a policy agenda for the next decades to begin to move towards a 60% reduction in CO_2 emissions needs to be developed and implemented. In the *roadmap for moving to a competitive low-carbon economy in 2050* (EC, 2011), the EU invites all Member States to develop national low-carbon Roadmaps if not already done.

Member States have responded to this invitation in different ways. Some Member States commissioned a study to explore scenarios for meeting the 2050 reduction targets. Other Member States developed a vision on long term decarbonisation, while others did not yet develop anything to explore the long term strategies. None of the Member States did develop a true roadmap in the sense of a clear action plan with the main policy interventions for the next decades.

Table 18 provides an overview of the relevant studies or visions that have been developed by the ten selected Member States in reply to the aforementioned invitations from the EU Roadmap.

Table 18 Availability of 2050 roadmap/vision

DE	DK	ES	FR	HU	IT	NL	PL	SE	UK
x	x	-	x	-	-	x	-	x	x
-62%	100% renewable		-65%			--80%*		-80%	-80%
Study	Vision		Study			Study		Study	Vision

Note: X means roadmap available. The Netherlands has set a lower target for transport than for the other sectors, around 50%.

This overview shows that none of the countries has set goals for 2050, except the UK and Denmark. The UK Climate Change act sets a goal of at least 80% lower emissions for the year 2050 than the 1990 baseline. However, carbon budgets for the period after 2020 have not been defined yet. Some of the countries have set a lower goal for transport than for the economy as a whole. The Danish government has published a strategy as well, strongly focussing at electrification of the passenger car fleet and the use of biofuels.

The Swedish Environmental Protection Agency (EPA) was given a mission from the government to propose a roadmap for a carbon free Sweden in 2050. The final roadmap is expected by the end of 2012. The National Transport Administration (NTA) has made it own interpretation of the carbon free vision 2050, concluding that transport emissions need to be reduced by 80%.

All of the long term studies performed are to inform politicians, to raise awareness of the need for action, and to bring in elements for a climate neutral future economy. Except the UK, none of the countries is planning to ratify a 2050 target, including a roadmap.

Generally, the roadmaps have been developed to make projections for the economy as a whole, and not specifically for the transport sector. The consequence of this is that transport is just one of the sectors highlighted and the information publicly available per sector is limited. The detail of the information available differs from study to study.

Generally, the studies and visions that have been developed have the character of back and fore casting and have only limitedly evaluated the feasibility, economic impact and instrumentation of measures. The studies have rather a technical character. The studies are in most cases not the view of the government, or a chosen strategy, but the result of a research.

Below, we discuss the main conclusions and the most striking results from the different studies available.

Denmark (Danish Government, 2011)
The Danish roadmap has been published by the government itself and can be regarded as a government roadmap. The Danish strategy is strongly focussed on electrification of the passenger car fleet, together with a strong increase of sustainable electricity (by 2020 half of electricity consumption should be generated by wind; by 2030 complete phase out of coal). Furthermore the vision mentions need for second generation biofuels. The vision provides some first contours of policy packages to be implemented to achieve the goals. However, the transport part needs to be further detailed, as the vision indicates.

Germany (Prognos et al., 2010)
The German study has developed vehicle fleet estimates for 2050. Largest contributions are expected from plug-in hybrid electric vehicles, with a market share of 85% in 2050. In addition, the modal share of rail freight transport is estimated to increase from 18 to 27%, while inland waterway transport declines. The German study also assumes a large market share of 85% for biofuels. The German study is optimistic about passenger car transport development. The study mentions potential policy instruments, but does not estimate their impacts.

France (Perthuis, 2011)
France developed a strategy towards 2030. The main elements for transport are an HGV vehicle tax, new high-speed rail lines, improvement of the rail freight network and higher fuel taxes. The emphasis is on electric vehicles with a 25% share in the fleet. Light vehicles are estimated to have reduced emissions to 102 g/km by 2030. In 2030, the estimated emissions of transport are projected to be 6% lower than in 1990. For the period after 2030, further

electrification and the application of hydrogen and biofuels are mentioned, along with 25% demand reduction. However, these demand reduction measures are not elaborated in detail.

Netherlands (ECN & PBL, 2011; KiM, 2011)
The Dutch roadmap (ECN &PBL, 2011) is a back-casting study. Although the overall reduction is defined at 80%, the objective for transport is lower than that, less than 50%. Electric vehicles play a significant role in the roadmap.

As background for the Dutch roadmap, KiM (2011) were asked to estimate the technical potential of a broad range of technical measures for including improvement of fuel efficiency, reduction of demand and reduction of the carbon content of fuels. The study concludes that there is enough technical potential to reduce the emissions by 60-80% in 2050 by targeting at demand reduction, alternative fuels (biofuels, low-carbon electricity and low-carbon hydrogen) and fuel efficient vehicles. However, if the target of 60-80% applies to all vehicle modes equally, a large role will need to be given to biofuels for heavy-duty vehicles (since electricity and hydrogen are considered to be no realistic alternatives for HDVs), with 50-85% blending and 85% GHG reduction. The latter figure is in line with Skinner et al. (2010).

However, as the study notes, the availability of sufficient sustainable biofuels is at least very uncertain. It can be noted as well that such GHG reduction potentials for biofuels are rather optimistic. Therefore the conclusions regarding the overall reduction potential is questionable as well, at least where heavy-duty vehicles are concerned, and could be challenged.

KiM (2011) recognised that for the technical potential to come true, a strong focus on technological development is needed, as well as strong government involvement and the need for creation of social acceptance. Early action of governments is needed because of long lead times and large investments.

Sweden (Trafikverket, 2010)
NTA assumes that technical improvements, modal shift, biofuels and some other measures will not be sufficient to reduce the CO_2 emissions from the road sector by 80 % between 2004 and 2030. It concludes that the total road transport demand (in vehicle-kilometres) must be reduced by approx. 15% compared to the present level.

UK (HM Government, 2011)
The government strategy, focussing on 2030, is built on improving the efficiency of cars and vans, and along with a higher share of biofuels. These are the most important measures. In contrast with the Danish government, the UK government does not make a choice about which technology will emerge as the most effective means of decarbonising car travel, but takes a technology neutral approach. The UK is the only one mentioning concerns about the sustainability of the supply of biofuels that could potentially limiting their use.

Conclusion from national studies and visions
The summaries above make clear that none of the studies or visions can be regarded as a clear and full roadmap. They are rather exploring reduction options, with a focus on the technical options, rather than assessment of policy instruments or policy packages. This also explains why most of the scenarios developed, except Denmark and UK limitedly, have not yet led to a clear change of the policy.

The assumptions made in the studies differ significantly. The UK for example chooses a technology neutral focus with strong focus on reducing the vehicle emissions, while Denmark strongly aims at electrification of the passenger car fleet. Furthermore, the German study assumes an 85% share of biofuels, while the UK is much more reluctant to steering at large amounts of biofuels.

Nevertheless, all studies and visions mainly rely on technology break through. The largest potentials are attributed to the electrification of vehicle fleet and high shares of biofuels. This implies that there is a strong belief in the development of new technologies which are currently not yet available. The uncertainties with regard to the true reduction potential of these technologies (which are still highly uncertain, see also the next section) are generally neglected or at least not put forward very prominently.

Table 19 provides an overview of the main assumptions or projections on technical reduction options in each study.

Table 19 Main assumptions of the studies and scenarios

	DE	DK	FR	NL	SE	UK
Annual transport demand developments	-0.15% p.c. 1.20% trucks		0.40% p.c. 1.50% trucks	0.75% p.c. 1.30%trucks		
Fuel efficiency conventional cars	-30% compared to 2008		102g/km (2030)	-50% compared to 2010		50-70 g/km (2030)
Market share Electric Vehicles	35-38% (50% plug-in)	Large role	50% in 2030, including hybrid	Large role		Technology neutral position
Market share of biofuels	85% (road transport)	Heavy transport	10% (2020/2030)	50-85%	x	Up to 10% (2030)
Biofuels GHG reduction	2^{nd}-3^{rd} generation			85%		
Modal shift	From 17 to 27% rail freight transport		From 14 to 25% rail freight transport	x	x	x
Demand reduction			25% demand reduction after 2030	x	15% compared to present level	
Other	20% hybrid truck, no hydrogen			Regulation of spatial planning	Regulation of spatial planning	

Note: x means mentioned but not quantified.

With regard to the non-technical reduction options of modal shift, more efficient vehicle use and limiting transport demand growth, the picture is not very consistent. Some studies/visions mention some of these reduction options why others don't. From these options, modal shift is getting most attention.

Assumptions on the annual transport volume growth rates have been made explicit in three of the national 2050 studies (see Table 19). These assumptions differ significantly, in particular for passenger car transport. The higher annual growth rate in The Netherlands (0.75% per year) corresponds to a 35% volume growth in 2050 compared to 2010 while the growth rate assumed for Germany (-0.15% per year) would result in a 6% decrease. The assumed growth rates for freight transport volume are considerably higher than for passenger cars, but vary less. They correspond to a growth of 61 to 74% between 2010 and 2050, which is roughly in line with what was assumed in the impact assessment for the 2011 White Paper on Transport, but much lower than over the past decades. These assumptions on transport volume growth may seriously influence the conclusions of the studies and the feasibility of reducing emissions and the need for policies.

5.3 Scenarios for meeting 2050 targets: gaps and uncertainties

Both the existing policies and the national outlooks to 2050 focus on **technical reduction options**. This means that for the decarbonisation of the transport sector Member States mainly rely on energy efficient vehicles and even more on low-carbon energy carriers. However, policies for supporting the uptake of technical innovations, such fiscal incentives, are not fully developed and could be (further) improved in all Member States. Particularly CO_2 based vehicle taxes and higher fuel taxes could improve market conditions for low-carbon technology. It seems that many Member States mainly rely on the EU vehicle standards and energy policy.

While relying strongly on technical reduction options, the high uncertainties regarding GHG emission reduction potential of technical innovations do not receive much attention in most of the studies. Both biofuels and electrification are far from proven technologies and the GHG reduction potentials for these technologies that are assumed in some of the visions are very high.

For **biofuels**, ILUC can lead to GHG emissions that are in the order of the GHG emissions saved by reducing the use of fossil fuels, as shown by a broad range of recent scientific literature. Various studies have concluded that this effect is so large that the current biofuels policies in the EU will only lead to very limited GHG emission reduction in 2020 (IFPRI, 2011; EC, 2010). The period after 2020 has not been studied in such detail, but there are no clear signs that the GHG reduction potential from grown crops will improve significantly, as the ILUC problem will remain. Furthermore, the amount of sustainable biofuels available is another uncertainty. Several studies have tried to estimate the potentially available amount of biomass in Europe and worldwide for 2020, 2030 and beyond. All these studies show large uncertainties (PBL, 2012).

Regarding **electric vehicles**, recent studies show that there is still high uncertainty about the speed and potential of the uptake of electric vehicles. For large market shares, significant breakthroughs are required in particularly the battery technology. Capacity to cost and capacity to mass ratios should improve enormously to make business cases for electric vehicles with sufficiently large ranges competitive. Also solutions need to be found for fast, safe and battery-saving charging, infrastructure availability, consumer acceptance and response, availability of some materials and well-to-wheel impacts (CE, 2011b; Smokers, 2012). Plug-in hybrid vehicle technology is often regarded as a bridging technology to full electric vehicles and could be an important technology for CO_2 emission factors of cars well below the 95 gram/km. Very fuel efficient internal combustion engine vehicles are likely to remain important as well.

The uncertainties with technical reduction options make that for a robust climate strategy for transport, also **non-technical reduction options** need to be considered. In this respect it should be noticed that the non-technical reduction options do not play a central role in most of the national outlooks to 2050. Modal shift and reducing demand are included in some cases, but without analysing how this could be achieved with policy instruments. A similar approach can be observed in the EU White Paper where ambitious modal shift targets are set, but where it is unclear how this could be achieved by the policy strategy that is proposed.

Also in the current transport policy of Member States, policies that can stimulate non-technical reduction options are not well elaborated or in some cases even work in an opposite direction. Examples are infrastructure, speed and charging policies. Reducing road congestion and facilitating transport growth prevail, even when from a macro-economic perspective alternative approaches are more efficient (like congestion charging).

Only few of the studies (Denmark and The Netherlands) illustrate that a low-carbon future will lead to higher costs for companies and citizens. This illustrates the tendency of governments to pay limited attention to the impact on society.

6 Conclusions and recommendations

6.1 A key role for national policies

For meeting the 2050 GHG reduction targets, policies at all administrative levels are required. Main EU policies in this respect are CO_2 regulation of vehicles and energy carriers. With the CO_2 regulation for cars and vans and the Renewable Energy Directive and Fuel Quality Directive, first steps have been taken in this direction. Furthermore, the EU has a role in setting frameworks for fiscal policy (e.g. fuel taxes) and infrastructure charging and cross border infrastructure development. Also the international transport modes (maritime shipping and aviation) EU action is very important.

EU Member States also have a key role to play in the decarbonisation of transport. Economic instruments can strongly support the uptake of energy saving and low-carbon technology, e.g. vehicles taxes and fuel taxes that are (partly) based on CO_2 emissions. Some countries are very successful in using this policy instrument. The strongest selling-argument for low-carbon innovations is that saving carbon results in saving money. Also national policies for (bio)fuels can help to make a shift to low-carbon energy carriers as long as the impacts on GHG emissions over the entire energy chain are taken into account (including effects of indirect land-use change).

Technology alone is likely to be insufficient to solve the problem and for meeting the 2050 reduction target. Therefore, also policies are needed to curb down transport growth, to make more efficient use of available (vehicle) capacity and to stimulate a shift to specific modes. Economic instruments can play a role here as well, e.g. infrastructure charges, ticket taxes for aviation and the abolishment of (implicit) subsidies on transport such commuter tax advantages. Also speed policy and spatial and infrastructure policies can contribute to these changes of transport patterns. Furthermore, policies stimulating specific modes, including cycling and public transport policy are relevant in this respect.

Overall, the analysis shows that long term decarbonisation targets are not yet well integrated in the existing national transport policies. Furthermore, significant differences can be observed between countries. Climate objectives are certainly reflected in certain parts of transport policy, such a CO_2 differentiation of vehicle taxes. However, in none of the Member States achieving 60% GHG emission reduction in transport in 2050 compared to 1990 levels is realistically achievable with the current policy strategy.

This study provides clear guidance for countries on methods to improve their transport-climate policy and identifies best and worse cases in the different countries.

Most of these policies have one thing in common. To be effective, they need to be consistent, regularly updated and tightened (e.g. to keep pace with innovation) and provide continuously, predictable incentives to the market.

The text box below summarises the main policy opportunities for Member States. In the next sections, the conclusions on the main policy instruments are further elaborated.

Specific policy opportunities

For meeting the long term GHG emission reduction targets as proposed in the 2011 White Paper on transport, a strong development of national transport policies is imperative. Key elements in a more ambitious, focused and effective decarbonisation policy strategy at national level are the following:

- Integration of the 2050 goals into current policies, including the development of necessary policy packages in addition to the development of technology scenarios.
- Higher vehicle taxes and company car taxes for the most polluting vehicles, first by means of differentiation of existing taxes, with the absolute CO_2 emission level of the vehicle as harmonised tax base (frequently adjusted for fuel efficiency improvements).
- Higher fuel taxes for both road and non-road fuels and electricity to reduce pay-back times of energy saving measures and low-carbon technology. Annual adjustment of fuel taxes for inflation.
- Ticket taxes for aviation, preferably differentiated to flight distance.
- Road infrastructure charging, as a means to limit the growth of transport demand and reduce congestion without inducing additional traffic.
- Strong integration of climate objectives into spatial policy, infrastructure policy, speed policy and infrastructure charging, in particularly focusing on curbing down demand growth of the most carbon-intense modes of transport.
- Focusing biofuel policy on real well-to-wheel GHG emission reduction, e.g. by stimulating biofuels row ate and residues and avoid the use of biofuels that have significant indirect land-use change effects.
- Broad stimulation and support to the innovations needed for the uptake of electric vehicles.
- Reduce commuter tax advantages and/or use this instrument to promote public transport.
- Design of specific policies for stimulating low-carbon modes in such a way that rebound effects are limited and net emissions reductions are guaranteed. Policies to stimulate cycling and walking (particularly in urban areas) can be regarded as no-regret and are likely to have significant GHG reduction potential.

6.2 Economic incentives

First, differentiating existing taxes to CO_2 emissions is a step that has been taken already in a number of countries, but needs intensification. Furthermore, raising taxes and charges levels especially for the most polluting vehicles, fuels and transport modes can provide significant incentives for low-carbon technology and energy saving. That way, economic instruments help to create a market for low-carbon technology. This also supports EU instruments such as CO_2 regulation of vehicles and regulation of energy carriers.

All the countries investigated have some type of vehicle taxation (purchase taxes and/or annual taxes), but tax structures vary enormously and can in many cases be strongly improved by basing them more directly on CO_2 emissions. In Denmark and Hungary, fuel efficient cars can have higher vehicle taxes than less fuel efficient alternatives. In some countries, the bonus/malus systems are outdated (e.g. France and Sweden), since they were not adapted for the improvements in vehicle fuel efficiencies. This makes that these policies become soon ineffective and attract free riders. Annual updates of the schemes, taking account of fuel efficiency improvements, are therefore very important.

About half of all new cars in the EU are company cars. Therefore, the company car tax structure can be a powerful instrument to promote the purchase of fuel efficient cars. At the moment, only a limited number of countries do apply such a structure (UK and the Netherlands). This could in future provide a significant driver towards more efficient vehicle fleets.

Both vehicle taxes and company car taxes can be based on CO_2 labelling which makes it easier for users to choose relatively clean models. At the same time avoiding discontinuities in the tax structure (e.g. from using certain CO_2 classes) is to be preferred.

Apart from the tax structures, also tax levels matter. Introducing or increasing the level of vehicle taxes, fuel taxes of both road and non-road fuels and infrastructure charges can contribute significantly to the decarbonisation of transport. Fuel taxes provide incentives for all possible GHG reduction options and are therefore an extremely powerful instrument. In real terms, fuel taxes have decreased in many Member States. Annually correcting them for inflation is therefore a first improvement. Introducing a carbon-based element on top of existing fuel taxes, as is the case in Sweden and included in the Proposal for the Revision of the Directive on Energy Taxation would be very effective as well.

An increasing number of Member States introduced already some type of distance based charges for lorries, particularly on motorways. Introducing such schemes in all Member States and extending them to all vehicles and/or all roads would be very effective for curbing down transport growth. Moreover it could be used to significantly reduce congestion, air pollution and noise and cover infrastructure costs in an economically efficient way.

Another favourable option from an environmental point of view is the abolishment of commuter tax deductions, since that would reduce commuter distances. Furthermore it could be used to promote low-carbon modes such as cycling public transport as is already done in some Member States.

Aviation, the fastest growing transport mode, is exempted from fuel taxes (and VAT), mainly because of international conventions. However, Member States can introduce these for flights within the country or make bilateral agreements with other Member States. Another option is the introduction of ticket taxes as already done by a few Member States. When differentiated, these can also provide incentives to reduce flight distances and resulting emissions. Maritime transport is another fast growing transport mode that requires incentives to make fuel efficiency improvements attractive and curb demand.

6.3 Other policies

Spatial policy, infrastructure policy, the level and enforcement of speed limits and infrastructure charging are important instruments for influencing transport growth rates, the modal split and the efficiency of the transport system. However there are only very few examples of Member States that seriously deploy one or more of these types of policies for reducing GHG emissions.

Raising speed limits and significant increase in road infrastructure capacity is happening in various Member States and induces further transport growth and so result in increasing GHG emissions. Furthermore, increased speed limits directly increase the vehicle tailpipe emissions.

Integrating land-use planning and transport planning can on the long term reduce car dependency and reduce transport distances. This means that new development is mixed (housing, services and jobs) and (i) clustered around existing public transport oriented development), or (ii) planned simultaneously with the provision of new transport infrastructure.

There is a need for further guidance and/or assessment tools on the integration of climate change issues in EIAs and SEAs. Key options are applying higher CO_2 prices in cost benefit analysis and explicit carbon rating of all new infrastructure projects.

Modal shift can be achieved by the construction of infrastructure and operational subsidies. Most of the countries currently use these instruments to encourage the use of alternative modes, in addition to the application of a low VAT rate for public transport and modest charging framework for the infrastructure costs. The net climate effect of modal shift policies should be carefully evaluated on a case by case basis, since the construction of infrastructure and granting subsidies may also result in higher GHG emissions when additional transport demand is induced. In case of walking and cycling, this risk does not apply.

6.4 Roadmaps

Various Member States have in response to the EU Roadmap developed a study or vision on the climate policy till 2050. These studies generally rely very much on technical reduction options and EU regulation. The risks and uncertainties of the GHG reduction potential of biofuels and electrification are not well addressed and taken into account in these strategies.

Furthermore these scenarios are not translated into concrete policy instruments. This means that there is a significant gap between the long term GHG reduction targets and the national transport policies. The analysis, conclusions and opportunities identified in this report can give guidance for closing this gap.

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GLOSSARY

BAU	Business as usual, i.e. the projected baseline of a trend assuming that there are no interventions to influence the trend.
Biofuels	A range of liquid and gaseous fuels that can be used in transport, which are produced from biomass. These can be blended with conventional fossil fuels or potentially used instead of such fuels.
Biogas	A gaseous biofuel predominantly containing methane which can be used with or instead of conventional natural gas. Biogas used in transport is also referred to as biomethane to distinguish it from lower grade/un-purified biogas (e.g. from landfill) containing high proportions of CO_2.
CBA	Cost-benefit assessment. An analysis taking into account monetary and non-monetary costs and benefits.
CNG	Compressed Natural Gas. **Natural gas** can be compressed for use as a transport fuel (typically at 200 bar pressure).
CO_2	Carbon dioxide, the principal **GHG** emitted by transport.
EEA	European Environment Agency.
EEAC	European Environmental and Sustainable Development Advisory Councils
EIA	Environmental Impact Assessment. An assessment of the possible positive or negative impact that a proposed project may have on the environment, together consisting of the environmental, social and economic aspects.
ETS	Emission Trading System
EU-12	The countries that joined the EU in 2004 and 2007. Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria, Romania.
EU-15	The 15 EU countries before 2004. Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, United Kingdom Austria, Finland, Sweden.
EU-27	Both EU-12 and EU-15.
EV	Electric vehicle. A vehicle powered solely by electricity stored in on-board batteries, which are charged from the electricity grid.
GHG	Greenhouse gas emissions. GHG emissions from transport are largely CO_2.
HDV	Heavy duty vehicle, including tucks and busses.
Lifecycle emissions	In relation to fuels, these are the total emissions generated in all of the various stages of the lifecycle of the fuel, including extraction, production, distribution and combustion. Also known as WTW emissions.
NREAP	National renewable energy action plan, as part of the Renewable Energy Directive.
Options/measures	These deliver **GHG emissions** reductions in transport and can be technical or non-technical.
Policy instrument	These may be implemented to promote the application of the **options** for reducing transport's **GHG emissions.**
RED	Renewable Energy Directive. Common EU framework for the promotion of energy from renewable sources (Directive 2009/28/EC).
RLI	Dutch Council for the Environment and Infrastructure.

SEA	Strategic Environmental Assessment. A system of incorporating environmental considerations into policies, plans, programmes and strategies.
TTW emissions	Tank-to-wheel emissions, also referred to as direct or tailpipe emissions. The emissions generated from the use of the fuel in the vehicle, i.e. in its combustion stage.
UN	United Nations
VAT	Value Added Tax
WTT emissions	Well-to-tank emissions, also referred to as fuel cycle emissions. The total emissions generated in the various stages of the lifecycle of the fuel prior to combustion, i.e. from extraction, production and distribution.
WTW emissions	Well-to-wheel emissions. Also known as **lifecycle emissions**.

Annex A Questionnaire

QUESTIONS

The assessment for your country should cover **1)** the current transport policy and **2)** the long term decarbonisation strategy (e.g. from the 2050 Roadmap, when available). We would like you to report in English.

You can type you answers after the questions. Please use as much space as you need. If you would prefer to put your answers in a separate file, this is also possible. Also providing certain data in separate data file or spread sheet is possible.

Part I. Current Transport Policies

Could you give an overview of the policies within your countries listed below and answer the specific questions for each of them.

The questionnaire does not cover all the questions that could be raised from needed policies identified above. The reason is that for some policy instruments (e.g. vehicle taxation), we have already a quite complete data set from existing studies or EU wide statistics (see the Annex an overview of this). These issues are therefore not included in the questions below.

CO_2 reduction targets and general national approach

1. CO_2 targets and general national approach
   a) What are the official CO_2 reduction targets for your country for 2020, 2030 and 2050 (whole economy)?
   b) What are the official CO_2 reduction targets for transport for your country for 2020, 2030 and 2050? What are the specific targets per transport mode, if any?
   c) What are the main policy instruments to achieve these goals? What is e.g. the balance between more technology (vehicles and fuels), a more efficient transport system (better occupancy, shorter travel distances) and more fuel efficient driving behaviour (lower speeds, eco-driving)?
   d) What is the balance between instruments for technology neutral incentives and specific technology stimulation?
   e) What is the balance in policy instruments between promoting 'good' behaviour/alternative and discouraging 'bad' behaviour/alternatives?

   Answers

2. Please provide reference to the main general policy documents related to general climate policies and transport-specific climate policies or broader sustainable transport policies with a strong climate component (e.g. transport strategy, decarbonisation strategy, environmental strategy).

   Answer

Fiscal Policies

3. Please provide detailed information of fiscal policies that influence the CO_2 emissions of passenger and freight transport:
   a) What is the taxation scheme for travel reimbursement for commuter and business trips (including different approach of different modes).
   b) How are transport electricity and non-road fuels (agriculture, rail, inland waterways, aviation) levied?
   c) Does your country have a ticket tax for aviation? If so, for which flights and with what charge level?

Answers

Infrastructure charging

4. Please provide detailed information on infrastructure pricing policy in your country:
    a) What **road** infrastructure charging schemes exist or are planned in your country (for what users, what roads (road types and share of the network), average charge levels for cars, vans and trucks, total annual revenues and CO_2 or other relevant differentiations/incentives)
    b) Are there **toll roads** in your country? Please specify (e.g. share of roads, average toll levels for cars, vans and trucks; total annual revenues)

Answers

Infrastructure policy

5. How is infrastructure policy used to reduce CO_2 emission in your countries:
    a) Are CO_2 emissions parts of the evaluation of infrastructure investment projects?
    b) If so, how are they assessed, evaluated and integrated in decision making?
    c) What is the CO_2 shadow price that is used/specified?
    d) What is the policy regarding development of airports? Are there any plans for enlargement or upgrades of existing airports, development of new airports? How much public funding or support is involved in these investments?

Answers

Public transport and non-motorised transport modes

6. How is public transport supported:
    a) Are there national policies to support public transport?
    b) Is there a target for public transport use?
    c) Are there incentives to support public transport for commuting?
    d) What is the overall annual budget for public transport services in your country (for all public service obligations, possibly differentiated by mode or to the national/regional/local level)?

Answers

7. Does your country explicitly support non-motorised transport modes? In what way?

Answer

Rail freight and shipping

8. Does your country explicitly support rail freight transport? In what way?

Answer

9. Does your country explicitly support inland navigation? In what way?

Answer

10. Does your country explicitly support maritime shipping? In what way?

Answer

Spatial policies

11. Are spatial planning policies designed to reduce transport demand growth, such as the following?
    a) Is preventing or limiting urban sprawl an objective of the spatial policy? If so, how is this instrumented?
    b) Is there national policy to stimulate developments around public transport hotspots?
    c) Other spatial policies implicitly or explicitly aimed at modal shift or decarbonisation?

Answers

Biofuels and other renewable energy sources

12. How does your country stimulate biofuels:
    a) Are there specific incentives for biofuels from waste and residues?

Answer

Innovation of vehicle technology and subsidies

13. In what way is innovation supported?
    a) What subsidies or technology specific tax incentives (*for users*) exist in your countries for electric vehicles, fuel cell vehicles, hybrids, biofuels, low-resistance tyres, aerodynamic devices for trucks, speed limiters, etc. (also including incentives for non-road modes)
    b) What incentives are there for these types of vehicle, energy or fuel technologies *for manufacturers*?
    c) Is eco-driving stimulated in your country? How?
    d) What is the national policy regarding charging infrastructure for electric vehicles, hydrogen or CNG? How much is invested in development of such infrastructure?

Answers

Case studies

14. Do you have case studies illustrating a best practise with respect to national climate policy in your country which would be interesting to highlight and could serve as an example for other countries? This can also be an example that has already been described before.

Answer

Part II. 2050 Roadmap for your country

1. Does your country have a 2050 roadmap (if yes, please provide link or electronic document)?
2. Are there national CO_2 reduction targets mentioned in the national Roadmap? How does this compare to the official targets (see question 1 of Part I) and to the current emissions and Business as usual emission levels?
3. The same questions as 1, but than specifically for transport.
4. What is the general approach of the roadmap (e.g. back-casting, forecasting, scenario study)?
5. What is the autonomous transport scenario that is used in the roadmap (in terms of tonne-km, passenger-km, per transport mode; road, rail, inland waterway, maritime, aviation)?
6. What kind of (technical and other) GHG reduction options are foreseen to reduce the passenger-km/tonne-km (e.g. energy efficiency improvements, low-carbon fuels and electricity, modal shift, limiting demand growth, etc.)?
7. What is the contribution of these different solutions?
8. What is the balance between instruments for technology neutral incentives and specific technology stimulation?

9. What kind of national government policy instruments are proposed to achieve the emission reductions (e.g. fiscal, spatial, infrastructure, subsidies, regulation, speed & traffic management. etc.) ?
10. What is the balance in policy instruments between promoting ‘good’ behaviour/alternative and discouraging ‘bad’ behaviour/alternatives?
11. Is there a link with existing or planned policy instruments/initiatives? Are goals/measures implemented in policy papers and/or legislation?
12. What are the most important conclusions from the roadmap?
13. Please provide the key graphs with the business as usual and GHG reduction scenarios developed in the roadmap.

Answers

Annex B Table of contents of the database

1. General data (GDP, population)
2. Trend freight volume (tkm)
3. Freight volume 2009
4. Trend passenger volume (pkm)
5. pkm per capita
6. GHG Emiss Transport per mode
7. GHG per GDP (CO_2/€)
8. Share transport in total emissions (%)
9. Length of networks (km)
10. Infrastructure Investments (€)
11. Emissions of new cars (g/km)
12. EU agreed emission limits
13. EU Excise duties (€)
14. Share of biofuels (%)
15. Motorisation rate (cars/1,000 inh.)
16. Speed Limits (km/h)