
FINAL REPORT

SPECIFIC CONTRACT

MOVE/A3/350-2010 IMPACT ASSESSMENTS AND EVALUATIONS (EX-ANTE, INTERMEDIATE AND EX-POST) IN THE FIELD OF THE TRANSPORT

Supporting study to the Impact Assessments of the European Commission's internalisation strategy, to establish an inventory of measures for internalising external costs in all modes of transport

An inventory of measures for internalising external costs in transport

European Commission

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November 2012 FINAL



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1. Introduction

1.1. Background

The Europe 2020 strategy¹, the Roadmap for moving to a competitive low carbon economy in 2050² and the 2011 White Paper on Transport³ all make clear that the transport sector faces huge challenges. Particularly the objective of reducing transport's GHG emissions by 60% in 2050 compared to 1990 levels call for further policy development. The same is true for the very ambitious objectives for development of the TEN-T, co-modality and modal shift. Furthermore the reduction of road congestion deserves attention. The internalisation of external costs is one of the leading principles in EU transport policy for solving these challenges.

As defined in the IMPACT Handbook⁴ on estimation of external cost in the transport sector, external costs are costs to society that, without policy intervention, are not taken into account by the transport users. Transport users are thus faced with incorrect incentives for transport supply and demand, leading to welfare losses. Internalisation, which is often referred to as the 'user pays' and 'polluter pays' principle, means that these costs are made part of the decision making process of the users, usually by introducing market based instruments. By making transport users pay for the external costs they induce on society, they take account of these costs in their transport decisions and get an incentive to reduce them.

The polluter pays principle has strong roots in EU legislation. The EU Treaty mentions it as a principle; Article 191 paragraph 2 states:

"Union policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Union. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay."

In the 2011 White Paper on Transport, the internalisation of external costs plays prominent role and is included as one of the ten 'goals for a competitive and resource efficient transport system':

"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."

The White Paper proposes a set of actions for this move towards full and mandatory internalisation of external costs under its Action 39 "Smart pricing and taxation".

Furthermore, achieving some of the other 'goals for a competitive and resource efficient transport system' from the White Paper could also benefit from or would even require a further development of infrastructure charging policy, in particular:

¹ COM(2010) 2020

² COM(2011) 112

³ COM(2011) 144

⁴ Handbook on estimation of external costs in the transport sector Internalisation Measures and Policies for All external Cost of Transport (IMPACT), CE Delft/INFRAS/Fraunhofer-ISI/University of Gdansk, 2008.

- shifting 30% of road freight over 300 km to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050;
- making that by 2050 the majority of medium-distance passenger transport goes by rail;
- completing a fully functional and EU-wide multimodal TEN-T 'core network' by 2030 and 'comprehensive network' by 2050, including completing a European high-speed rail network by 2050 and tripling the length of the existing high-speed rail network by 2030.

There is generally agreement on the overall objectives like achieving 'fair and efficient pricing' and a transport system that contributes to a 'smart, sustainable and inclusive economy', as also put forward in the Europe 2020 Strategy. However the way this is turned into practice is far from straightforward and one of the most debated issues in European transport policy.

A central element in the EU policy for internalisation of external costs is the so-called Eurovignette Directive 1999/62/EC, which provides the basis for the EU charging policy for heavy goods vehicles. This Directive 1999/62/EC has been amended twice: in 2006 and recently in 2011. The Directive enables Member States to charge the full infrastructure costs and, since its 2011 revision, also some external costs (air pollution and noise). In addition, charges can be differentiated to some extent, in order to reduce road congestion or to provide incentives to use cleaner vehicles. Mark-ups up to 15% can be introduced in mountainous areas or even up to 25% when the revenues are invested in the cross border sections of Priority Projects.

Article 11.4 of the revised Directive 1999/62/EC⁵ asks the Commission to present by 16 October 2012 "a report that summarises the other measures [than the ones included in the Directive] taken to internalise or reduce the external costs related to environment, noise and health from all transport modes, including the legal basis and maximum values used. Furthermore a "timetable of the measures which remain to be taken to address other modes or vehicles and/or the external-cost elements not taken into account yet" is requested, "taking into account progress in revising Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity".

To support the Commission with this, a study has been commissioned titled 'An inventory of measures for internalising external costs in transport'. This study is carried out under the Framework contract MOVE/A3/350-2010 Impact Assessments And Evaluations (Ex-Ante, Intermediate And Ex-Post) In The Field Of The Transport. This is the final report of this study.

1.2. Aim and scope of the study

This study aims to support the Commission with the evaluation of existing internalisation policies in the light of Article 11.4 of the revised Directive 1999/62/EC. As the legislative requirement is related to road charging, regulatory policies have been interpreted as pricing measures. The aim of the study is therefore to describe existing and close to implementation pricing policies to internalise the external costs of transport. The overview includes data on revenues and administrative costs.

⁵ Directive 2011/76/EU

This study is primarily a data gathering study on existing pricing instruments in all transport modes. In addition it includes some comparisons across Member States and transport modes. The most recent data have been gathered: data for 2010 and where possible even 2011. A full comparison of existing taxes/charges with external cost levels is not part of this study. However, the link with external costs is discussed, and where possible, high level comparisons have been made.

The study is limited to:

- Pricing instruments (including emission trading and VAT⁶). Non-pricing instruments such as environmental zoning or regulation (e.g. of vehicles or energy carriers to improve GHG emissions performance) are not included in this study.
- The following cost categories: air pollution, climate change, noise, accidents, congestion, infrastructure wear & tear, as far as related to vehicle use (costs from vehicle production and the fixed part of the costs of infrastructure provisioning are outside the scope of this study).
- All pricing instruments that can be regarded as (partly) internalising some of these external costs, regardless whether the instrument is stated to be aimed at internalising these external costs or not.
- Already implemented policy measures (or close to implementation) at Member State and regional level. In addition, for aviation, inland navigation and maritime shipping, internalisation measures are covered at local level: for a selection of (air)ports of the TEN-T Core Network (as defined in COM (2011) 650 final).

Measures for the internalisation of external costs of road transport at a local level are not fully covered, because the number of relevant schemes would simply be too high, as also parking schemes are then to be included. Moreover, measures for internalising the external costs of road transport at a local level have been very recently evaluated in the Study on Urban Aspects of the Internalisation of External Costs - MOVE/B4/310-1/2011, carried out by CE Delft and ECORYS. As information on the few existing urban road pricing schemes in the EU is readily available from this study, factsheets have been filled out for these schemes (London, Stockholm, and Milano⁷).

1.3. Approach

Information on the existing pricing instruments has been gathered per transport mode and type of instrument. For each instrument, a factsheet has been made per Member State, summarizing the main properties of the instrument.

Table 1 gives an overview of the relevant measures per mode that have been covered.

⁶ Only in case of special tariffs (e.g. reduced rates) or exemptions.

⁷ In that study also the scheme in Durham is included. However, this scheme is not included in a factsheet as it covers only one single street, and is therefore too specific for the current study.

Table 1: Internalisation measures per transport mode and administrative level

	EU	National	Regional	Local
Road Transport		Fuel taxes (including reduced levels and exemptions) Infrastructure charges: - Time-based user charges (vignettes) - Distance-based user charges Insurance taxes Vehicle purchase and/or registration taxes Vehicle ownership and/or circulation taxes Company car taxation VAT reductions/exemptions	Tolls on specific parts of the regional network (e.g. bridges, tunnels).	Urban road pricing schemes (see footnote 7)
Rail Transport	ETS	Fuel taxes Electricity taxes Infrastructure charges (incl. fees for delays) VAT reductions/exemptions	<i>out of scope</i>	<i>out of scope</i>
Inland Navigation		Fuel taxes Fairway dues Charges related to prevention of water pollution. VAT reductions/exemptions	Fairway dues	Port charges for selected ports of the TEN-T Core Network, as defined in COM (2011) 650 final. Not included in the analysis are dues for locks and bridges (for maritime shipping and inland navigation), as far as they are not related to one of the TEN-T core network ports.
Maritime shipping		Fuel Taxes Charges related to prevention of water pollution ⁸ VAT reductions/exemptions		
Aviation	ETS	Fuel taxes Ticket taxes VAT reductions/exemptions		Airport charges for selected airports of the TEN-T Core Network, (as defined in COM (2011) 650 final), in particular: Landing and Take-Off (LTO) charge (often differentiated w.r.t. noise emissions) Noise surcharge Emission charge

The approach for gathering and analysing the data and main results per transport mode are provided in this report (chapter 2 to 6). This includes some key high level comparisons of the various Member States. Also information on administrative costs has been gathered (not differentiated by Member State), based on a number of selected case studies per type of instrument. Where possible, administrative costs for both the government and the users are presented.

Payments for services provided by private or public bodies have not been included:

- All types of insurances. Particularly Pay As You Drive insurances might be regarded to be relevant for internalising accident costs, but until now these are not applied on a large scale in any Member State.
- Charges for pilotage services in ports are not covered.

⁸ Data on penalties and insurances (e.g. related to 2000/59/EC and 2005/35/EC) were not gathered systematically but were added in cases where they were found while gathering the other data for filling the factsheet.

1.4. Outline of the report

This report is structured as follows:

- Results and high level analysis for road transport: chapter 2
- Results and high level analysis for rail transport: chapter 3
- Results and high level analysis for inland navigation: chapter 4
- Results and high level analysis for maritime shipping: chapter 5
- Results and high level analysis for aviation: chapter 6
- Comparison of modes and link with external costs: chapter 7
- Conclusions and recommendations: chapter 8
- Index of all factsheets: Annex A
- Exchange rates used: Annex B
- Background data on airport charges for 3 aircraft types: Annex C
- Average external costs: Annex D.

The factsheets themselves can be found in the separate Annex report.

2. Road transport

2.1. Introduction

This chapter provides an overview of the findings for road transport. In the first section, an overview is provided of the following:

- a. Design parameters of pricing policies for road transport
- b. Four vehicles representative of the market, that are used to compare the pricing measures among various countries on an equal basis
- c. The main data sources that have been used for road transport
- d. Summary of main findings.

In the second part (section 2.2 to 2.7), the main results are presented per type of pricing instrument: fuel taxes, vehicle taxes (purchase and/or registration, and ownership and/or circulation taxes), infrastructure charges, insurance taxes, VAT and other charges/taxes. In section 2.8 an overview is given of special treatment of electric and hybrid vehicles. Section 2.10 summarizes the findings on administrative costs. Finally in section 2.11 the main conclusions are given.

a. Design parameters

There are a number of external effects that national governments or local authorities try to internalise:

- Climate change
- Air pollution
- Noise
- Accidents
- Congestion
- Infrastructure wear & tear

Each of these externalities requires (a combination of) different design parameters to achieve internalisation. For climate change costs, fuel taxation is the theoretically the first best internalisation measure together with emission trading systems (ETS). ETS has the advantage of providing a market-based mechanism for determining the internalisation price, whereas taxation offers a more stable pricing signal over time. Ideally, the taxation component that is meant to internalise the cost of greenhouse gas emissions should be linked to the ETS price to maintain a comparable price signal across the sectors subject to the two systems. It is important to remark, however, that ETS provides a price for what is considered the 'acceptable' level of emissions, as established by the overall cap on emissions fixed by the system, and not an estimate of the actual climate change costs.

Accident costs are best internalised with insurance taxes based on accident rates and pay-as-you drive insurance. For the other cost categories, fully differentiated distance-based charges are generally regarded as theoretically optimal.

IMPACT Deliverable 3⁹ provides an extensive discussion on the optimal internalisation strategies for the various cost categories and transport modes (see section 3 of that study). It summarizes the preferred approach as follows:

“The analysis of cost drivers shows that it is important to distinguish the following types of taxes and charges: fixed ones (not related to transport activity), fuel based taxes and kilometre based charges. Internalisation of external costs is recommended using a combination of instruments. The main recommended internalisation approaches are:

- *Carbon content based fuel taxes or inclusion in ETS for internalisation of climate change costs.*
- *Differentiated kilometre charges for internalisation of air pollution, noise and congestion costs. Preferably charges should be differentiated to vehicle characteristics (including Euro standard and particulate filters) location and time of the day. Accident costs can be internalised by either a kilometre based charge (differentiated to relevant parameters like location, vehicle type and driver characteristics) or via charging insurance companies based on accident rates. The latter option is to be preferred but requires further study. For congestion costs local road pricing schemes can be a good alternative to differentiated kilometre based charges. For aviation and maritime shipping, the number of visits to (air)ports could be taken as charge base.”*

Governments do not necessarily include only parameters that lead to internalisation, but rather focus on generating an income for the public budget. In addition there may be good reasons for second or third best solutions, such as high administrative costs of certain instruments, lack of public support or other policy objectives. In the context of climate policy, differentiating vehicle taxes to CO₂ emissions, although not directly internalising climate change costs, is generally seen as a way to improve demand-side market conditions for low carbon vehicles and to correct for market failures such as the consumer myopia of car buyers.

Many countries have made a transition in the design of taxes and charges for road transport. An increasing number of countries introduced distance-based infrastructure charges (particularly for heavy goods vehicles (HGVs) and on motorways) and/or various vehicle related taxes differentiated to CO₂ emissions.

Below is a brief overview of the main parameters used for tax and charge differentiation.

a.1. CO₂ emission factor or fuel efficiency

The CO₂ emission factor of cars, usually expressed in g/km, is the primary parameter to provide incentives for buying low-carbon cars. The application can use the absolute emission level, or be based on intervals. Very often, upper and lower thresholds are instated, above or below which the tax rate does not change further.

As the CO₂ emission factor for a certain fuel type is closely linked to fuel consumption, also the fuel efficiency (usually expressed in l/100km or km/l) is an appropriate measure for the CO₂ emissions. However, these are not directly comparable across different fuel types.

a.2. Euro/EURO class

The Euro (light duty vehicles) or EURO (heavy duty vehicles) emission class determines the amount of emissions of a number of pollutants with mainly local effects. The most important ones are NO_x and PM, which have severe effects on human health. Other air pollutant pollutants (as also included in the EC

⁹ Internalisation measures and policies for the external cost of transport - Produced within the study Internalisation Measures and Policies for all external cost of Transport (IMPACT) – Deliverable 3, CE Delft/INFRAS/Fraunhofer-ISI/University of Gdansk, 2008

Regulations on the matter) are CO, THC, NMHC and the sum of NO_x and THC. For light duty vehicles, the limit values are set in g/km. For heavy duty vehicles, the measure is g/kWh. Table 2 and Table 3 show the emission standards for Euro 6 (LDVs) and EURO VI (HDVs), respectively.

Table 2: Euro 6 emission standard levels (light duty vehicles)

Euro 6 emission limits

Category	Class	Reference mass (RM) (kg)	Limit values													
			Mass of carbon monoxide (CO)		Mass of total hydrocarbons (THC)		Mass of non-methane hydrocarbons (NMHC)		Mass of oxides of nitrogen (NO _x)		Combined mass of total hydrocarbons and oxides of nitrogen (THC + NO _x)		Mass of particulate matter (PM)		Number of particles (P)	
			L ₁ (mg/km)		L ₂ (mg/km)		L ₃ (mg/km)		L ₄ (mg/km)		L ₅ + L ₆ (mg/km)		L ₇ (mg/km)		L ₈ (#/km)	
			PI	CI	PI	CI	PI	CI	PI	CI	PI	CI	PI (†)	CI	PI	CI
M	—	All	1 000	500	100	—	68	—	60	80	—	170	5,0	5,0		
N ₁	I	RM ≤ 1 305	1 000	500	100	—	68	—	60	80	—	170	5,0	5,0		
	II	1 305 < RM ≤ 1 760	1 810	630	130	—	90	—	75	105	—	195	5,0	5,0		
	III	1 760 < RM	2 270	740	160	—	108	—	82	125	—	215	5,0	5,0		
N ₂			2 270	740	160	—	108	—	82	125	—	215	5,0	5,0		

Key: PI = Positive ignition, CI = Compression ignition
 (†) A number standard is to be defined for this stage.
 (‡) Positive ignition particulate mass standards apply only to vehicles with direct injection engines.

Table 3: EURO VI emission standard levels (heavy duty vehicles)

Euro VI emission limits

	Limit values							
	CO (mg/kWh)	THC (mg/kWh)	NMHC (mg/kWh)	CH ₄ (mg/kWh)	NO _x (†) (mg/kWh)	NH ₃ (ppm)	PM mass (mg/kWh)	PM (‡) number (#/kWh)
ESC (CI)	1 500	130			400	10	10	
ETC (CI)	4 000	160			400	10	10	
ETC (PI)	4 000		160	500	400	10	10	
WHSC (†)								
WHTC (‡)								

Note:
 PI = positive ignition.
 CI = compression ignition.
 (†) The admissible level of NO_x component in the NO_x limit value may be defined at a later stage.
 (‡) A number standard is to be defined at a later stage and no later than 1 April 2010.
 (§) The limit values relating to WHSC and WHTC, replacing the limit values relating to ESC and ETC, will be introduced, at a later stage, once correlation factors with respect to the current cycles (ESC and ETC) have been established, no later than 1 April 2010.

As the timing of a new standard coming into force is strictly defined, there is a strong correlation between the emission standard of a vehicle and its age.

a.3. Fuel type

The most common fuel types are still diesel and gasoline, yet many countries have already foreseen special regimes or stimulating measures for hybrid, electric or other alternative fuel vehicles. Typically, gasoline powered vehicles have higher fuel consumption and resulting CO₂ emissions per kilometre driven (and higher fuel cost), but lower emissions of local pollutants per kilometre than an equivalent diesel vehicle.

a.4. Engine size/power

Engine size, expressed in cc or cm³, is the cylinder capacity of the vehicle. Engine power is typically expressed in kW (kilowatt) or HP (horsepower). There is a positive correlation between cylinder capacity and engine power, but due to technological developments, it has become possible to generate higher

engine power with lower engine size. Both measures are rough proxies for emission levels. They have been applied for several years as a design parameter for road vehicle taxation, as they are easy to measure. With changing reporting requirements for direct emission levels, countries are switching more and more to these direct emission levels (CO₂ and Euro/EURO class) as a base for vehicle taxation or other pricing measures. A few countries (Belgium, France, Spain) have developed their own measure for engine power, which is usually referred to as fiscal horsepower. The calculation varies between countries, but it is representative of engine power.

a.5. Vehicle size, configuration and weight

Vehicle weight has frequently been applied in road vehicle taxation. For passenger transport, it is often a (rough) indication of vehicle emissions. It should be noted that for the CO₂ emission standards for new cars and vans (i.e. the 95 g/km and 147 g/km targets for 2020), limit value curves are based on vehicle mass.¹⁰ Vehicle weight, and certainly also vehicle size (height, width, length), are also strong indications of a vehicle's "luxury" value. Heavier vehicles suggest heavier engines, more advanced equipment. A longer, higher and/or wider vehicle provides more space for passengers and storage. As such, weight and size based taxation for passenger cars also suggests a government's intention to target upper market vehicles.

In heavy duty freight transport, the picture is very different. Weight is a direct indication of the amount of damage a vehicle can do to road infrastructure. Especially in combination with the axle configuration (it is commonly stated that road damage increases proportional to the fourth power of weight per axle)¹¹ and suspension type, there is a very strong correlation.

a.6. Vehicle age

Often vehicle age is a basis to reduce the rate of a certain tax. The reasoning behind this is that vehicles are typically used less as their age advances (because they spend more time in maintenance, because they are replaced as the primary vehicle in a household, etc.), and that the externalities they generate with use decline.

This is certainly a valid argument. However, technological advances may compensate or even negate this reduction due to lower usage, as new vehicles have significantly better environmental characteristics. As such, age based rate reductions would optimally be combined with a differentiation based on CO₂ emission level or Euro/EURO class.

a.7. Value and purchase price

Incorporating a vehicle's value in a taxation measure (usually purchase price plus one or more supplements such as customs duty, or a reduction for a vehicle's age) is applied in many Member States as tax basis for vehicle taxation. It serves only as a distant proxy for the externalities caused by the vehicle and is rather a strong indication for "luxury" value of a vehicle. There may be several cases, in particular for new technologies such as hybrid or electric vehicles, where a high-value vehicle causes relatively less emissions and noise.

¹⁰ See recent study for DG CLIMA http://ec.europa.eu/clima/policies/transport/vehicles/cars/docs/study_car_2011_en.pdf




¹¹ See for example

<http://stc.ucdavis.edu/DOCS/2010/2010%20Fall/Madanat,%20Repricing%20Highway%20Pavement%20Deterioration.pdf>
and <http://trid.trb.org/view.aspx?id=378404>

b. Representative vehicles

To enable comparisons among the Member States, a number of representative vehicles have been selected for which the level of each tax was calculated. One passenger car (specific by make and type) from each of the B, C and D categories was chosen, as shown on Table 4. Main properties of the vehicles are taken from the EEA's CO₂ monitoring database¹²; other data were retrieved from the manufacturer's Belgian website.

Table 4: Selected passenger car types used for making comparisons

Category	Class B: small car	Class C: medium car	Class D: large car
Car model and type	Peugeot 207 1.4	Volkswagen Golf 1.6	Ford Mondeo 2.0
Fuel type	Gasoline	Diesel	Gasoline
CO ₂ emissions (g/km)	147	119	184
l/100km	6.34	4.49	7.93
Engine size (cc)	1360	1598	1999
Weight (kg)	1214	1314	1496
Euro class	5	5	5
Purchase price in Belgium (incl. VAT) (€)	12283	22115	35820
Engine power (kW)	54	77	149
NO _x (g/km)	0.06	0.18	0.06
PM (g/km)	0.005	0.005	0.005
Length (mm)	4030	4199	4784
Picture			

For Heavy Duty Vehicles, a model (nonspecific) heavy goods vehicle has been used, with the following properties:

- Gross Vehicle Weight (GVW): 40,000 kg
- Tractor Weight: 14,000 kg
- Axle configuration: 2 axles (tractor) + 3 axles (semi-trailer)
- Air suspension
- 400 HP, 298 kW, 6000 cc engine size
- EURO V
- Purchase price: € 120,000

¹² <http://www.eea.europa.eu/data-and-maps/data/co2-cars-emission/>



c. Main data sources

The main sources used to fill out the factsheets for road transport are listed below. Various sources provided information to complete all fields of the sheets.

c.1. ACEA Tax Guide 2012¹³

The ACEA Tax Guide, an annual publication by the European Automobile Manufacturers Association, lists road taxation measures for all European countries. The data are collected by national representatives, and are updated in the beginning of each calendar year. Apart from information on the individual measures, an indication of total revenue of the measures is also included for many countries.

c.2. OECD/EEA database on instruments used for environmental policy and natural resources management¹⁴

This database contains detailed information on all measures used for environmental policy for all OECD Member States, including all 27 EU Member States. Many times additional information on revenue and earmarking was found in this database.

c.3. Taxes in Europe database v2

The European Commission's DG TAXUD manages its own database of taxes in European countries. Highly detailed, this source often provided the legal basis and useful English language links for more information on the measures.

d. Overview of main findings

All in all, five main groups of internalisation measures were identified: fuel taxes, registration taxes (incl. purchase taxes), ownership taxes (incl. circulation taxes), insurance taxes and infrastructure charges. The countries applying each of them are shown in Table 5, while the revenues of three of those are shown in Table 6 (for the latest year available as described in the factsheets). For fuel taxes, the revenue data are for gasoline, diesel and LPG only (for 2011, except Denmark and Germany, which are 2010), unless it is marked otherwise.

¹³ <http://www.acea.be>

¹⁴ <http://www2.oecd.org/econst/queries/>

Table 5: Pricing instruments for road transport per country

	Fuel	Registration	Ownership	Insurance	Infrastructure
Austria	x	x	x	x	x
Belgium	x	x	x	x	x
Bulgaria	x	x	x	x	x
Cyprus	x	x	x	x	
Czech Republic	x	x	x		x
Denmark	x	x	x	x	x
Estonia	x		x		
Finland	x	x	x	x	
France	x	x	x	x	x
Germany	x		x	x	x
Greece	x	x	x	x	x
Hungary	x	x	x	x	x
Ireland	x	x	x	x	x
Italy	x	x	x	x	x
Latvia	x	x	x		
Lithuania	x		x	x	x
Luxemburg	x		x	x	x
Malta	x	x	x	x	
Netherlands	x	x	x	x	x
Poland	x	x	x		x
Portugal	x	x	x	x	x
Romania	x	x	x	x	x
Slovak Republic	x		x	x	x
Slovenia	x	x	x	x	x
Spain	x	x	x	x	x
Sweden	x		x	x	x
United Kingdom	x		x	x	x

Table 6: Revenues of pricing instruments for road transport per country (million €)¹⁵

	Registration	Ownership	Infrastructure	Insurance	Subtotal	Fuel
Austria	€ 452.25	€ 1,721.00	€ 1,535.50	€ 324.00	€ 4,032.75	€ 4,350.00 ⁽¹⁾
Belgium	€ 378.60	€ 1,455.00	€ 119.60	€ 734.00	€ 2,687.20	€ 4,388.19
Bulgaria	N/A	€ 378.60	€ 100.73	N/A	€ 183.53	€ 940.49
Cyprus	€ 63.89	N/A	-	€ 8.60	€ 72.49	€ 334.16
Czech Republic	€ 23.77	€ 184.21	€ 331.03	-	€ 539.02	€ 3,183.44
Denmark	€ 1,804.05	€ 1,345.69	€ 49.55	€ 249.25	€ 3,448.55	€ 2,432.96
Estonia	-	€ 3.50	-	-	€ 3.50	€ 312.82
Finland	€ 941.00	€ 691.00	-	€ 286.35	€ 1,918.35	€ 2,652.56
France	€ 1,919.00	€ 1,160.00	€ 8,442.60	€ 3,934.00	€ 15,455.60	€ 23,539.91
Germany	-	€ 8,500.00	€ 4,500.00	€ 3,500.00	€ 16,500.00	€ 35,738.28
Greece	€ 249.00	€ 1,194.00	€ 530.00	€ 301.62	€ 2,274.62	€ 4,359.66
Hungary	€ 111.81	€ 265.00	€ 167.90	-	€ 544.71	€ 1,886.89
Ireland	€ 383.60	€ 1,010.41	€ 184.00	€ 71.00	€ 1,649.01	€ 2,347.98
Italy	€ 1,142.00	€ 6,610.00	€ 4,971.00	€ 4,051.00	€ 16,774.00	€ 22,767.37 ⁽²⁾
Latvia	€ 5.01	€ 55.75	-	-	€ 60.77	€ 370.18
Lithuania	-	€ 38.83	€ 21.70	-	€ 60.53	€ 489.96
Luxemburg	-	€ 63.10	N/A	€ 13.32	€ 76.42	€ 920.08
Malta	€ 36.81	€ 44.24	-	€ 6.20	€ 87.25	€ 99.48
Netherlands	€ 2,005.00	€ 5,022.70	€ 155.00	€ 409.40	€ 7,592.10	€ 7,396.71
Poland	€ 317.17	€ 204.53	€ 468.00	-	€ 989.70	€ 5,400.17
Portugal	€ 831.83	€ 46.77	€ 1,782.70	€ 484.03	€ 3,145.33	€ 2,169.79
Romania	€ 42.26	€ 197.85	N/A	€ 30.44	€ 270.55	€ 2,082.54
Slovak Republic	-	€ 122.04	€ 418.10	€ 48.56	€ 588.70	€ 1,058.08
Slovenia	€ 40.10	€ 105.80	€ 298.34	€ 36.08	€ 480.32	€ 955.59
Spain	€ 734.00	€ 2,242.00	€ 1,808.70	€ 692.00	€ 5,476.70	€ 11,319.22
Sweden	-	€ 1,158.65	€ 75.91	€ 338.46	€ 1,573.02	€ 4,687.03
United Kingdom	-	€ 6,367.20	€ 64.40	€ 990.24	€ 7,421.84	€ 30,244.98
Total	€ 11,481.16	€ 39,892.08	€ 26,024.76	€ 16,508.54	€ 93,906.55	€ 176,428.52

(1): includes Methane and heavy fuel oil

(2): includes Methane and heavy fuel oil

Data are for the latest year available as described the factsheets (in most cases this is 2010 or 2011)

In the following sections, the main findings of the factsheets are summarised. Per type of pricing instrument, a table is presented with the main design parameters per country, as well as the charge level for each of the representative vehicles (where relevant). Detailed information for each measure can be found in the factsheets.

2.2. Fuel taxes

Fuel taxes, the bulk of which are formed by excise duties, serve many purposes. They are intended to cover strategic issues regarding security of supply, production processes as well as externalities of fuel consumption. Of course, they are also an important source of revenue for public budgets.

¹⁵ "N/A": not available. "-": not applicable.

Tax levels in Europe are as shown for the most common fuel types (gasoline and diesel: unleaded, low sulphur, minimum required level of biofuel blended) in the following graphs, extracted from DG TAXUD's Excise duty tables for energy products.¹⁶

In several cases, mainly for natural gas, the tax level is below the minimum level set in Directive 2003/96/EC. This is because, for LPG and natural gas exemptions are made possible in Art. 15 (1) I of Directive 2003/96/EC. Four countries (Bulgaria, Latvia, Lithuania and Romania) have tax level lower than the minimum for diesel, which is due to the transitional periods allowed by their Accession Treaty (Bulgaria and Romania), or by Directive 2004/74/EC (Latvia and Lithuania).

The highest fuel taxes are levied in the Netherlands (for gasoline), Italy and the UK (for both gasoline and diesel). Denmark has the highest tax levels for LPG and natural gas. The UK is the only country in the EU which has equal taxes on gasoline and diesel, while Cyprus is the only one to charge exactly the minimum levels required by Directive 2003/93/EC. Most countries give exemptions or reductions to the biofuel share blended with fossil fuels. Some also levy an additional CO₂ charge on fuel (Denmark, Finland, Ireland, Luxemburg, and Sweden). The equivalent CO₂ tax in €/tonne is listed in Table 7.

Table 7: Road fuel tax equivalents (in 2012)¹⁷

Country	CO ₂ tax level (€/tonne)
Denmark	12
Finland	59
Ireland	20
Luxembourg	9
Sweden	121

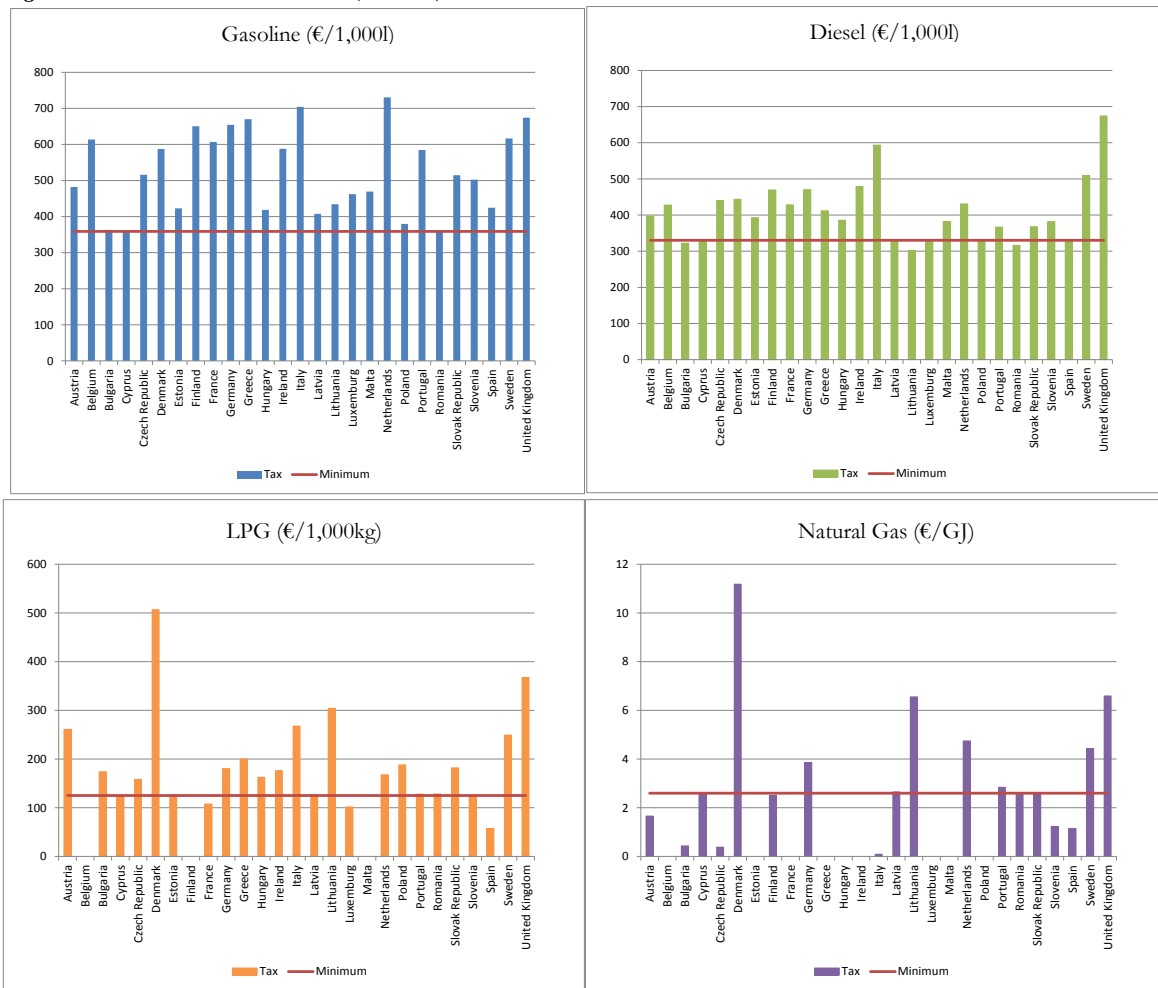
Fuel taxes can be regarded – together with emission trading systems – as the first best instrument for internalising climate costs of CO₂ emissions. The carbon content of a fuel is almost fixed (only biofuel content can have an impact), and the correlation between fuel consumed and CO₂ emitted is perfect. Given the higher carbon content of diesel, a higher tax on diesel than on gasoline would better reflect the climate impact of a litre of fuel, than what is the case with current fuel taxes in EU Member States, which are all at least as high for gasoline as for diesel (and in most cases considerably higher).

If one considers the current fuel tax levels as being meant for internalising climate costs only (from exhaust CO₂ emissions), then the minimum tax levels of the Energy Taxation Directive correspond to relatively high CO₂ costs (€126 and €151 per tonne of CO₂ for diesel and gasoline respectively). However, the fact that gasoline is generally taxed heavier than diesel illustrates that fuel taxation is not merely an instrument for internalising climate costs. In most countries it is mainly meant for generating revenues. Also competitiveness concerns related to the cost of road haulage may play a role to tax diesel lower than gasoline.

¹⁶ http://ec.europa.eu/taxation_customs/resources/documents/taxation/excise_duties/energy_products/rates/excise_duties-part_ii_energy_products_en.pdf

¹⁷ Gasoline: 2.311 t CO₂/1,000l; Diesel: 2.7304 t CO₂/1,000l

Figure 1: Fuel tax levels in the EU (in 2012)



Revenues from energy products are published by the EC's DG TAXUD.¹⁸ Gasoline revenues include both the leaded and unleaded variants. Diesel revenues in the EC's publication include both road and rail fuel. DG MOVE's 2012 Pocketbook indicates that rail accounts for only about 2% of final energy consumption in the transport sector, versus 82.1% attributable to road transport; therefore the figures in Table 8 can be regarded as principally raised from road transport. For Austria, Italy and Poland, no separate numbers were included. Additionally, it should be noted that Italy has a relatively large share of CNG powered vehicles.

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http://ec.europa.eu/taxation_customs/resources/documents/taxation/excise_duties/energy_products/rates/excise_duties_energy_products_en.pdf

Table 8: Road fuel tax revenues (year: 2011, except Germany: 2010)

	Gasoline	Diesel	LPG	Total
Austria	N/A	N/A	N/A	€ 4,350.00
Belgium	€ 959.61	€ 3,425.75	€ 2.83	€ 4,388.19
Bulgaria	€ 269.54	€ 608.54	€ 62.41	€ 940.49
Cyprus	€ 184.58	€ 149.58	€ 0.00	€ 334.16
Czech Republic	€ 1,194.37	€ 1,976.41	€ 12.66	€ 3,183.44
Denmark	€ 1,091.16	€ 1,323.53	€ 18.27	€ 2,432.96
Estonia	€ 147.93	€ 164.60	€ 0.29	€ 312.82
Finland	€ 1,333.68	€ 1,017.61	€ 301.27	€ 2,652.56
France	€ 6,267.00	€ 17,254.86	€ 18.05	€ 23,539.91
Germany	€ 17,728.96	€ 17,871.52	€ 137.80	€ 35,738.28
Greece	€ 2,935.58	€ 1,400.67	€ 23.41	€ 4,359.66
Hungary	€ 729.58	€ 1,151.52	€ 5.79	€ 1,886.89
Ireland	€ 1,052.76	€ 1,289.56	€ 5.66	€ 2,347.98
Italy	N/A	N/A	€ 543.77	€ 22,767.37
Latvia	€ 135.15	€ 231.81	€ 3.22	€ 370.18
Lithuania	€ 148.91	€ 294.39	€ 46.66	€ 489.96
Luxemburg	€ 223.28	€ 696.58	€ 0.21	€ 920.08
Malta	€ 46.76	€ 52.04	€ 0.68	€ 99.48
Netherlands	€ 4,040.90	€ 3,291.43	€ 64.38	€ 7,396.71
Poland	N/A	N/A	€ 228.82	€ 5,400.17
Portugal	€ 812.50	€ 1,351.51	€ 5.78	€ 2,169.79
Romania	€ 621.30	€ 1,424.93	€ 36.31	€ 2,082.54
Slovak Republic	€ 397.79	€ 654.16	€ 6.13	€ 1,058.08
Slovenia	€ 335.81	€ 618.55	€ 1.23	€ 955.59
Spain	€ 2,624.21	€ 8,693.83	€ 1.18	€ 11,319.22
Sweden	€ 2,488.49	€ 2,178.18	€ 20.36	€ 4,687.03
United Kingdom	€ 13,204.68	€ 17,003.94	€ 36.36	€ 30,244.98
Total	€ 58,974.53	€ 84,125.48	€ 1,583.54	€ 176,428.52

2.3. Vehicle taxes

a. Registration taxes

Many EU countries (20 of 27) apply a registration tax/charge/fee/excise duty on at least some share of vehicles (re)entered into the fleet. This is an important moment for the government to promote or discourage certain vehicle types. Estonia, Germany, Lithuania, Luxemburg, the Slovak Republic, Sweden and the UK are the countries not levying a tax upon vehicle registration.

A full overview of the parameters used for registration taxes for passenger cars and heavy goods vehicles is given in Table 9. The most important parameters for passenger and freight vehicles are indicated by the letters “P” and “F” respectively. Secondary parameters are noted with “p” and “P”.

In Table 10 and Figure 2, the tax levels are shown for the representative vehicles, as far as they are applicable.

In nine Member States (Austria, France, Latvia, Malta, the Netherlands, Portugal, Romania, Slovenia and Spain) and in the Flemish region in Belgium¹⁹, the CO₂ emissions (expressed in g/km) are a main parameter in registration taxes. In four Member States (Cyprus, Denmark, Finland and Ireland) and in the Walloon region in Belgium, it plays a minor role, in seven Member States it is not an element in the tax structure. Seven Member States have no registration tax at all.

Combinations of Euro/EURO class and fuel type, important indicators for emissions of local pollutants such as NO_x and PM, are used by half of the Member States that have a registration tax.

Half of the Member States also use the value (for new vehicles equivalent to purchase price, for older vehicles the age or accumulated mileage is also considered) of the vehicle as the starting point for the tax calculation. While the percentage of the value that constitutes the tax is mostly determined by advanced internalisation parameters (CO₂ emissions as the prime example), these are generally also countries with the highest vehicle tax levels for passenger cars entering the fleet. The countries with the highest rates (based on the average tax level for the three representative vehicles chosen earlier) are:

1. Denmark
2. Malta
3. Netherlands
4. Finland
5. Greece
6. Ireland
7. Portugal
8. Hungary
9. Austria
10. Spain

Portugal and Hungary are the only countries in this list not using vehicle value in the calculation.

Tax levels vary greatly between countries, and are very often progressive, with larger vehicles being taxed disproportionately higher.²⁰ This is another way to include the luxury value of a vehicle in the level of the tax, as it is mainly more luxurious vehicles that have higher emissions, engine power or weight. Another form of taxing vehicle purchases is excise duty. Malta and Cyprus, as well as Greece and Poland, apply this form of taxation. Bulgaria levies a product charge paid at first registration, while the Czech Republic applies an administrative charge due upon registering a new vehicle.

Taxation at the moment of a vehicle entering the fleet is mostly done for passenger vehicles only. Commercial freight vehicles are only subject to the tax in 6 of 20 Member States (Denmark, France, Greece, Italy, Malta and Romania), and even then exemptions or reductions to zero apply in some of them, e.g. Denmark (exemption for freight vehicles with GVW over 4,000 kg, and buses) and Malta (tax level for class N3 vehicles of one of the two most recent EURO classes equal to zero). In France, Italy and Romania, the tax is based primarily on engine power. The excise duty in Greece is based solely on the vehicle's value.

¹⁹ Note that in the case of Belgium three different regimes apply (in Flanders, Wallonia and Brussels), and these are mentioned separately.

²⁰ See also <http://www2.oecd.org/econstat/queries/MotorVehicleCO2.htm>

The remark can be made that at the moment of purchase and registration, the amount of use of the vehicle and the externalities linked to use are not certain yet, except for those caused by production and waste treatment/recycling at the end of the vehicle's lifetime. Only Bulgaria and Romania explicitly state their version of registration tax to pursue the internalisation of these costs.

Table 9: Parameters used for calculating vehicle registration taxes (for 2012)

Country	Parameter							
	CO ₂	Euro/EURO	Fuel type	Engine size/power	Weight	Configuration	Age	Value
Austria	P	p	P					P
Belgium (Brussels)				P			p	
Belgium (Wallonia)	p			P			p	
Belgium (Flanders)	P	p	p				p	
Bulgaria							p	
Cyprus	p			P			p	
Czech Republic		P						
Denmark	p				f			P
Estonia								
Finland	p							P
France	P			P, F	f			
Germany								
Greece		p		P			p	P, F
Hungary		p	p	P			p	
Ireland	p							P
Italy				P, F	F			
Latvia	P						p	
Lithuania								
Luxemburg								
Malta	P	f	p	F	F	P		P
Netherlands	P	p	p					P
Poland				P				P
Portugal	P	p	p	P				
Romania	P	p		P, F			p	
Slovak Republic								
Slovenia	P	p	p					P
Spain	P							P
Sweden								
United Kingdom								

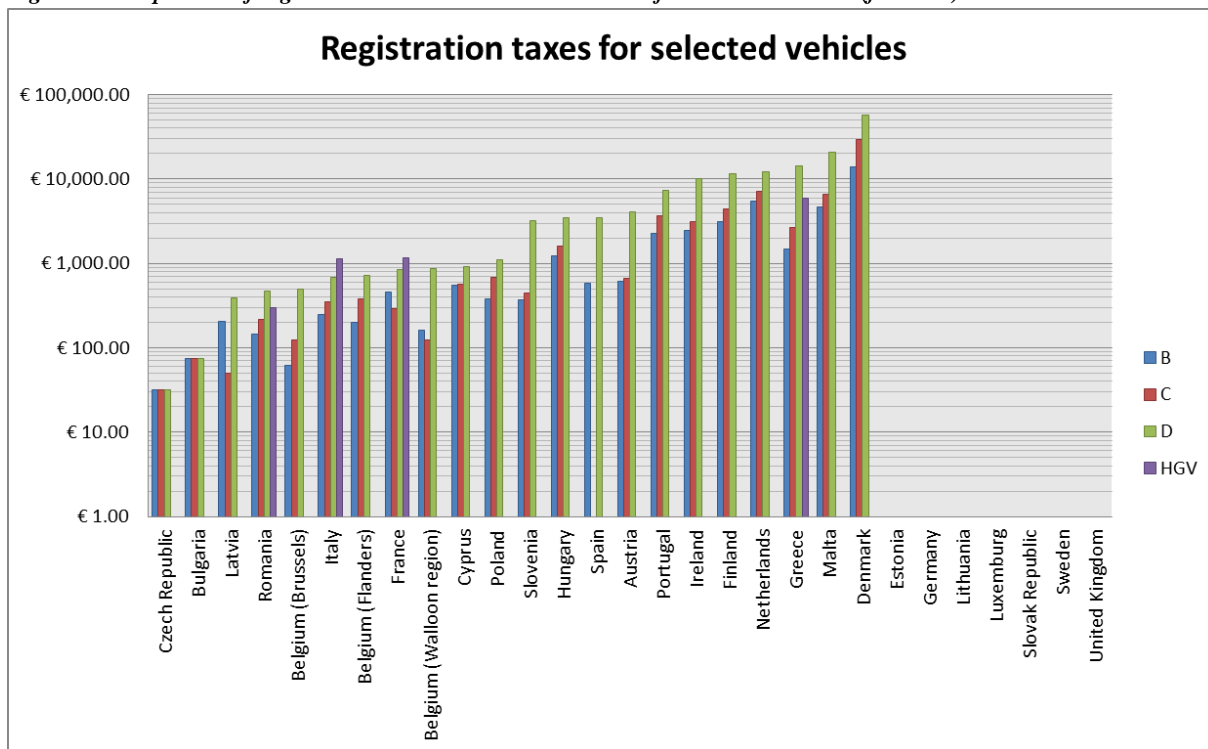
Note: The most important parameters for passenger and freight vehicles are indicated by the letters "P" and "F" respectively. Secondary parameters are noted with "p" and "f". Configuration refers to the amount of axles on the motor vehicle and the (semi-)trailer and the suspension type.

Table 10: Registration tax levels for representative vehicles (for 2012)

Country	B	C	D	HGV
Austria	€ 620.50	€ 659.01	€ 4,031.85	-
Belgium (Brussels)	€ 61.50	€ 123.00	€ 495.00	-
Belgium (Wallonia)	€ 161.50	€ 123.00	€ 870.00	-
Belgium (Flanders)	€ 201.32	€ 384.26	€ 730.63	-
Bulgaria	€ 74.65	€ 74.65	€ 74.65	-
Cyprus	€ 554.88	€ 570.49	€ 917.54	-
Czech Republic	€ 32.16	€ 32.16	€ 32.16	-
Denmark	€ 14,087.97	€ 29,458.31	€ 56,879.51	€ 0.00
Estonia	-	-	-	-
Finland	€ 3,095.49	€ 4,395.11	€ 11,567.00	-
France	€ 456.51	€ 287.90	€ 835.68	€ 1,161.50
Germany	-	-	-	-
Greece	€ 1,473.96	€ 2,653.74	€ 14,328.00	€ 6,000.00
Hungary	€ 1,225.81	€ 1,623.09	€ 3,463.50	-
Ireland	€ 2,456.60	€ 3,096.04	€ 10,029.60	-
Italy	€ 246.54	€ 351.54	€ 680.26	€ 1,133.17
Latvia	€ 207.28	€ 50.34	€ 389.17	-
Lithuania	-	-	-	-
Luxemburg	-	-	-	-
Malta	€ 4,717.65	€ 6,547.50	€ 20,985.36	€ 0.00
Netherlands	€ 5,458.41	€ 7,182.71	€ 12,308.02	-
Poland	€ 380.77	€ 685.55	€ 1,110.42	-
Portugal	€ 2,243.13	€ 3,654.49	€ 7,332.89	-
Romania	€ 145.81	€ 218.13	€ 474.22	€ 300.00
Slovak Republic	-	-	-	-
Slovenia	€ 368.49	€ 442.29	€ 3,223.80	-
Spain	€ 583.44	€ 0.00	€ 3,492.45	-
Sweden	-	-	-	-
United Kingdom	-	-	-	-

Note: For definition of vehicles, see section 2.1.

Figure 2: Comparison of registration taxes in EU Member States for selected vehicles (for 2012)



Note: Logarithmic scale. For definition of vehicles, see section 2.1.

b. Ownership and circulation taxes

All Member States levy one or more forms of periodic ownership or circulation tax with regard to road transport vehicles. Contrary to registration taxes, heavy duty vehicles are subject to this form of taxation in nearly all countries, often with a separate regime targeting only this class of vehicles²¹. This mainly applies to heavy goods vehicles; buses are often not subject to this tax either. Three countries (Estonia, Lithuania and Poland) do not have a periodic tax for passenger vehicles, only for heavy duty vehicles with GVW above 3,500 kg. In Estonia and Lithuania, buses are not covered by the tax.

The most applied design parameters are engine size/power and CO₂ emissions for passenger cars, and GVW for heavy goods vehicles, in many cases combined with the vehicle's axle configuration and suspension type. Twelve Member States (Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Luxemburg, Malta, Portugal, Sweden and the UK) have a CO₂ based component in their ownership taxes. Euro/EURO class is not applied very often to differentiate. It seems logical that vehicle value is not applied for periodic taxation, as there is no act linked to vehicle value in owning or driving a vehicle that would warrant taxation on that parameter.

Many countries are in a transition from one form of taxation to another, usually from engine size/power to CO₂ emissions. As such, the system which determines the tax level depends on the year of first

²¹ Directive 1999/62/EC as modified by Directive 2006/38/EC sets common rules on annual taxes for heavy goods vehicles (above 12 tonnes). The Directive provides minimum rates for the annual vehicle tax on heavy goods motor vehicles and vehicle combinations (articulated vehicles and road trains) in accordance with the number and the configuration of axles and with the maximum permissible gross laden weight. The structure of taxes and the procedures for levying and collecting them fall under the exclusive competence of national authorities. For the 'representative HGV' chosen for this study, the minimum tax rate would be €515/year.

registration, with newer vehicles benefitting from modern technologies and the lower ratio CO₂/engine size this provides them with.

Treatment of diesel vehicles differs significantly between Member States. Countries that have a tax based on CO₂ emissions only, favour the use of diesel powered vehicles. The list includes France (only company cars), Greece, Ireland, Malta and the UK. The Netherlands and Sweden on the other hand impose much heavier charges on diesel than on gasoline powered vehicles. Finland does both: a pure CO₂ based tax for all vehicles, plus an additional tax for diesel vehicles only, which adds up to a situation similar to that in the Netherlands and Sweden.

Specific targeting of company owned vehicles takes place in France, Latvia and the Slovak Republic.

Taxation of heavy goods vehicles is mainly based on GVW, axle configuration and suspension type, clearly targeting road infrastructure externalities. However, as annual vehicle taxes are in no way related to distance driven this is a very crude way of internalisation. Countries using only GVW as the charge base are missing an important part of the correlation between vehicle properties and infrastructure damage, as a 20-tonne two-axle truck will likely cause much more road damage than a 40-tonne, 6 axle vehicle. Most countries in this case do include additional parameters for vehicle emissions (EURO class mainly), to create additional internalisation there. Ireland (which has relatively few very heavy freight vehicles) and Greece are the exceptions.

Table 11 provides an overview of the tax structure of ownership taxes in the various member States. Table 12 and Figure 3 show the ownership tax levels for the exemplary vehicle types selected in section 2.1.

Table 11: Parameters used for calculating vehicle ownership taxes (for 2012)

Country	Remarks	Parameter						
		CO ₂	Euro/ EURO	Fuel type	Engine size/ power	Weight	Configuration	Age
Austria	Engine related Insurance Tax				P (kW)			
Austria	Vehicle Tax				F (kW)	F		
Belgium					P (cc)	F	F	
Bulgaria			f		P (kW)	F	F	p
Cyprus		P			p (cc)			
Czech Republic					p (cc)	F	F	
Denmark	Green owner's tax	P		p				
Denmark	Weight tax					F	F	
Estonia						F	F	
Finland	Motor Vehicle tax When CO ₂ is not known, weight is the secondary option.	P						
Finland	Power tax			P		P, F	F	
France	Axle tax/TSVR					F	F	
France	Annual Malus	P						
France	Company car tax older cars: based on fiscal horsepower	P						
Germany		P	p, F	p	p (cc)	F		
Greece	older cars: based on engine size	P				F		
Hungary			f		p (kW)	F		p
Ireland	older cars: based on engine size	P				F		
Italy			p		p (kW)	F	F	
Latvia	Company car tax				P (cc)			
Latvia					p (cc, kW)	P, F	F	
Lithuania						F	F	
Luxemburg	older cars: based on engine size	P		p		F	F	
Malta	older cars: based on engine size	P	p	p		F	F	p, f
Netherlands				p		P, F	F	
Poland						F	F	
Portugal	older cars: based on engine size and fuel type	P			p (cc)	F	F	p, f
Romania					p (cc)	F	F	
Slovak Republic	business vehicles only				p (cc)	F	F	
Slovenia			p		p (cc), f (kW)	f		
Spain					p, f (cc)	f		
Sweden	older cars: based on weight and fuel type	P	p	p		F	F	
United Kingdom	older cars: based on engine size	P	f			F	F	

Note: The most important parameters for passenger and freight vehicles are indicated by the letters "P" and "F" respectively. Secondary parameters are noted with "p" and "f".

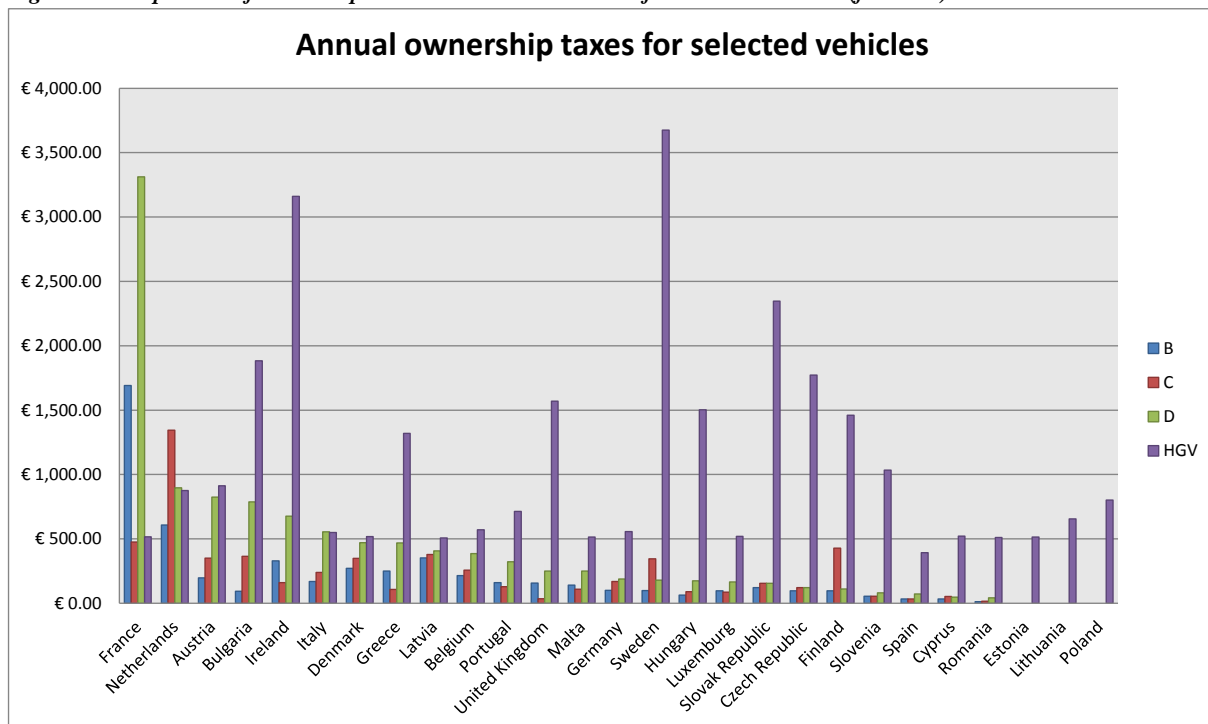
Table 12: Ownership tax levels for representative vehicles (for 2012)

Country	Remarks	B	C	D	HGV
Austria	Engine related Insurance Tax	€ 198.00	€ 349.80	€ 825.00	-
Austria	Vehicle Tax	-	-	-	€ 912.00
Belgium		€ 215.42	€ 256.61	€ 385.84	€ 571.00
Bulgaria		€ 92.77	€ 363.78	€ 787.13	€ 1,883.63
Cyprus		€ 32.54	€ 53.51	€ 47.82	€ 521
Czech Republic		€ 96.47	€ 120.59	€ 120.59	€ 1,772.65
Denmark	Green owner's tax	€ 271.42	€ 349.35	€ 470.28	
Denmark	Weight tax	-	-	-	€ 517.85
Estonia		-	-	-	€ 515.20
Finland	Motor Vehicle tax When CO ₂ is not known, weight is the secondary option.	€ 96.73	€ 86.51	€ 110.23	-
Finland	Power tax	€ 0.00	€ 342.30	€ 0.00	€ 1,460.00
France	Axle tax/TSVR	-	-	-	€ 516.00
France	Annual Malus	€ 0.00	€ 0.00	€ 0.00	-
France	Company car tax older cars: based on fiscal horsepower	€ 1,690.50	€ 476.00	€ 3,312.00	-
Germany		€ 101.20	€ 169.81	€ 187.98	€ 556.00
Greece	older cars: based on engine size	€ 249.90	€ 107.10	€ 469.20	€ 1,320.00
Hungary		€ 63.26	€ 90.20	€ 174.55	€ 1,503.57
Ireland	older cars: based on engine size	€ 330.00	€ 160.00	€ 677.00	€ 3,160.00
Italy		€ 168.48	€ 240.24	€ 555.04	€ 549.92
Latvia	Company car tax	€ 321.49	€ 321.49	€ 321.49	-
Latvia		€ 31.02	€ 56.40	€ 86.01	€ 507.61
Lithuania		-	-	-	€ 654.54
Luxemburg	older cars: based on engine size	€ 97.02	€ 85.68	€ 165.60	€ 520.00
Malta		€ 140.00	€ 110.00	€ 250.00	€ 515.00
Netherlands		€ 608.00	€ 1,344.00	€ 896.00	€ 876.00
Poland		-	-	-	€ 801.32
Portugal	older cars: based on engine size and fuel type	€ 160.78	€ 128.43	€ 321.55	€ 713.00
Romania		€ 13.02	€ 14.88	€ 41.86	€ 510.92
Slovak Republic	business vehicles only	€ 121.77	€ 155.36	€ 155.36	€ 2,347.25
Slovenia		€ 54.55	€ 54.55	€ 80.81	€ 1,033.74
Spain		€ 34.08	€ 34.08	€ 71.94	€ 392.74 ²²
Sweden	older cars: based on weight and fuel type	€ 98.26	€ 344.66	€ 179.05	€ 3,675.54
United Kingdom		€ 157.05	€ 34.90	€ 250.12	€ 1,570.50

Note: For definition of vehicles, see section 2.1.

²² Please note that this relates to "Impuesto sobre Vehículos de Tracción Mecánica". It does not take into account the "Impuesto sobre actividades economicas" included in the scope of the Eurovignette Directive for the calculation of minima, and which would amount to € 404.56.

Figure 3: Comparison of ownership taxes in EU Member States for selected vehicles (for 2012)



Note: For definition of the selected vehicles, see section 2.1.

2.4. Infrastructure charges

The European Union sets the conceptual framework for the harmonisation of road user charges for HDVs with Directive 1999/62/EC (later amended by Directive 2006/38/EC and Directive 2011/76/EU), also known as the Eurovignette Directive. Several Member States have taken action since then, implementing policies to charge road vehicles for the use of the infrastructure. This came on top of a handful of Member States which already applied a form of road charging prior to the EU's actions, mostly through privatised firms managing certain sections of infrastructure.

Multiple internalisation targets can be achieved with distance-based infrastructure charges or road tolls:

- Infrastructure costs: particularly when charges are differentiated to axle load.
- Air pollution costs: particularly when charges are differentiated to fuel type and Euro/EURO class
- Noise costs: ideally charges should then be differentiated to noise emission class and day/night, however in practice such a differentiation is not sufficiently well developed yet.
- Congestion costs: this requires charges that are differentiated to road section and time of the day (or ideally even the actual congestion level).

Distance-based systems for heavy duty transport only are used in Germany, Austria, the Czech Republic, the Slovak Republic, Poland (national roads network) and Slovenia. Furthermore France, Greece, Ireland, Italy, Poland (toll motorway), Portugal and Spain have systems in place that charge all road users on specific parts of the road network. Several countries are preparing to set up or upgrade their system in the coming years, as Figure 4 and Figure 5 illustrate.

Figure 4: Overview of road charging systems for Heavy Goods Vehicles in the EU (2012)

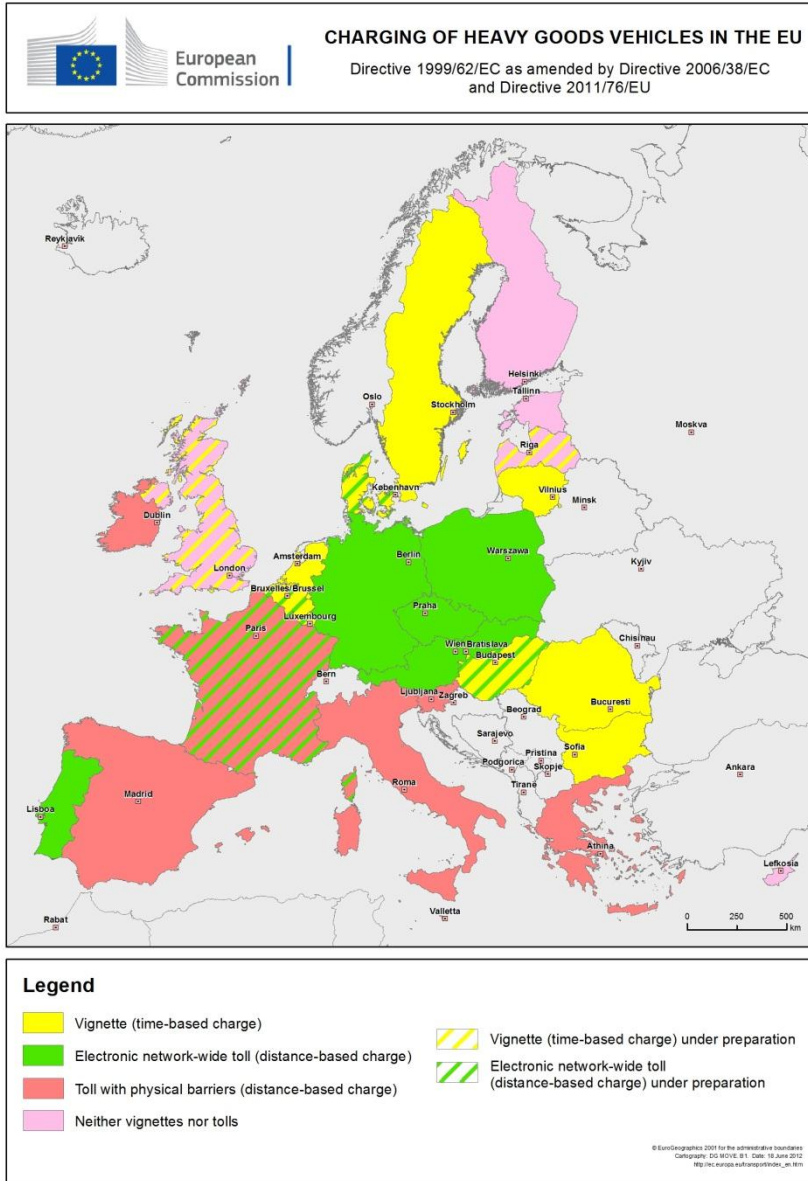


Table 13: Infrastructure charge per km (equivalent) for HGV (based on data in Table 14) (source: own calculation)

Country	HGV toll/km
Austria	€ 0.30
Czech republic	€ 0.17
France	€ 0.21
Germany	€ 0.16
Greece	€ 0.09
Italy	€ 0.16
Poland	€ 0.06
Slovak Republic	€ 0.19
Slovenia	€ 0.25
Spain	€ 0.29

The implementation of the system varies between countries. Older systems mainly use toll booths or toll plazas (with electronic subscription services). Also in cases where a limited part of the network is tolled, or the management of the system is in the hands of several small operators, a system with toll booths is mostly used. Newer systems are often GPS/microwave-technology based, with mandatory on board units (OBUs) for vehicles driving in those countries. Austria, Germany, the Czech Republic, the Slovak Republic, Poland and Portugal all use systems with OBUs (where tolls are collected at toll plazas, the use of an OBU is often optional for customers which want to use the electronic payment lanes). The Czech Republic is the only one to have a network-wide rate differentiation based on the time of using the infrastructure (higher rate on Friday evening). In other countries (France, Spain, Austria, Slovenia) time-based differentiation is applied on certain parts of the network.

It should be noted that several countries charge for the use of specific infrastructure outside the standard road pricing schemes. Examples include the Oresund Bridge between Denmark and Sweden, the M6 in the UK, and various tunnels in Belgium, the Netherlands and of course in the Alps.

Apart from distance-based charges (kilometre charges or tolls), there are also time-based road access charges (vignettes). Time-based charges have the advantage of providing a steady income for the infrastructure operator (mostly the state) at low operational costs, as further follow up requirements are limited. However, as time-based charges do not well correlate with the external costs, they are not a proper means for internalisation of external costs: once the charge is paid, access to and use of the infrastructure is unlimited. Differentiation can be made based on one or more of the design parameters, but only at the moment of purchase of the vignette.

The Eurovignette for heavy goods vehicles with GVW over 12,000 kg is the prime example of an international application of this system, and is valid in Belgium, Denmark, Luxemburg, the Netherlands and Sweden. It differentiates on EURO class of the vehicles. Austria, Bulgaria, the Czech Republic, Hungary, Romania, the Slovak Republic and Slovenia all use national vignettes for passenger cars. Trucks in Bulgaria, Hungary, Lithuania and Romania are subject to the same system (albeit at a much higher rate), the other countries use distance-based systems for heavy duty transport. Table 14 shows the charge levels of road infrastructure charges for the representative vehicles. All time-based charges are given based on the rate for 1 year.

Table 14: Road user charge levels for representative vehicles (for 2012)

Country	Charge description	Vehicle B	Vehicle C	Vehicle D	HDV (vignette per year)	HDV (distance-based charge for selected road sections)
<i>Time-based</i>						
Austria	vignette	€ 77.80	€ 77.80	€ 77.80		
Belgium	Eurovignette				€ 1,250.00	
Bulgaria	vignette	€ 34.26	€ 34.26	€ 34.26	€ 664.69	
Czech Republic	vignette	€ 60.29	€ 60.29	€ 60.29		
Denmark	Eurovignette				€ 1,252.03	
Hungary	vignette	€ 145.94	€ 145.94	€ 145.94	€ 797.79	
Luxemburg	Eurovignette				€ 1,250.00	
Netherlands	Eurovignette				€ 1,250.00	
Romania	vignette	€ 28.00	€ 28.00	€ 28.00	€ 1,210.00	
Slovak Republic	vignette	€ 50.00	€ 50.00	€ 50.00		
Slovenia	vignette	€ 95.00	€ 95.00	€ 95.00		
Sweden	Eurovignette				€ 1,257.97	
<i>Distance-based</i>						
Austria	distance-based HDV charge (100 km Maut)					€ 30.45
Czech Republic	distance-based HDV charge (100 km daytime)					€ 16.56
France	road toll (Paris-Lille, 221 km)	€ 15.40	€ 15.40	€ 15.40		€ 45.30
Germany	distance-based HDV charge (100 km Maut)					€ 15.50
Greece	road toll (120 km Korinthos-Patras)	€ 3.10	€ 3.10	€ 3.10		€ 11.00
Ireland	road toll (M1, 87 km)	€ 1.80	€ 1.80	€ 1.80		€ 5.90
Italy	road toll (plain roads, 100 km)	€ 6.42	€ 6.42	€ 6.42		€ 15.60
Poland	road toll (100 km)	€ 2.28	€ 2.28	€ 2.28		€ 6.16
Portugal	road toll (A25 Portico 9, max 21 km)	€ 1.85	€ 1.85	€ 1.85		€ 4.60
Slovak Republic	distance-based HDV charge (100 km)					€ 18.90
Slovenia	road toll (Kompolja-Tepanje, 121.9 km)					€ 30.60
Spain	road toll (Barcelona-Tarragona, 100.36 km)	€ 12.97	€ 12.97	€ 12.97		€ 28.66
United Kingdom	road toll (M6, 43 km)	€ 6.40	€ 6.40	€ 6.40		€ 12.80

2.5. Insurance taxes

Insurance taxes could be seen as a measure to internalise accident costs. Almost all countries use this mechanism to generate income. Just under half of the countries foresee earmarking of a part of the revenues for health- or emergency service-related funds, and some also for funds related to the insurance sector. Rates and earmarking practices are summarised in Table 15. The overview shows very large differences between Member States.

Pay-as-you-drive insurance policies could also be seen as a way to better internalise road safety externalities. However, as these are not policy instruments, they are not covered in this study.

Table 15: Insurance tax levels in the EU (for 2012)

Country	Tax rate	Remark
Austria	11.00%	Engine related insurance tax exists as well.
Belgium	27.10%	Basic rate: 10%. Of the rest, 17.5% earmarked for a health risk related fund (INAMI), 0.35% for the Red Cross. The basic rate is reduced for commercial vehicles.
Bulgaria	2.00%	
Cyprus	5.00%	Fully earmarked for the Motor Guarantee Fund. Stamp duty of € 1.71 is also levied.
Czech Republic	0.00%	
Denmark	42.90%	Standard rate. Lorries are exempt, buses pay 34.4%, mopeds pay DKK 230/year).
Estonia	0.00%	
Finland	23.00%	
France	34.20%	16.2% is earmarked for road transport risk related funds.
Germany	19.00%	
Greece	18.00%	18% on the part of the insurance related to liability, 5% of which is earmarked for the Motor Guarantee fund.
Hungary	1.50%	Fully earmarked for the Fire Brigade Tax.
Ireland	5.00%	2% is earmarked for special funds for the insurance sector.
Italy	25.35%	10.5+2.5% is earmarked for road transport risk and health related funds.
Latvia	0.00%	
Lithuania	15.00%	
Luxemburg	4.00%	
Malta	10.00%	
Netherlands	9.70%	
Poland	0.00%	
Portugal	26.74%	17.5% is earmarked for various health and road transport related funds, 0.242% for the insurance sector.
Romania	1.50%	Fully earmarked for the Motor Guarantee Fund.
Slovak Republic	8.00%	Fully earmarked as a Fire Brigade levy.
Slovenia	6.50%	
Spain	8.15%	2.15% is earmarked for special funds of the Insurance sector (financial risks).
Sweden	32.00%	
United Kingdom	6.00%	

2.6. VAT exemptions and discounts

Table 16 lists the VAT rates that are applied in the various Member States on road transport services (like bus transport, taxis etc.). Rates are provided for both domestic and intra-community and international services. The overview shows that for domestic transport services, usually either the standard VAT rate of the low VAT rate applies. International road transport is often exempted from VAT.

Table 16: VAT rates (%) applied to road transport services in EU Member States, 2012

Country	Domestic transport	Intra-community and international transport	Standard general rate
Austria	10	20	20
Belgium	6	6	21
Bulgaria	20	0	20
Cyprus	5	0	17
	8		
	17		
Czech Republic	14 ⁽¹⁾	0	20
	20		
Denmark	Exemption	0	25
	25		
Estonia	20	0	20
Finland	9	0	23
France	7	0	19.6
Germany	19	19	19
	7	7	
Greece	13	13	23
Hungary	27	0	27
Ireland	Exemption	0	23
Italy	10	0	21
	Exemption		
Latvia	12	0	21
Lithuania	21	0	21
Luxembourg	3	0	15
Malta	0	Not applicable	18
	18		
Netherlands	6	6	21
Poland	8	0	23
Portugal	6	0	23
Romania	24	0	24
Slovakia	20	0	20
Slovenia	8.5	0	20
Spain	8	8	18
Sweden	6	0	25
UK	0	0	20

Source: European Commission, VAT rates applied in the Member States of the European Union, Situation at 1st July 2012.

Notes: (1) 10% applies only on regular transport.

2.7. Other measures

Member States have developed several other pricing measures that are relevant within the scope of this study.

The design of the **benefit in kind that is attributed to company cars** used for private trips by employees can be an important element in influencing vehicle sales. As on average half of all new cars is a company car, environmental incentives can have significant impact on the vehicle fleet. Revenues of this

form of income taxes are always intended for the general public budget, no mention of earmarking was found.

Almost all countries tax the employee for the private use of a company car based on the value of the vehicle. This does not constitute internalisation as such, as it is not related in any way to how much the vehicle is used, but it can be regarded as a compensation for a hidden subsidy. The treatment of fuel used during private trips by company cars is therefore an important element that can compensate for this lack of differentiation.

Only a few countries are directly including CO₂ emissions in determining the amount of fringe benefits derived from the personal use of a company car: Belgium, the Netherlands and the UK. The value of the vehicle is still the starting point, but the CO₂ emission levels (and the fuel type) determine the percentage of that value that is added to the employee's taxable income.

Denmark and Sweden have systems in place that also account for environmental qualities of the vehicles, but in an indirect way. In France, the company car tax (which was included in the section on ownership taxes) covers that part of the vehicle fleet.

A few countries have **purchase premiums** in place to support the sales of environmentally friendly vehicles. In most of them, this takes the form of a reduction of the registration tax. Three countries do not have registration charges, but do give premiums for such vehicles: Luxemburg (between €750 and €4,000), Sweden (SEK 40,000) and the UK (25% of purchase price up to £5,000).

A few cities within the EU have a **local congestion charging scheme**. City access charges are in place in a few European city centres; London, Stockholm and Milano are the best known examples. London and Milano also include environmental properties of the vehicle in setting the charge level. Recently an in-depth study on urban congestion charging and parking fees has been completed by Ecorys and CE Delft (commissioned by DG MOVE)²³.

2.8. Special treatment of electric vehicles and hybrids

Greater use of electric and (plug-in) hybrid vehicles is one of the key aspects of the 2011 Transport White Paper on Transport²⁴.

Several Member States are trying to contribute by including special rates for these vehicle types in national road vehicle taxation, mainly at the level of registration or ownership taxes, see Table 17.

Table 17: Special treatment of electric vehicles and hybrids (for 2012)

Country	Tax type	Special treatment
AT	Registration	Tax bonus of €500 for hybrid, biofuel type E 85, in the form of methane in the form of LNG, CNG or LPG, or hydrogen vehicles; tax for electric vehicles is equal to 0.
BE	Registration	Electric vehicles and PHEV are exempt from the BIV in Flanders.
BE	Registration	Private persons who purchase a passenger car that is powered exclusively by an electric motor receive a personal income tax reduction of 30% of the purchase price (with a maximum of € 9,510).
DK	Registration	Hybrids are not exempt; electric/hydrogen vehicles are if they weigh less than 2,000 kg.
FI	Registration	Electric vehicles pay the minimal tax, equal to 5% of retail value of the vehicle (Car tax).
FR	Registration	Vehicles with CO ₂ emissions below 50g/km get a €5,000 eco-bonus; hybrids with emissions below 105g/km get a €2,000 eco-bonus.

²³ Study on Urban Aspects of the Internationalisation of External Costs, ECORYS/CE Delft, 2012.

GR	Registration	Hybrids and electric vehicles are exempt.
HU	Registration	There are special low rates for electric and hybrids vehicles (also for CNG/LPG powered vehicles)
IE	Registration	Tax relief is given to hybrids (€1,500), plug-in hybrids (€2,500) and electric vehicles (€5,000). Only for electric vehicles still after 2012.
LV	Registration	Electric vehicles are exempt.
LU	Registration	Purchasers of electric vehicles (or other vehicles emitting 60 g/km or less of CO ₂) receive a premium of € 5,000 (PRIME CAR-e) until 31 December 2012.
MT	Registration	Electric and hybrid vehicles have a tax rate equal to 0.
NL	Registration	Electric vehicles are exempt, as are low emission vehicles (<102g/km for gasoline, <70g/km for diesel).
PT	Registration	Hybrids and electric vehicles get a 50% discount.
RO	Registration	Hybrids and electric vehicles have a rate equal to 0.
SI	Registration	Hybrids and electric vehicles are treated like gasoline cars.
ES	Registration	Hybrids and electric vehicles have a rate equal to 0. Many regions subsidise the purchase of these vehicle types.
SE	Registration (subsidy)	The "Super green car premium" of SEK 40,000 is applied both for the purchase by private persons and companies. For companies purchasing a super green car, the premium is calculated as 35% of the price difference between the super green car and a corresponding petrol/diesel car, with a maximum of SEK 40,000.
UK	Registration (subsidy)	Purchasers of electric vehicles and plug-in hybrid vehicles with CO ₂ emissions below 75 g/km receive a premium of £5,000 (maximum) or 25% of the value of a new car or £8,000 (maximum) or 20% of the value of a new LCV meeting eligibility criteria (for example, minimum range 70 miles for electric vehicles, 10 miles electric range for plug-in hybrid vehicles).
AT	Ownership	Electric vehicles are exempt from the engine related insurance tax
CZ	Ownership	Electric road vehicles, hybrid vehicles (electricity + combustion engine), vehicles running on LPG or CNG gas, E85 fuel (gasoline + ethanol) are exempt from the tax.
FR	Ownership	Electric vehicles are exempt from the company car tax. Hybrid vehicles emitting less than 110 g/km are exempt during the first two years after registration.
DE	Ownership	Electric vehicles are exempt the first 5 years after registration, and get a 50% reduction after that.
GR	Ownership	All reductions/exemptions for electric or hybrid vehicles were recently cancelled.
IT	Ownership	Electric, LPG and CNG vehicles are 100% exempt from the ownership tax the first 5 years, and 75% exempt afterwards in many regions.
LV	Ownership	All vehicles propelled with electromotors (including BEVs and PHEVs) are exempt.
LU	Ownership	Electric vehicles have a rate equal to 0.
MT	Ownership	Electric vehicles have a rate equal to 0.
NL	Ownership	Exemptions for low emission vehicles are still in effect, but will decrease and disappear completely by 2015. A correction for the additional weight of the battery for electric vehicles is maintained.
PT	Ownership	Vehicles exclusively powered with electricity or a renewable energy (other than a fuel) are exempt.
SE	Ownership	Electric vehicles consuming no more than 37 kW/100km, along with other "green cars", are exempt for the first 5 years.
UK	Ownership	The rate for alternatively fuelled vehicles is equal to 0.
SE	Other	For electric and plug-in hybrid vehicles, the taxable value of the car for the purposes of calculating the benefit in kind of a company car under personal income tax is reduced by 40% compared with the corresponding or comparable petrol or diesel car. The maximum reduction of the taxable value is SEK 16,000 per year.
UK	Other	Electric cars are exempt from company car tax until April 2015 and electric vans are exempt from the van benefit charge until that date too.

2.9. Earmarking of revenues

The practice of reserving all or part of the revenues of a tax for a specific purpose is known as earmarking. In transport and environmental taxation, this is not an uncommon phenomenon. Table 18 below highlights all forms of earmarking that could be identified for road transport, except for insurance tax revenues which are already discussed in section 0. Particularly the Czech Republic, but also Latvia and Lithuania have instated several forms of earmarking. Other countries may also apply this, but not explicit mentions were found.

Table 18: Applications of earmarking of road tax revenues (for 2012)

Country	Tax type	Earmarking
AT	Fuel	Revenues were earmarked for road infrastructure maintenance until 1987, now they go into the general public budget.
CZ	Fuel	9.1% of the revenues are earmarked for the state fund of Transport Infrastructure
FR	Fuel	Part of the extra regional tax (0.73€/l for gasoline and 1.35€/l for diesel) is earmarked for transport infrastructure (not just road).
LT	Fuel	A part of the revenues is earmarked for the Road Maintenance and Development Programme (in 2009: 55%).
PL	Fuel	A “fuel fee”, earmarked for road construction, of PLN 95.19/1,000 l for gasoline and PLN 239.84/1,000 l for diesel is included in fuel tax.
PT	Fuel	Part of the revenue is earmarked for the Forestry Permanent Fund (€ 0.005/l gasoline, and € 0.0025/l diesel, up to a ceiling of 30 million euro)
CZ	Registration	The revenue from the EURO class based surcharge is earmarked for supporting the collection, processing, utilization and liquidation of car wrecks.
RO	Registration	Revenues are earmarked for the National Environmental Fund.
CZ	Ownership	Revenues are earmarked for maintenance, repairs and building of highways and first class roads.
LV	Ownership	Revenues are earmarked for the Traffic Road Fund, and are used for reconstruction of roads. Revenues are shared between state road fund (70%) and municipal road funds (30%).
LT	Ownership	Revenues are earmarked for the Road Maintenance and Development Programme.
AT	Infrastructure	All revenues are earmarked for construction and maintenance of roads of national importance.
BG	Infrastructure	Revenues are earmarked for operation and maintenance costs for the national road network.
CZ	Infrastructure	Revenues are earmarked for road construction and maintenance.
DE	Infrastructure	Revenues are in principle earmarked for the improvement and maintenance of the transport system. The costs for operating and administrating the system also need to be paid from its revenues. Furthermore, € 150 million of the revenues goes to the general budget, as well as up to € 450 million to government programs for employment, training, environment and safety in the road freight sector which is subject to the toll.
LT	Infrastructure	Revenues are earmarked for the Road Maintenance and Development Programme.
RO	Infrastructure	Revenues are earmarked for road construction and maintenance.

2.10. Administrative costs

Administrative costs of tax collection depend on the complexity of the system, which is mainly determined by the amount of tax payers and the (physical) requirements for tax collection. The relative cost of administration is of course also influenced by the level of the tax itself: increasing the tax level, *ceteris paribus*, makes for a lower share of administrative costs.

Fuel taxes are collected at the level of the distributors, which limits the amount of tax payers. Ownership and registration taxes are collected for each individual vehicle, making the system a lot more complex from that perspective. In both cases, physical requirements are fairly straightforward. For fuel tax, the

sales volume per fuel type is needed. Vehicle taxes are based on standardised properties of the vehicles. Road user charging can be more complex – at least for distance-based charging – , as it requires additional efforts in setting the system up physically, be it with toll booths, automatic licence plate recognition or microwave gates or GPS tracking.

In a 2007 conference paper²⁴, Pavel and Vitek gave estimates of administrative costs of the Czech system of environmental charges for the year 2004. For fuel taxes, the administrative costs are around 0.64%. The administrative costs of motor vehicle taxation would be 6.47%, about ten times as much. In a 2001 publication²⁵, Smulders and Vollebergh refer to a study by Sandford, Godwin and Hardwick²⁶ of 1989, in which data were published on administrative costs in the UK. Table 3.4 of the Smulders and Vollebergh paper gives the values²⁷:

Table 3.4 **Relative Administrative and Compliance Costs of Different Types of Taxes (% of total revenue)**

Tax or Group	Administrative Costs	Compliance Costs	Total Operating Costs
Income tax	1.53	3.40	4.93
VAT	1.03	3.69	4.72
Corporation tax	0.52	2.22	2.74
Petroleum revenue tax	0.12	0.44	0.56
Excise duties (hydrocarbon oils; tobacco, alcoholic drinks)	0.25	0.20	0.45
Minor taxes (stamp duty, cars, betting and gambling)	0.85	1.48	2.33

Source: Sandford, Godwin, and Hardwick (1989, 192).

The ratio of car tax administration cost to fuel tax is just over 7, which is very comparable to the value found for the Czech Republic in 2004. There is a great difference in the absolute values though, which could have several causes.

For other countries, information of this level of detail was not available. However, the OECD regularly publishes reports on the tax administrations of its member countries. The latest version dates from 2011, and contains a table with the administrative costs of general tax collection. The Czech Republic in 2005 has an average of 1.29%, which can be compared to the values given above for fuel taxes and motor vehicle taxes individually. For the UK values, the time difference of 20 years is too great for a valid comparison. Average administrative cost levels in the UK are remarkably lower than in the Czech Republic though.

²⁴ Downloadable on <http://www.worldcotax.org/downloads/Presentations/PavelVitek.pdf>.

²⁵ “Green Taxes and Administrative Costs: The Case of Carbon Taxation”, Sjak Smulders, Herman R.J. Vollebergh, NBER Working Paper No. 7298, <http://www.nber.org/chapters/c10606.pdf>

²⁶ “Administrative and Compliance Costs of Taxation”, Sandford, Godwin and Hardwick, 1989.

²⁷ Administrative costs are the costs incurred by the tax receiver, compliance costs are the costs incurred by the tax payer.

Table 19: OECD overview of administrative costs of general tax collection

Country	Administrative costs for tax functions/net revenue collections (costs per 100 units of revenue)										Trend	Abnormal or unusual factors likely or known to influence reported ratio
	2001	2002	2003	2004	2005	2006	2007	2008	2009			
1) OECD countries												
Australia/2	1.06	1.07	1.05	1.05	1.03	0.99	0.93	0.96	1.02	Unclear		
Austria	0.71	0.72	0.91	0.78	0.66	0.65	0.64	0.79	0.85	Increasing	High tax burden; revenue base <u>excludes</u> social security contributions (SSCs).	
Belgium	n.avail.	n.avail.	n.avail.	1.89	1.42	1.35	1.40	1.27	1.40	Unclear	Revenue <u>excludes</u> SSCs.	
Canada	1.08	1.20	1.33	1.17	1.31	1.35	1.22	1.14	1.33	Unclear	Revenue includes SSCs	
Chile	n.avail.	n.avail.	0.89	0.88	0.69	0.63	0.60	0.66	0.90	Unclear	Revenue <u>excludes</u> SSCs. Costs exclude tax debt collection function carried out by separate agency	
Czech Rep.	n.avail.	2.08	n.avail.	n.avail.	1.29	1.38	1.25	1.18	1.46	Unclear	Revenue <u>excludes</u> SSCs & , from 2004, excises .	
Denmark	n.avail.	0.73*	0.87	0.83	0.74	0.63	0.62	0.64	0.67	Unclear	High tax burden; revenue includes VAT on imports; *2002 excludes municipalities.	
Estonia/2	Data not collected for any of these years.				1.03	0.88	0.86	0.38	0.40	Unclear	Revenue includes SSCs & costs for customs to 2007	
Finland	0.77	0.82	0.82	0.80	0.79	0.78	0.77	0.80	0.87	Increasing	High tax burden; revenue includes SSCs	
France	1.41	1.44	1.41	1.35	1.07	1.23	1.20	1.17	1.31	Increasing	Revenue <u>excludes</u> SSCs	
Germany	n.avail.	n.avail.	n.avail.	n.avail.	0.86	0.83	0.78	0.75	0.79	Unclear	Revenue <u>excludes</u> SSCs	
Greece	n.avail.	n.avail.	1.65	1.69	n.avail.	n.avail.	n.avail.	n.avail.	n.avail.	Unclear	Revenue <u>excludes</u> SSCs; cost base includes some non-tax administration costs	
Hungary	1.23	1.35	n.avail.	1.14	0.99	1.11	1.15	1.17	1.20	Increasing	Revenue includes SSCs	
Iceland	n.avail.	1.12	1.06	1.02	n.avail.	n.avail.	n.avail.	0.28	0.32	Decreasing	Revenue includes SSCs	
Ireland	0.90	0.95	0.91	0.86	0.82	0.78	0.79	0.95	1.08	Increasing	Costs include customs; revenue includes SSCs and VAT on imports.	
Israel	Data not collected for any of these years.							0.75	0.79	Unclear		
Italy	n.avail.	n.avail.	n.avail.	n.avail.	1.36	1.24	1.16	1.08	1.20	Unclear	Revenue <u>excludes</u> SSCs. Costs exclude tax fraud work carried out by GDF and debt collection.	
Japan	1.42	1.54	1.66	1.67	1.58	1.45	1.43	1.49	1.71	Increasing	Relatively low tax burden; revenue <u>excludes</u> SSCs.	
Korea	0.85	0.85	0.82	0.86	0.81	0.79	0.71	0.79	0.84	Increasing	Revenue <u>excludes</u> SSCs.	
Luxembourg/2	n.avail.	n.avail.	n.avail.	1.59	1.42	1.25	1.18	1.01	1.13	Unclear	Revenue <u>excludes</u> SSCs.	
Mexico/2	n.avail.	1.44	1.41	1.29	1.18	1.06	0.95	0.43	0.58	Decreasing	Revenue & costs include customs. Big increase in tax revenues from 2005, costs exclude IT capital costs	
Netherlands	1.74	1.76	1.39	1.30	1.35	1.15	1.11	0.99	1.11	Decreasing	Revenue includes SSCs (including new categories from 2006) and VAT on imports	
N. Zealand	0.90	0.87	0.83	0.81	0.76	0.71	0.75	0.76	0.88	Increasing		
Norway	0.56	0.59	0.59	0.56	0.72	0.71	0.67	0.54	0.50	Decreasing	High tax burden; revenue includes SSCs	
Poland	1.50	1.78	1.95	2.62	1.93	1.75	1.42	1.59	1.72	Increasing	Costs and revenue <u>include</u> customs operations; revenue <u>excludes</u> SSCs	
Portugal	1.61	1.68	1.51	1.49	1.59	1.43	1.41	1.17	1.44	Decreasing	Revenue <u>excludes</u> SSCs, excises and local taxes.	
Slovak Rep.	1.43	1.46	1.45	1.26	2.43	2.49	2.41	n.avail.	n.avail.	Unclear	Revenue <u>excludes</u> SSCs & , after 2004, excise	
Slovenia	1.14	1.13	1.17	1.05	0.93	0.98	0.83	0.81	0.90	Decreasing	Revenue includes SSCs	
Spain	0.81	0.78	0.83	0.82	0.74	0.68	0.65	0.82	0.97	Increasing	Revenue & costs include customs operations	
Sweden/2	0.55	0.56	0.57	0.59	0.38	0.39	0.41	0.39	0.40	Constant	High tax burden, revenue includes SSCs; from 2005, costs exclude debt collection)	
Switzerland	n.avail.	n.avail.	0.66	0.62	0.30	0.29	0.28	0.31	0.31	Constant	Revenue & costs relate almost exclusively to VAT	
Turkey/2	0.81	0.72	0.74	0.83	0.87	0.84	0.83	0.85	0.93	Increasing	Revenue <u>excludes</u> SSCs	
UK	1.06	1.11	1.04	0.97	1.10	1.12	1.10	1.12	1.14	Constant	Data to 2004 refer to direct taxes administration only.	
USA/2	0.46	0.52	0.57	0.56	0.52	0.47	0.45	0.49	0.61	Unclear	Revenue includes SSCs; no national VAT	
2) Selected non-OECD countries												
Argentina	0.88	0.86	0.85	0.83	1.60	1.62	1.84	0.93	1.14	Unclear	Revenue/costs include customs from 2005	
Bulgaria	Data not collected for any of these years from these revenue bodies.				6.49	3.19	1.29	1.28	1.37	Decreasing	New tax collection responsibilities from 2006 (i.e. SSC's), and new vat collection procedures)	
China	Data not collected for any of these years from these revenue bodies.				n.avail.	n.avail.	n.avail.	n.avail.	n.avail.	Unclear		
Cyprus	Data not collected for any of these years from these revenue bodies.				5.7	5.1	5.8	5.00	7.37	Increasing	Revenue <u>excludes</u> SSCs.	
India	Data not collected for any of these years from these revenue bodies.				n.avail.	n.avail.	n.avail.	0.69	0.75	Unclear	Direct taxes only	
Indonesia	Data not collected for any of these years from these revenue bodies.				n.avail.	n.avail.	n.avail.	0.64	0.58	Decreasing		
Latvia	Data not collected for any of these years from these revenue bodies.				1.24	1.19	1.31	1.13	1.14	Decreasing	Revenue base includes SSCs	
Lithuania	Data not collected for any of these years from these revenue bodies.				1.42	1.24	1.15	1.07	1.18	Decreasing		
Malaysia	Data not collected for any of these years from these revenue bodies.				1.20	1.14	1.29	1.04	1.41	Unclear		
Malta	n.avail.	n.avail.	0.85	0.83	1.14	1.09	0.97	0.43	0.48	Unclear	Revenue & costs only for direct taxes administration. Revenue includes SSCs. Direct taxes only for 2003/2004.	
Romania	Data not collected for any of these years from these revenue bodies.				0.63	0.72	0.91	0.81	0.72	Unclear	Revenue includes SSCs and customs. Costs include customs and all other functions.	
Russia/2	Data not collected for any of these years from these revenue bodies.				n.avail.	n.avail.	n.avail.	0.92	1.05	Unclear		
S. Arabia/2	Data not collected for any of these years from these revenue bodies.				n.avail.	n.avail.	n.avail.	1.06	1.26	Increasing	Costs include all non-tax functions.	
Singapore	0.87	0.90	0.99	1.01	1.02	0.93	0.83	0.77	0.80	Unclear	Very low tax burden that excludes the equivalent of SSCs	
S. Africa	n.avail.	n.avail.	1.21	1.25	1.19	1.21	1.02	1.05	1.11	Decreasing	Costs include customs operations; revenue includes VAT on imports and customs duties.	

Administrative costs of road tolls differ significantly from those of fuel taxes or vehicle taxes. As explained above, the first difference is that it usually requires a significant initial investment in tolling infrastructure, which then has to be maintained or updated. The second big difference is that the operation of a tolling system is often managed by one or more private companies.

For France, which uses a toll system with toll booths, the ASFA publishes numbers on the financial situation of its members. The annual revenues for 2010 were € 8.4 billion. Given that the profit margin is around € 1.5 billion²⁸, total expenses are close to € 6.9 billion. Of this sum, about 20% (equivalent to € 1.38 billion) are actual operational costs (the largest categories of expenses are taxes and road maintenance, at 31% each).²⁹ The total ratio of operational costs to revenue is then 16.4%.

²⁸ According to an article in Le Figaro of 18 August 2011, see <http://www.lefigaro.fr/societes/2011/08/18/04015-20110818ARTFIG00515-l-inflation-toujours-plus-rapide-sur-l-autoroute.php>

²⁹ ASFA's key numbers, [http://www.autoroutes.fr/FCKeditor/UserFiles/File/ASFA_chiffres_cles12\(1\).pdf](http://www.autoroutes.fr/FCKeditor/UserFiles/File/ASFA_chiffres_cles12(1).pdf).

In IMPACT D3 (2008), CE Delft studied then current schemes for road pricing. Among others, they estimated costs and revenues for a number of them. The German road charging scheme for HDVs, which had then just started its operations, is based on GPS tracking. Annual revenues were estimated at € 3 billion, while operational costs were about € 600 million. This would produce a ratio of 20%. In 2010, revenues of the system amounted to € 4.5 billion, while operational costs decreased to € 490.724 million, according to a publication by the German Ministry of Finance³⁰. This would bring the ratio to 10.9%. The Austrian system, based on DSRC (Dedicated Short Range Communication), was started in 2004. Its annual revenue was then estimated at € 600 million (2010: € 1,535 million), with operational costs at € 75 million. The ratio of operational costs to revenue was thus about 12.5%. In Switzerland the ratio is considerably lower because of the higher charge rates.

2.11. Conclusions

The drive for better internalisation of external costs has brought about many changes in the way EU Member States handle the taxation of road vehicles. Many countries are moving to measures that better reflect the environmental properties of a vehicle as base of the charging, for example replacing engine size by CO₂ emissions. However, a lot of progress is still possible.

From the perspective of internalisation, the relative importance of periodic taxation, or even better distance-based charging, is higher than that of charging at the moment a vehicle (re)enters the fleet: the use of the vehicle is what creates the externality, not the purchase as such. However, for improving market conditions for fuel efficient vehicles, and taking account of consumer myopia, CO₂ based registration taxes and company car taxes can be very effective to eliminate the cost difference between vehicles with low and high fuel efficiency.

Improvements in vehicle tracking technology can create opportunities for distance-based charging, as several insurance companies in the EU already provide pay-as-you-drive motor vehicle policies, which is essentially based on the same system. Moreover an increasing number of Member States has introduced a distance-based charge for trucks. Road user charging in Europe is starting to take off, also because of advances in technology. Especially in new Member States, road infrastructure development is actively supported by user charging schemes. Time-based systems like the Eurovignette, which is still being used by five EU countries, are likely to be replaced by distance-based systems in the future.

Fuel taxation (mostly in the form of excise duties) dwarfs the revenues of all other motor vehicle charges, at around € 170 billion a year, against € 94 billion for all other road charges combined. The internalisation achieved by levying fuel taxes is ambiguous however. They are an optimal instrument for internalising climate change costs (CO₂). However, internalisation of other externalities such as local air pollution or infrastructure costs are not well achieved by fuel taxation, but rather by differentiated distance-based charges.

³⁰ Bundesfinanzministerium, Bundshaushaltsplan 2010, http://www.bundesfinanzministerium.de/Content/DE/Downloads/Bundshaushaltsplan/Haushaltsplan-2012.pdf?__blob=publicationFile&v=3

3. Rail transport

3.1. Introduction

Approach and main data sources

The inquiry on the internalisation of external costs in the railway sector is focused on:

- a. policies and measures adopted (or close to implementation) to set up the rail usage charges (sometimes also called ‘rail track access charges’) and penalties for delays in each Member State;
- b. the level and structure of taxation of gasoil and electricity levied in the rail sector by Member States’ authorities, including VAT reductions/exemptions.

The analysis concerns all EU Member States with the exception of Cyprus and Malta, where railways do not exist; therefore these two countries do not appear in the tables of this chapter as well as in the factsheets reported in the annex report.

a. Rail usage charges

The research was conducted in two steps:

1. Analysis of relevant documentation/studies/papers on the rail usage charging system adopted in the Member States have been consulted:
 - Network Statements³¹ published by the EU countries infrastructure managers.
 - Railway access charge systems in Europe, Marine Vidaud (EPFL-LITEP) and Guillaume de Tilière (BG Consulting Engineers), Conference paper STRC, September 2010.
 - Rail Diesel Study, UIC, March 2006.
 - IMPACT, Internalisation measures and policy for the external cost of transport, Deliverable 3, 2008.
 - Rail Charging and Accounting Schemes in Europe, Case studies from six countries, EIM, CER, May 2008.
 - ECMT, Railway reform & charges for the use of the infrastructure, 2005.
 - DIFFERENT, User reaction and Efficient differentiation of charges and tolls, Deliverable 7.1, 2006.
 - ENACT, Deliverable 2-Social marginal cost pricing and second-best alternatives, 2007.
2. Request of detailed (and updated) information through a detailed Questionnaire sent to the railway infrastructure managers of the European Member States.

b. Gas oil and electricity taxation in the rail sector

The same approach was adopted for the collection of information related to level and structure of gasoil and electricity taxation and on VAT reductions/exemptions in the different Member States.

1. Analysis of document published by the European Commission: Excise Duty Tables, Part II- Energy products and Electricity, July 2012.

³¹ http://www.rnc.eu/index.php/members_ns.html

2. Request of detailed information to the Member States' national administrations through a short questionnaire.

Instruments applied in the railway sector for internalising external costs

Table 20 shows the instruments applied in the railway sector for internalising external costs: rail infrastructure access charges imposed to train operators and excises of gasoil and electricity applied to the railway sector. Following the Directive 2001/14/EC, rail usage charges do exist in all countries while some national administrations apply either excise reductions or exemptions from gasoil/electricity taxation.

Table 20: Instruments applied in the EU Member States to internalize external costs, 2012

Country	Infrastructure access charge	Energy taxation (excise)	
		Gasoil	Electricity
Austria	√	√	√
Belgium	√		
Bulgaria	√	√	√
Czech Republic	√	√	
Denmark	√		
Estonia	√	√	√
Finland	√	√	
France	√	√	√
Germany	√	√	√
Greece	√	√	√
Hungary	√		√
Ireland	√	√	√
Italy	√	√	
Latvia	√	√	
Lithuania	√	√	√
Luxembourg	√		√
Netherlands	√	√	√ ⁽¹⁾
Poland	√	√	√
Portugal	√		
Romania	√	√	√
Slovakia	√	√	
Slovenia	√	√	√
Spain	√		√
Sweden	√		
United Kingdom	√	√	

(1) Exemption applies to the business use of electricity above 10 million kWh per year per electricity connection on the conditions that the consumer has agreed to obligations for improving energy efficiency.

3.2. Rail usage charges

Main agreements and differences between the various EU Member States

European countries' railway charging systems are all based on Directive 2001/14/EC³². According to the Directive, charges are set and collected by an independent charging body; generally the infrastructure

³² Directive 2001/14/EC is part of the first railway package, also known as Infrastructure package, which comprises three directives : Directive 2001/12/EC of 26 February 2001 amending Council Directive 91/440/EEC on the development of the Community's railways; Directive 2001/13/EC of 26 February 2001 amending Council Directive 95/18/CE on the licensing of

manager provided its independence from railway undertakings. The services that must be covered by the infrastructure manager are those of the minimum access package:

- a. handling of requests for infrastructure capacity;
- b. the right to utilise capacity which is granted;
- c. use of running track points and junctions;
- d. train control including signalling, regulation, dispatching and the communication and provision of information on train movement;
- e. all other information required to implement or operate the service for which capacity has been granted.

Charges paid to the infrastructure managers may be used to fund their business, may include scarcity costs and may be adjusted to consider the cost of the environmental impact of operating the trains.

The Directive approach requires charges at least recovering marginal infrastructure costs with MS' governments funding the difference between the social marginal costs and the full, long-run financial cost paid by the infrastructure manager. The principles set by the Directive have been differently implemented in national legislations not only with regard to pricing structures but also to charge basis, level of internalisation and level of charges imposed.

The analysis is structured in the following sections:

- *Comparison of the charge structures*, in which tables comparing the variables and the external costs included in the infrastructure access charge per MS are reported and commented
- *Administrative costs*, which similarly to the paragraph above includes a table reporting the countries applying charges related to the management of the capacity demand by railway operators
- *Comparison of average and maximum charge levels*, which highlights the variability of the level of infrastructure access charges between countries.
- *Revenues deriving from access charges and share of covered costs*.

Comparison of charge structures

The comparison between rail usage charges adopted in the European Union is not always straightforward. Charge structures are generally complex, as they often include different components (train path-line charge, train installations charge, shunting charge, etc.) and depend on different charge basis (train-km, gross tonne-km, etc.). There exist a wide variety of structures, from the quite simple one of Finland, applying charges based only on gross tonne-km and train type, to the very complicated one adopted in Austria, where charges are based on all relevant variables. A synthetic comparison of charge structures across EU countries is shown in Table 21 and Table 22.

Table 21: Comparison of charge structures of rail usage charges: charge base (2012)

Country	Infrastructure Manager	Gross tonne-km	Train-km	Line or section category	Time	Train type
Austria	ÖBB Infrastruktur AG	√	√	√	√	√
Belgium	Infrabel	√	√	√	√	
Bulgaria	National Railway Infrastructure company	√	√			
Czech Republic	SZDC	√	√	√		√
Denmark	Banedanmark- Rail Net Denmark	√	√			

railway undertakings, Directive 2001/14/EC of 26 February 2001 on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification.

Estonia	EVR	√	√			
Finland	Finnish Transport Agency	√				√
France	RFF		√	√	√	√
Germany	DB-Netz	√	√	√	√	√
Greece	OSE		√	√	√	√
Hungary	VPE	√	√	√		√
Ireland	Department for transport	√				
Italy	RFI		√	√	√	√
Latvia	Latvian Railway LDZ		√			
Lithuania	JSC Lithuanian Railways	√	√			√
Luxembourg	ACF	√	√	√		√
Netherlands	Prorail	√	√	√		√
Poland	PKP	√	√	√		
Portugal	REFER		√	√		√
Romania	CFR	√	√	√		
Slovakia	ZSR	√	√	√		√
Slovenia	AZP		√	√		√
Spain	ADIF		√	√	√	√
Sweden	Trafikverket	√	√	√		√
United Kingdom	Network Rail	√	√	√		√
	HS1		√		√	√
	Eurotunnel				√	√

Table 22: Comparison of charge structures of rail usage charges: approaches

Country	Infrastructure Manager	Charge structure approach
Austria	ÖBB Infrastruktur AG	Variable charge per train-km (capacity) and per gross tonne-km (maintenance and renewal).
Belgium	Infrabel	Variable charge per train-km. Added charges for stations and terminals
Bulgaria	National Railway Infrastr. Company	Charge per train-km and per gross tonne-km
Czech Republic	SZDC	Capacity allocation fee plus charge per train-km for operations control and charge per gross tonne-km for maintenance and renewal. Adjustments for electric traction versus diesel
Denmark	Banedanmark- Rail Net Denmark	Variable charge per train-km plus peak variable charge per train in congested sections plus variable charge per train for bridges
Estonia	EVR	Variable charge per ordered train-km plus variable charge per actual gross tonne-km
Finland	Finnish Transport Agency	Variable charge per gross tonne-km
France	RFF	Track access charge plus path reservation charge (path km) plus running charge (train-km)
Germany	DB-Netz	Charge based on line quality and service priority, multiplied by performance-based factors
Greece	OSE	Marginal value for traffic management multiplied by capacity occupancy coefficient and peak period coefficient plus marginal value for line maintenance multiplied by line quality coefficient and line burden coefficient plus charge for traction power per tonne-km
Hungary	VPE	Charge for ensuring the train path per train-km plus running fee per train-km by type of line plus running fee per gross tonne-km
Ireland	Department for transport	Direct maintenance cost per gross ton km multiplied by traffic density coefficients plus direct renewals cost per gross tonne-km
Italy	RFI	Fixed reservation fee based on line type plus variable operating fee (speed, weight, density on line, length of line used, and time in node section)
Latvia	Latvian Railway LDZ	Variable charge per train-km (costs of maintenance, development and profit margin)
Lithuania	JSC Lithuanian Railways	Train path reservation fee plus charge per gross tonne-km
Luxembourg	ACF	Reservation fee (administrative cost of processing train path request) + variable operating

		fee (gross tonne-kms, axle loads, average speed, level of service required) + capacity scarcity fee
Netherlands	Prorail	Charge per train-km, per tonne-km and per station stop (by type of station)
Poland	PKP	Variable charge per gross tonne-km adjusted for type of line used (maximum line speed and traffic density)
Portugal	REFER	Variable charge per train-km
Romania	CFR	Variable charge by weighted tonne-km by type of line plus variable charge per train-km
Slovakia	ZSR	Variable charge per path km by line type plus variable charge per gross tonne-km by line type plus charge for the use of passenger stations, marshalling yards and freight terminals
Slovenia	AZP	Variable charge per train-km adjusted for type of train and relative weight
Spain	ADIF	Reservation fee per volume of traffic per year plus reserve capacity charge (type of service, train type, time of day) + variable charge per train-km actually used (type of line & service)
Sweden	Trafikverket	Variable charge based on train-km and gross tonne-km plus emission charge per litre diesel consumed plus accident charge plus passage charge (congested areas)
United Kingdom	Network Rail	Variable charge (axes loads, speed, unsprung mass, yaw-stiffness) plus mark up for electrified lines plus charge for stations
	HS1	Variable charge per train per minute + traction electricity charge + congestion & carbon charges
	Eurotunnel	Charge per train and type of transport

Also the types of costs included in the rail infrastructure usage charge differ substantially between Member States. A comparison of external cost categories reflected in the rail usage charge is reported in Table 23.

Table 23: Cost categories included in the rail usage charges

Country	Wear and tear	Power	Scarcity / Congestion	Environmental		Accident	Year
				Noise	Air pollution		
Austria	X		X				2012
Belgium	X		X				2012
Bulgaria	X						2013
Czech Republic	X			X ⁽¹⁾	X		2012
Denmark	X		X				2012
Estonia	X						2012
Finland	X				X	X	2012
France	X		X				2012
Germany	X		X	X ⁽²⁾			2012
Greece	X	X	X				2012
Hungary	X						2012
Ireland	X		X				2012
Italy	X		X				2012
Latvia	X					X	2012
Lithuania	X	X					2012
Luxembourg	X	X	X				2012
Netherlands	X			X ⁽³⁾			2012
Poland	X						2012
Portugal	X						2012
Romania	X						2012
Slovakia	X						2012
Slovenia	X						2012
Spain	X		X				2012

Sweden		X		X		X	X	2012
United Kingdom	Network Rail	X	X	X				2012
	HS1	X	X	X		X		2012
	Eurotunnel	X						2012

(1) A noise factor will be introduced in 2013.

(2) A noise related component in the access charge for freight traffic and a bonus system will be introduced in December 2012.

(3) Bonuses for trains with silent wagons are currently provided.

From this overview it becomes clear that all countries charge for the wear and tear costs, although at different level. Some countries apply access charges including scarcity and/or congestion costs, only few charge for the power costs, environmental and accidents costs:

- Power costs include charge for traction power consumption and are considered by Greece, Lithuania, Luxembourg and UK (Network Rail and High Speed 1).
- Scarcity costs incur when the presence of a train prevents another train from operating or requires it to take another inferior path. Congestion costs incur when one train delays another. Although timetables are planned in order to avoid such an inconvenience, this can happen when rail lines are highly used and the presence of an additional train on the tracks may lead to additional delays to other trains by reducing the ability of the system to recover from delays (ECMT, 2005). Scarcity may be charged through a supplement for congested infrastructure like in Austria, Denmark, Luxembourg, Spain and UK-HS1, Italy, or through a specific parameter for scarcity associated to track sections as in Belgium and Greece. Congestion can be charged through the payment for the delay provoked like in Austria, Germany. Greece, UK-Network Rail, or through a specific parameter in the access fee formula for specific routes like in Italy and in Germany - which in this respect applies not only a payment per delay minute, but also a parameter for busy routes - or through a mark-up for congested areas as in Sweden.
- Environmental costs are distinguished in noise and air pollution costs. Currently none of the EU countries internalize noise costs, although some changes are expected in the future: Czech Republic will introduce a noise factor in the access charge formula in 2013; from December 2012 Germany will introduce a noise related component in the freight train path price together with a bonus system, Netherlands aims at reducing noise by providing bonuses to trains with silent wagons. Air pollution is charged for in the Czech Republic, Finland, Sweden and HS1. In particular in Finland diesel freight traffic is higher charged with respect to electrified freight traffic, in Sweden the infrastructure access charge specifically includes a component which reflects the costs of emission of carbon dioxide, nitrogen oxides, sulphur dioxide, hydrocarbon and particles. Carbon costs are also charged by HS1.
- Finally, accident costs are charged by three countries (Finland, Latvia and Sweden). Costs may be charged through the payment of an amount which is based upon previous period actual accident costs as in the case of Latvia accident charge or through a specific component included in the access fee (Finland and Sweden).

Administrative costs

Administrative costs in the rail sector are intended as charges imposed by rail infrastructure managers on railway operators for the handling of the capacity demands. According to what emerges from the analysis of the documents and in particular of the Network Statements and the responses to the Questionnaire, administrative costs are explicitly included in the rail usage charge of 16 Member States. However, the way in which such costs are charged, varies between countries, as shown Table 24.

In Austria, Estonia and Germany administrative costs are included in the access charge as the handling of capacity is included in the price of services provided by the infrastructure manager. Countries like Hungary, Luxembourg, Poland, Romania, Slovakia and Spain include administrative costs in the infrastructure access charge through a specific component. France charges administrative costs through an

additional charge to be paid by operators requiring a change/cancellation of a path already allocated. Finally, Bulgaria considers such costs as the expenditure for salary and social security payments of the personal who is engaged in such activities.

Table 24: Charging administrative costs in the rail usage charges adopted in EU Member States

Country	Administrative Costs	Year
Austria	X	2012
Belgium	X	2012
Bulgaria	X	2013
Czech Republic		2012
Denmark		2012
Estonia	X	2012
Finland		2012
France	X	2012
Germany	X	2012
Greece		2012
Hungary	X	2012
Ireland		2012
Italy	X	2012
Latvia	X	2012
Lithuania		2012
Luxembourg	X	2012
Netherlands	X	2012
Poland	X	2012
Portugal	X	2012
Romania	X	2012
Slovakia	X	2012
Slovenia		2012
Spain	X	2012
Sweden		2012
United Kingdom	Network Rail	2012
	HS1	2012
	Eurotunnel	2012

Comparison of average and maximum charge levels

Rail infrastructure charges do exist in all EU Member States. The divergence of current infrastructure charge levels is illustrated in Table 25 and in Figure 6 which report the average charges per train typology, being these high speed, passenger intercity, passenger regional and freight.

Data in Table 25 are mainly based on the average values reported in the questionnaires compiled by the Infrastructure Managers with some exceptions. Hungary and UK Eurotunnel provided indicative examples of charge levels and not average values. Data on Greece were not available, neither from the questionnaire nor from other documents (such as the Network Statement). For Finland, Lithuania, Estonia, Slovenia and Network Rail (UK) the data presented in the table have been estimated on the basis of the following elements:

- For Finland, considering that the infrastructure access charge is function of gross tonne-km, the passenger and freight average train weights have been assumed to be respectively of 500 tonnes and 1,000 tonnes.
- For Lithuania and Estonia, where the access charge includes a component that is function of train-km and a component function of gross tonne-km, the passenger train average weight has been assumed of 500 tonnes and freight average weights of 2,000 and 2,200 tonnes respectively (it is common knowledge that Baltic freight trains are much larger than other countries freight trains and according to UIC data an average weight for all trains, passenger and freight trains, of 1,864 tonnes for Lithuania and of 2,048 tonnes for Estonia have been estimated).
- For Slovenia the estimation provided derives from the division between revenues from passenger/freight train access charge and the passenger/freight transport train-kms made in 2011.
- For Network Rail the average charge for freight transport has been estimated assuming a weight of 1,000 gross tonnes for a typical freight train.

Table 25: Average level rail usage charge per train typology (Euro/train-km)

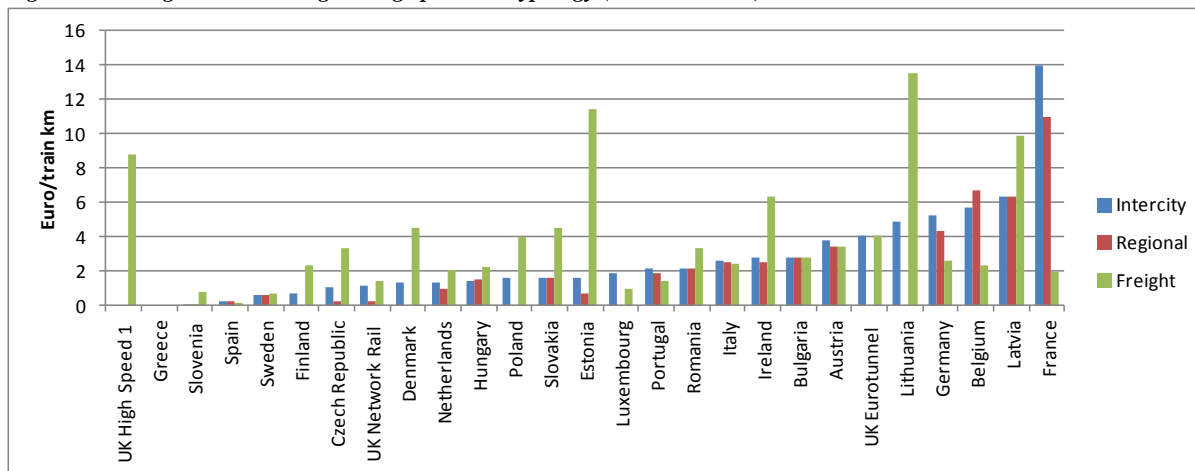
Country	High speed	Intercity	Regional	Freight	Year	
Austria		3.75 ⁽¹⁾	3.46 ⁽¹⁾	3.39 ⁽¹⁾	2012	
		3.18 ⁽²⁾	2.89 ⁽²⁾	2.99 ⁽²⁾		
		2.34 ⁽³⁾	2.05 ⁽³⁾	2.40 ⁽³⁾		
		1.86 ⁽⁴⁾	1.57 ⁽⁴⁾	2.06 ⁽⁴⁾		
		1.52 ⁽⁵⁾	1.23 ⁽⁵⁾	1.82 ⁽⁵⁾		
Belgium	9.53	5.65	6.71	2.28	2012	
Bulgaria		2.82	2.82	2.82	2013	
Czech Republic		1.01	0.24	3.37	2012	
Denmark		1.29 ⁽⁶⁾		4.52 ⁽⁶⁾	2011	
		0.49 ⁽⁷⁾		0.69 ⁽⁷⁾		
Estonia		1.63 ⁽⁸⁾	0.65 ⁽⁹⁾	11.41 ⁽¹⁰⁾	2011/2012	
Finland		0.70 ⁽¹¹⁾		1.85 ⁽¹²⁾	2012	
				2.35 ⁽¹³⁾		
France	13.00	14.00 ⁽¹⁴⁾	11.00	2.00 ⁽¹⁵⁾	2013	
Germany	7.29	5.23	4.35	2.56	2012	
Greece		N/A	N/A	N/A		
Hungary		1.38 ⁽¹⁶⁾	1.49 ⁽¹⁶⁾	2.27 ⁽¹⁶⁾	2012/2013	
Ireland		2.76	2.47	6.31	2008	
Italy	8.33	2.57	2.53	2.40	2012	
Latvia		6.33 ⁽¹⁷⁾	6.33 ⁽¹⁷⁾	9.90	2012	
		5.28 ⁽¹⁸⁾	5.28 ⁽¹⁸⁾			
Lithuania		4.91 ⁽¹⁹⁾	N/A	13.54 ⁽²⁰⁾	2012	
Luxembourg		1.88	N/A	0.94	2012	
Netherlands	48.93	1.33	0.94	2.07	2012	
Poland		1.58	N/A	3.97	2011/2012	
Portugal		2.16 ⁽²¹⁾	1.87 ⁽²¹⁾	1.38 ⁽²¹⁾	2012	
		1.33 ⁽²²⁾	1.28 ⁽²²⁾	1.12 ⁽²²⁾		
Romania		2.17	2.17	3.35	2012	
Slovakia		1.60	1.60	4.5	2012	
Slovenia		0.006 ⁽²³⁾		0.80	2011	
Spain	6.94	0.26	0.26	0.11	2012	
Sweden	0.88	0.63	0.62 ⁽²⁴⁾	0.65	2012	
			0.44 ⁽²⁵⁾			
UK	Network Rail	N/A	1.15	0.21 ⁽²⁶⁾	1.45 ⁽²⁹⁾	2012

				0.64 ⁽²⁷⁾		
				0.11 ⁽²⁸⁾		
	High Speed 1	38.77 ⁽³⁰⁾			8.83 ⁽³²⁾	2009
		42.72 ⁽³¹⁾				
	Eurotunnel			4.050 ⁽³³⁾		2012

Notes:

- (1) Brenner Line
- (2) Westbahn
- (3) Other international lines
- (4) Other main lines
- (5) Secondary lines
- (6) Average charge including bridge toll
- (7) Average charge excluding bridge toll
- (8) Typical 500-gross-tonne Intercity passenger train
- (9) Typical 200-gross-tonne regional passenger train
- (10) Typical 2200-gross-tonne freight train
- (11) Typical 500-gross-tonne intercity passenger train
- (12) Typical 1,000-gross-tonne electric freight train
- (13) Typical 1,000-gross-tonne diesel freight train
- (14) Long distance train and «tren d'équilibre du territoire»
- (15) After the 5€ compensation
- (16) Examples reported
- (17) Passenger electric trains
- (18) Passenger diesel trains
- (19) Net of electric power, 500 gross train tonne-km
- (20) Net of electric power, 2,000 gross train tonne-km Electrical
- (21) Diesel
- (22) Long distance and regional trains: the data is the result of the division between the revenues deriving from train passenger access charge and the passenger train-km in 2011. It is important to remark that revenues deriving from train passenger access charge refer only to commercial services which are about 5% of the passengers services, since the rail undertakings subjected to public service obligations are excluded from charging.
- (23) Commuter
- (24) Suburban
- (25) Average charge for suburban trains with 4 car train
- (26) Average charge for suburban trains with 12 car train
- (27) Charge for rural trains with 2 car train
- (28) Typical 1,000 gross ton freight train
- (29) Domestic charge
- (30) International charge
- (31) Trains operated at night: 5.10€
- (32) The value is €/train and it applies to a reserved weekly train and a reserved daily train with a speed of 120 km/h and 140 km/h, operating in the intermediate period. The access charge is composed of a reservation and an access fee.

Figure 6: Average level rail usage charge per train typology (Euro/train-km)



As expected, differences do exist. Traffic mix and traffic densities vary greatly between countries and this has a strong influence on costs: renewal and maintenance costs strongly depend from the traffic share and from typology of passenger and freight trains (speed, dimension and axle weight) and from traffic density (the relation between the traffic density and costs is not linear), labour costs and technology applied (automation and labour saving) are quite diverse, etc.

In addition, large differences of charge levels between countries are also the result of unlike political choices and in particular of the charging principle applied in the various countries. ECMT, 2005³³ distinguishes three approaches that the European governments have tended to follow:

- The social marginal cost pricing (MC), requiring government compensation for the difference between marginal cost and financial cost.
- Marginal cost with a mark-up (MC+) to reduce (or eliminate) government compensation and the gap between marginal cost and financial cost.
- The full cost recovery after receipt of grants (FC-), setting access charges to collect the difference between government contribution and full financial cost.

It is important to remark that MC and MC+ approaches require an accurate knowledge of the rail marginal costs and of social costs associated with the rail operations, whereas in the FC- approach government contribution are (in principle) known quantities. Nearly the 50% of the European countries apply the marginal cost pricing approach with or without mark up, while the other 50% adopt the full cost recovery approach after receipt of grants, meaning that the infrastructure manager acts as a commercial organization needing to recover their costs (this is the case of Belgium, Germany, Italy, the Baltic States, Hungary, Romania, Poland), see Table 26.

Table 26 Charging principles in EU countries

Country	Pricing principle
Austria	MC+
Belgium	FC-
Bulgaria	MC+
Czech Republic	MC+
Denmark	MC+
Estonia	FC-
Finland	MC+
France	MC+
Germany	FC-
Hungary	FC
Italy	FC-
Latvia	FC
Netherlands	MC
Poland	FC
Portugal	MC+
Romania	FC
Sweden	MC+
United Kingdom	MC+

Source: ECMT, 2005.

³³ ECMT, Railway Reform and Charges for the Use of Infrastructure, 2005.

The maximum charge levels are reported only for some countries for which the infrastructure managers have answered to the specific question in the questionnaire. From the comparison between average and maximum charges, reported in Table 27, a high variability among Intercity charges clearly emerges: the percentage variation between average and maximum charges ranges from 10% in Portugal to 1019% in Spain. Much lower variability is registered among regional trains and freight trains.

Table 27 Comparison of average and maximum charge levels

Country	High speed			Intercity			Regional			Freight		
	Aver. ch.	Max. ch.	Var. (%)	Aver. ch.	Max. ch.	Var. (%)	Aver. ch.	Max. ch.	Var. (%)	Aver. ch.	Max. ch.	Var. (%)
Belgium	9.5	11.2	17.1	5.7	12.0	111.7	6.7	8.0	19.4	2.3	2.9	25.4
Czech Republic				1.0	1.2	13.9	0.2	0.2	0.0	3.4	3.6	7.4
Luxembourg				1.9	2.3	20.7	N/A	N/A	N/A	0.9	1.3	33.0
Netherlands	48.9	48.9	0.0	1.3	2.1	60.2	0.9	2.0	112.8	2.1	2.9	40.1
Poland				1.6	4.4	177.2	N/A	N/A	N/A	4.0	9.2	132.2
Portugal				2.2	2.4	9.7	1.9	2.1	11.8	1.4	1.6	13.0
Romania				2.2	2.4	12.4	2.2	2.4	12.4	3.4	4.2	25.1
Spain	6.9	10.6	52.9	0.3	2.9	1019.2	0.3	0.3	0.0	0.1	0.4	254.5
UK Network Rail				1.15	N/A	N/A	0.21	N/A	N/A	1.4	2.2	49.8

Revenues deriving from access charges and share of covered infrastructure costs

Table 28 reports the annual revenues deriving from access charges and total costs where available. Also for this table, the data collected mainly derive from responses to the questionnaire and from figures published in Infrastructure Managers' annual reports.

Table 28: Annual revenues from railway usage charges and total costs

Country	Annual revenues (million €)	Total costs (million €)	Year
Austria	437.0	N/A	2011
Belgium	649.0	1,392.5	2011
Bulgaria	48.9	175.5	2011
Czech Republic	169.8	564.8	2010
Denmark	101.3	479.5	2011
Estonia	54.2	55.1	2011
Finland	61.0	470.0	2011
France	4,648.6	N/A	2011
Germany	4,150.0	5,160.0	2011
Greece	N/A	N/A	
Hungary	479.4 ⁽¹⁾	N/A	2011
Ireland	37.7	171.1	2011
Italy	2,132.1	N/A	2010
Latvia	N/A	N/A	
Lithuania	180.3 ⁽²⁾	N/A	2012
Luxembourg	24.0	N/A	2010
Netherlands	239.0	1,845.0	2011
Poland	683.8	1,038.4	2011

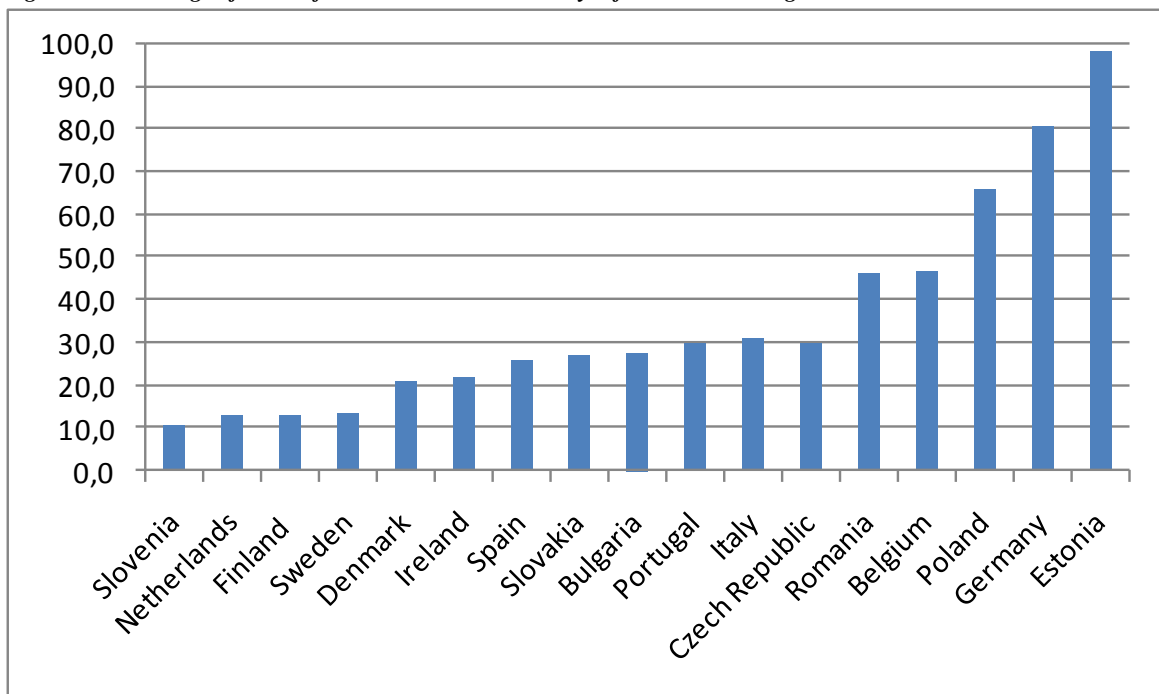
Portugal		61.4	207.3	2010
Romania		215.5	464.1	2010
Slovakia		95.6	352.0	2011
Slovenia		7.6	71.6	2011
Spain		362.5	1,406.6	2011
Sweden		87.7 ⁽³⁾	636.1	2011
United Kingdom	Network Rail	6,985.0	N/A	2011-2012
	HS1	0.3	N/A	2009
	Eurotunnel	278.4	N/A	2011

Note: The total revenues for all countries for which data is available amounts to 21,549.9 million €. The total costs for the countries for which cost data is available (which is different set of countries) amounts to 14,489.6 million €.

- (1) MAV's rail track operation revenues
- (2) Revenues from operating activities
- (3) Revenues from minimum access package services

In Figure 7 the share of covered infrastructure costs are reported. Also to this respect a high variability between countries emerges: the percentage of costs covered by infrastructure charges ranges from 10.6% in Slovenia to 98.4 % in Estonia. There exists a certain consistency between the share of costs covered and the charging principle adopted in each country: in fact those countries which cover not more than the 30% of costs, apply the marginal cost charging principle (with the exception of Slovenia and Italy), while the other countries (Romania, Belgium, Poland, Germany and Estonia) apply costs recovery after receipt of grants.

Figure 7: Percentage of total infrastructure cost covered by infrastructure charges



Notes: The percentages for Romania and Italy have been directly provided in the questionnaire.

3.3. Fuel and electricity taxes

Most excises are subject to reductions and/or exemptions in line with the possibility for the Member States to apply total and/or partial exemption or reductions in the level of taxation to energy products and electricity used for the carriage of goods and passengers by rail³⁴, as shown on Table 29. Environmental costs are taken into consideration only by few countries: in both gasoil and electricity taxation only for Denmark (although the energy taxation applied to the railway sector is fully reimbursed), in gasoil taxation only for Finland, Ireland, Slovenia and Luxembourg which, however, applies exemption to the railway transport of goods and persons. Finally also Sweden includes a CO₂ component in the taxation of gas oil, but exemption is applied to railways.

Assuming that electricity producers pass on the full costs of ETS to the electricity consumers, it can be deduced that CO₂ external costs from electricity production are internalized only if railway infrastructure users pay the full electricity price.

Table 29: Exemptions/reductions applied in energy taxation (excise), 2012

Country	Gasoil	Electricity
Austria	Reduction	Standard rate
Belgium	Exemption	Exemption
Bulgaria	Standard rate	Standard rate
Czech Republic	Standard rate	Exemption
Denmark	Full refund	Full refund
Estonia	Reduction	Standard rate
Finland	Reduction	Exemption
France	Reduction	Standard rate
Germany	Standard rate ⁽¹⁾	Reduction
Greece	Standard rate	Standard rate
Hungary	Exemption	Standard rate
Ireland	Reduction	Standard rate
Italy	Reduction	Exemption ⁽²⁾
Latvia	Standard rate	Exemption
Lithuania	Standard rate	Standard rate
Luxembourg	Exemption	Standard rate
Netherlands	Reduction ⁽³⁾	Exemption ⁽⁴⁾
Poland	Standard rate	Standard rate
Portugal	Exemption	Exemption
Romania	Standard rate	Standard rate
Slovakia	Standard rate	Exemption
Slovenia	Partial refund	Standard rate
Spain	Exemption	Standard rate
Sweden	Exemption	Exemption
United Kingdom	Standard rate	No excise on electricity normally applies

(1) A partial tax refund for gasoil used as fuel in railway public transport is applied although the commercial rail transport, which is the biggest part of rail transport is not tax privileged.

(2) Exemptions applies for electricity used for urban and interurban transport

(3) If railway companies use diesel engines, they are allowed to use the red diesel which is charged at a lower rate with respect to the normal diesel. Operators can also ask for a partial excise duty refund for yearly consumptions of more than 153,000 litres.

³⁴ Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, Art 15 (e).

- (4) Exemption applies to the use of electricity above 10 million kWh per year per electricity connection on the conditions that the consumer is regarded to be an energy-intensive business and that the consumer has agreed to obligations for improving energy efficiency.

As reported in Table 30, the levels of excises on gas oil and electricity applied to railways substantially vary between Member States.

Table 30: Excise on gas oil and electricity applied to railways in each EU countries, 2012

Country	Gasoil	Electricity
	€/1,000L	€/MWh
Austria	98.00 ⁽¹⁾	15.00
Belgium	Exemption	Exemption
Bulgaria	322.12	1.00
Czech Republic	440.15	Exemption
Denmark	Exemption ⁽²⁾	Exemption
Estonia	110.95	4.47
Finland	160.50	Exemption
France	72.00	0.50 ⁽³⁾
		1.50 ⁽⁴⁾
Germany	431.68 ⁽⁵⁾	11.42
Greece	412.00	2.50 ⁽³⁾
		2.20 ⁽⁴⁾
Hungary	Exemption	1.00
Ireland	102.28	0.50 ⁽³⁾
		1.00 ⁽⁴⁾
Italy	177.96	Exemption
Latvia	329.90	Exemption
Lithuania	302.07	1.01
Luxembourg	Exemption	0.50 ⁽³⁾
		1.00 ⁽⁴⁾
Netherlands	255.00 ⁽⁶⁾	Exemption ⁽⁷⁾
Poland	330.01	4.56
Portugal	Exemption	Exemption
Romania	316.03	0.50 ⁽³⁾
		1.00 ⁽⁴⁾
Slovakia	386.40 ⁽⁸⁾	Exemption
	368.00 ⁽⁹⁾	
Slovenia	190.85 ⁽¹⁰⁾	Exemption
Spain	Exemption	0.50 ⁽³⁾
		1.00 ⁽⁴⁾
Sweden	Exemption	Exemption
United Kingdom	674.15	No excise applied

(1) Reduction provided in the form of tax refund: a refund of 299 €/1,000L is applied to railways where the standard tax rate for gas oil is of 397 €/1,000L.

(2) Exemptions in Denmark are applied through full reimbursement.

(3) Electricity for business use.

(4) Electricity for non-business use.

(5) Reduction provided in the form of tax refund: a refund of 54.02 €/1,000L is applied for gasoil used as fuel in public railways transport where the standard tax rate for gasoil is 485.70 €/1,000L. Commercial rail transport - which is the biggest part - is not tax privileged.

(6) Railway companies can ask for a partial refund of excise duty i.e. 33.66 €/1,000L for yearly consumptions of more than 153.000 litres.

(7) Exemption applies to the use of electricity above 10 million kWh per year per electricity connection on the conditions that the consumer is regarded to be an energy-intensive business and that the consumer has agreed to obligations for improving energy efficiency.

(8) Excise on gasoil with biodiesel content lower than 5.3%

(9) Excise on gasoil with biodiesel content equal or more than 5.3%

(10) The excise on gas oil is of 381.69 €/1,000L but a partial refund in the amount of 50% of the excise is applied in the railway transport

3.4. VAT exemptions and discounts

As for the case of gas oil and electricity excises, VATs on gas oil and electricity applied to the railway sector vary between EU countries. In line with Directive 2003/96/EC, reductions and exemptions are applied by some countries. Table 31 reports the values of VATs in each country as well as reductions and exemptions applied to railways.

Table 31: Exemptions and reduced VAT rates (%) applied to energy taxation in EU Member States, 2012

Country	Gasoil VAT rate (%)	Gasoil VAT exemption/reduction applicable to railways	Electricity VAT rate (%)	Electricity VAT exemption/reduction applicable to railways
Austria	20	Standard rate ⁽¹⁾	20	Standard rate ⁽¹⁾
Belgium	Exemption	Exemption	21	Standard rate
Bulgaria	20	Standard rate	20	Standard rate
Czech Republic	14	Reduction ⁽²⁾	14	Reduction ⁽²⁾
Denmark	Exemption	Exemption ⁽³⁾	Exemption	Exemption ⁽³⁾
Estonia	20	Standard rate	20	Standard rate
Finland	N/A ⁽⁴⁾	Reduction ⁽⁴⁾	N/A ⁽⁴⁾	Reduction ⁽⁴⁾
France	19.6	Standard rate	19.6	Standard rate
Germany	19	Standard rate	19	Standard rate
Greece	23	Standard rate	13	Standard rate
Hungary	27	Standard rate	27	Standard rate
Ireland	13.5	Standard rate	13.5	Standard rate
Italy	N/A	N/A	Exemption	Exemption
Latvia	21	Standard rate	21	Standard rate
Lithuania	21	Standard rate	21	Standard rate
Luxembourg	15	Standard rate	6	Standard rate
Netherlands	21	Standard rate	21	Standard rate
Poland	23	Standard rate	23	Standard rate
Portugal	13	Reduction	23	Standard rate
Romania	24	Standard rate	24	Standard rate
Slovakia	20	Standard rate	20	Standard rate
Slovenia	8.5 ⁽⁵⁾	Reduction ⁽⁵⁾	8.5 ⁽⁵⁾	Reduction ⁽⁵⁾
Spain	18	Standard rate	18	Standard rate
Sweden	6 ⁽⁶⁾	Reduction ⁽⁶⁾	6 ⁽⁶⁾	Reduction ⁽⁶⁾
United Kingdom	20	Standard rate	No excise/VAT applied	Standard rate

(1) The only exemption applied is to the transportation of goods concerning importation into and exportation outside the Community within the international freight traffic.

(2) Reduction applied on regular (mass) transport of passengers.

(3) Exemption applied through full reimbursement.

(4) The level of reduction is not available but this is applied to the public transport (railways included).

(5) The standard rate is of 20% but a reduced rate of 8.5% is applied to the transport of passengers and their accompanying luggage. Exemption is applied to international transport of passengers.

(6) The standard rate is of 25% but a reduction of 6% is applied to passenger transport.

Table 32 lists the level of the VAT rates applied to rail services in European countries relative to the domestic transport and the intra-community and international rail transport. As far as domestic rail transport is concerned, important variations between countries can be observed: some countries apply

very high level of VAT like Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Romania and Slovakia while for others like Belgium, France, Portugal, Spain and Sweden, the rate is very low; the lowest rate is registered in Luxembourg and corresponds to 3%.

As for intra-community and international transport lower variation emerges since most of the countries do not apply VAT (the zero rate implies exemption with refund of tax paid at preceding stage), few countries such as Austria, Germany and Greece apply quite high rates, while Belgium, Netherlands and Spain rates are low.

Table 32: VAT rates (%) applied to rail services in EU Member States, 2012

Country	Domestic transport	Intra-community and international transport
Austria	10	20
Belgium	6	6
Bulgaria	20	0
Czech Republic	14 ⁽¹⁾ 20	0
Denmark	Exemption	0
Estonia	20	0
Finland	9	0
France	7	0
Germany	19 7	19 7
Greece	13	13
Hungary	27	0
Ireland	Exemption	0
Italy	10 Exemption	0
Latvia	12	0
Lithuania	21	0
Luxembourg	3	0
Netherlands	6	6
Poland	8	0
Portugal	6	0
Romania	24	0
Slovakia	20	0
Slovenia	8.5	0
Spain	8	8
Sweden	6	0
UK	0	0

Source: European Commission, VAT rates applied in the Member States of the European Union, Situation at 1st January 2012

Notes: (1) 10% applies only on regular transport.

3.5. Conclusions

The instruments considered for the internalisation of external costs in the rail sector are railway infrastructure access charges and gas oil and electricity excises. The inquiry has been conducted on the basis of data collected from relevant documentation³⁵ and detailed questionnaires filled by the infrastructure managers and competent offices in the EU countries.

Data gathered show that both instruments are actually used to cover only part of the external costs produced by the rail mode of transport. Railway infrastructure access charges are in general quite complex and with considerable differences among the structures applied. The internalisation level substantially differs between Member States. While all countries charge the wear and tear costs, although at different level, and some countries apply access charges including scarcity/congestion costs, only few consider environmental or accidents costs, namely Czech Republic, Finland, Latvia, Sweden and UK. Administrative costs are explicitly charged by most countries (sixteen out of twenty-five). At present none of the Member States internalize noise costs, although Czech Republic and Germany will move in this direction in the next months and the Netherlands are aiming at applying a bonus system.

As for average charge level per train typology large differences between countries emerge. These differences are the result both of specific features of the national networks and of their use (i.e. traffic mix and traffic densities, technology employed, etc.), and of the pricing principle adopted. On the basis of available data, the comparison between average and maximum charge level per country highlights high variability among intercity charges and lower variability among regional and freight trains.

With reference to energy taxation to railways, Finland, Ireland and Slovenia internalize explicitly environmental costs with respect to gas oil only. No environmental costs are internalized by Member States through the electricity taxation. Many countries apply reductions/exemptions on railways gas oil and electricity excises. In the case of electricity, this situation leads to the mitigation or cancellation of the ETS' impact on rail transport.

With regard to VAT rates on energy for railways, the national standard rates are applied by almost all Member States. Reductions are registered in few countries i.e. Czech Republic, Finland, Portugal (VAT on gas oil), Slovenia and Sweden. A VAT exemption applies only in Denmark. Similarly to the energy used in road transport VATs on rail services strongly vary between countries as far as domestic transport is concerned, while as for intra-community and international transport most of the countries apply VAT exemption with refund of tax paid.

³⁵ In particular, the Network Statements published by the infrastructure managers of the EU countries and the Excise Duty Tables, Part II-Energy products and Electricity, July 2012, published by the European Commission have been consulted for the information regarding the infrastructure access charges and for the taxation of gas oil and electricity respectively.

4. Inland navigation

4.1. Introduction

For inland navigation charging measures include:

- Fuel taxes exemption (national/ international level),
- Port dues (local level),
- Fairway dues (national/ regional level),
- VAT reductions/ exemptions (national level),
- Charges related to prevention of water pollution (as far as these are policy instruments).

Not all the measures are applied in each Member State (see below Table 33). Port dues are applied in each Member State. Also, all countries have certain exemptions and discounts on fuel taxes and VAT for inland navigation. Fairway dues and waste water discharges are only applied in certain Member States.

Table 33: Instruments applied for Inland Navigation

	Fuel tax exemption	Port Dues	Fairway Dues	VAT Exemption/ Discount	Waste Water discharge
Austria	X	X		X	
Belgium	X	X	X	X	X
Bulgaria	X	X		X	
Czech Republic	X	X		X	
Estonia	X	X		X	N/A
Finland	X	X		X	N/A
France	X	X	X	X	X
Germany	X	X	X	X	X
Hungary	X	X		X	
Italy	X	X		X	
Latvia	X	X		X	N/A
Lithuania	X	X		X	N/A
Luxembourg	X	X	X	X	X
Netherlands	X	X		X	X
Poland	X	X	X	X	
Romania	X	X	X	X	
Slovak Republic	X	X		X	
Spain	X	X		X	N/A
United Kingdom	X	X		X	

To gain insight on the relevant information on the measures a literature review and interviews with stakeholders have been conducted. For national and regional taxes, interviews have been held with representatives from national governments and fairway managers.

Data on port charges on inland navigation was not available on an aggregated level, and needed to be collected on an individual basis. For the collection of data on port charges for inland navigation a representative selection of ports has been chosen (see Table 34), based on the following criteria:

- Type of port (inland port or maritime port with Inland navigation access)
- Size of the port³⁶
- River basin
- Country in which the port is located.

Table 34: Selection of ports for Inland Navigation

Name port	Country	River basin	Type of port
Krems	AT	Danube	Inland Port
Antwerp	BE	Scheldt area	Maritime port
Gent	BE	Gent – Terneuzen Canal	Maritime port
Liège	BE	Meuse	Inland Port
Vidin	BG	Danube	Inland Port
Děčín	CZ	Elbe	Inland Port
Frankfurt am Main	DE	Main	Inland Port
Hannover	DE	Mittellandkanal	Inland Port
Duisburg	DE	Rhine	Inland Port
Mannheim	DE	Rhine	Inland Port
Strasbourg	FR	Rhine	Inland Port
Lyon	FR	Rhône	Inland Port
Le Havre	FR	Seine	Maritime port
Paris (Gennevilliers)	FR	Seine	Inland Port
Budapest	HU	Danube	Inland Port
Montova	IT	Po	Inland Port
Mertert	LU	Mosel	Inland Port
Amsterdam	NL	Amsterdam-Rhine Canal	Maritime port
Hengelo	NL	Twente Canal	Inland Port
Nijmegen	NL	Rhine	Inland Port
Rotterdam	NL	Rhine	Maritime port
Utrecht	NL	Amsterdam-Rhine Canal	Inland Port
Szczecin	PL	Oder	Maritime port
Constantza	RO	Danube	Maritime port
Bratislava	SK	Danube	Inland Port
London	UK	Thames	Maritime port

To assess the administrative burden for both public and private parties, interviews were performed with the responsible authority, as well as with representatives from shippers and haulers organisations.

³⁶ The selection on size of the inland ports was based on the terminal list provided in Prograns ea (2008), Statistical coverage and economic analysis of the logistics sector in the EU (SEALS)

4.2. Fuel taxes

For inland navigation, fuel taxes are exempted for freight transport in all Member States (see Table 35). Fuel taxes are also exempted for commercial passenger transport, with the exception of France and Italy. However, fuel taxes need to be paid in all countries for recreational vessels, except for Belgium and Czech Republic.

Table 35: Application of fuel taxes for different types of Inland Navigation Vessels

Tax imposed	Freight	Passenger	Recreational / Pleasure
Austria	Partly*	Partly*	Yes
Belgium	No	No	Partly***
Bulgaria	No	No	Yes
Czech Republic	No	No	No
Estonia	No	No	Yes
Finland	No	No	Yes
France	No	Yes	Yes
Germany	No	No	Yes
Hungary	No	No	Yes
Italy	No	Yes	Yes
Latvia	No	No	Yes
Lithuania	No	No	Yes
Luxembourg	No	No	Yes
Netherlands	No	No	Yes
Poland	No	No	Yes
Romania	No	No	Yes
Slovak Republic	Partly**	Partly**	Yes
Spain	No	No	Yes
United Kingdom	No	No	Yes

* Tax Exemption for the Danube, the Bodensee and the Neusiedlersee.

** Tax Exemption for the Danube.

*** Tax Exemption for recreational vessels using gas oil.

Above mentioned reductions follow Directive 2003/96/EC, which allows Member States to apply exemptions for inland navigation except for pleasure crafts. Furthermore, both the Mannheim and Danube Convention oblige Member States to refrain from imposing any toll, tax, duty or charge based directly on inland navigation. Both conventions allow for fees on services (for instance port dues) and taxation on other bases (such as VAT).

4.3. Port dues

Type of charges

Port dues **can** consist of several components, which are highlighted in Table 36. Almost all ports have a port charge/ access charge. Furthermore, in many ports there is a transshipment charge, which is a charge for loading or unloading goods.

Table 36: Charge types in each selected port

Port	Country	Port charge	Transshipment charge	other
Krems	AT	x		
Antwerp	BE	x	x	daily charge
Gent	BE	x		
Liège	BE	x	x	

Vidin	BG	x		
Decin	CZ	x		
Duisburg	DE	x		anchoring/shore charge
Frankfurt am Main	DE	x		
Hannover	DE	x		
Mannheim	DE	x		
Le Havre	FR			no Dues
Lyon	FR		x	
Paris (Gennevilliers)	FR		x	
Strasbourg	FR		x	
Budapest	HU	x		anchoring charge
Mantova	IT	x		
Mertert	LU		x	
Amsterdam	NL	x		
Hengelo	NL	x		
Nijmegen	NL	x	x	
Rotterdam	NL	x		
Utrecht	NL	x		
Szczecin	PL	x	x	quay charge
Constantza	RO	x		
Bratislava	SK	x		
London	UK	x	x	

Charge base

Table 37 presents an overview of the different charge bases used per port, for freight transport. Most used charge bases are weight of the goods in tonnes and capacity of the ship in tonnes. Weight of the goods in tonnes is used in calculating the charge for the trans-shipped goods, while capacity of the ship in tonnes is used in calculating the port dues for entering the port area. The ports using gross tonnage (GT) as a charge base are all seaports. Three ports have an explicit external costs element in the port charges, namely Amsterdam, Antwerp and Rotterdam. All three ports offer discount for ships using environmental friendly engine types, such as ships with a CCR II engine. However, the charging structure of most port dues is differentiated to the size of loading capacity of the vessels, which is proxy for the fuel usage.

Table 37: Charge base for port dues in each selected port for freight vessels

Port	Country	Tonnes shipped	Tonnes capacity	Gross Tonnage (GT)	m ² of ship	Other
Krems	AT	x	x			
Antwerp	BE			x		Distance sailed in port, number of locks used, length of ship, environmental discount
Gent	BE					m ³ , per container
Liège	BE	x				m ² space used

Vidin	BG	x				Self-propelled / non-propelled
Decin	CZ		x			Self-propelled / non-propelled
Duisburg	DE	x	x		x	Type of goods
Frankfurt am Main	DE	x	x		x	Type of goods
Hannover	DE	x	x			Type of goods, cargo handling capacity.
Mannheim	DE		x			Type of goods
Lyon	FR					Per trailer/container, m3, pallet, boxes
Paris (Gennevilliers)	FR	x				Type of good
Strasbourg	FR	x				Type of good
Budapest	HU	x	x		x	
Mantova	IT					Length of ship
Mertert	LU	x				
Amsterdam	NL		x		x	Environmental discount
Hengelo	NL					m ³ water shifting.
Nijmegen	NL	x	x			
Rotterdam	NL		x			Environmental discounts
Utrecht	NL		x			Per container
Szczecin	PL			x		m ³
Constantza	RO		x			Self-propelled / non-propelled
Bratislava	SK	x			x	
London	UK	x		x		Per trailer/container.

For passenger transport, Table 38 gives an overview of the charge bases used. As can be concluded from the table, not all ports offer services for passenger ships (specified as “no charge” in the table).

Table 38: Charge base for port dues in each selected port for passenger ships

Port	Country	General charge	Length of ship	Gross Tonnage (GT)	Other
Krems	AT				No Charge
Antwerp	BE			x	
Gent	BE		x		Amount of passengers
Liège	BE				No Charge
Vidin	BG	x			General charge
Decin	CZ	x			General charge
Duisburg	DE				No Charge
Frankfurt am Main	DE				
Hannover	DE	x			General charge
Mannheim	DE				No Charge
Lyon	FR				No Charge
Paris (Gennevilliers)			x		Location of the quay
Strasbourg	FR			x	Amount of passengers
Budapest	HU				No Charge

Mantova	IT				Length
Mertert	LU				No Charge
Amsterdam	NL		x		
Hengelo	NL				No Charge
Nijmegen	NL				m ²
Rotterdam	NL				m ²
Utrecht	NL				Passenger capacity
Szczecin	PL				No Charge
Constantza	RO		x		
Bratislava	SK				No Charge
London	UK			x	

Besides charges for freight vessels and passenger ships, most ports have tariffs for other kinds of ships as well, for instance;

- Tugs and push boats,
- Recreational vessels,
- Hotel ships, and
- Housing boats.

Average charge levels

In order to compare the average charge levels for freight transport vessels, four representative vessel types were selected from the PLATINA project³⁷. These are:

- M5 – Self-propelled motor vessel (MGS), 1,250 tonnes
- M8 – Self-propelled motor vessel (MGS), 2,500 tonnes
- C3-L – Motor vessel +1 pushed barge (MGSS), 5,200 tonnes
- BII-4 – Push boat + 4 barges (MSS), 9,200 tonnes

Table 39 presents the ship measurements that were used to calculate the port dues for these vessel types. Please note that no standard key figures were available for the total volume and the gross tonnage of the vessels. The figures were calculated using some generic assumptions, and should therefore be treated as rough estimations.

Table 39: Ship characteristics of representative vessel types

Vessel type ¹	Payload (t) ¹	CEMT class ²	Length in m ²	Width in m ²	Loaded depth in m ²	Fuel usage l/ km ³	Total volume in m ³ ⁴	Gross Tonnage ⁵
M5	1,250	III	85	8.2	2.7	10.8	2,063	667
M8	2,500	Va	110	11.4	3.5	17.9	4,514	1,463
C3-L	5,200	Vb	180	11.4	3.7	24.9	7,716	2,532
BII-4	9,200	VIb	190	22.8	3.7	32.8	16,288	5,469

¹ Information provided by Via Donau

² Rijkswaterstaat (2011), Richtlijn vaarwegen 2011

³ NEA (2009), Kostenkengetallen binnenvaart 2008

⁴ No key figure is available. An estimation of the total volume was calculated using the following formula:

$$\text{Volume} = \text{length} \times \text{width} \times \text{moulded depth} \times \text{block coefficient}$$

³⁷ http://ec.europa.eu/transport/modes/inland/promotion/platina_en.htm

For the moulded depth = loaded depth + freeboard. For the freeboard (part of the hull above the waterline) we assume 1.5 m for a fully loaded ship. (Source: telephonic interview with Marin)

For the block coefficient we assume 85% for inland vessels. (Source: telephonic interview with Marin)

5 The GT was calculated using the standard formula $GT = V * (0.2 + 0.02 * \log_{10}(V))$

For which V = total volume

For calculating the port dues we further assume that:

- the ship is fully loaded upon arrival at the port,
- the ship fully unloads its cargo in the port, and
- the ship carries building materials (sand).

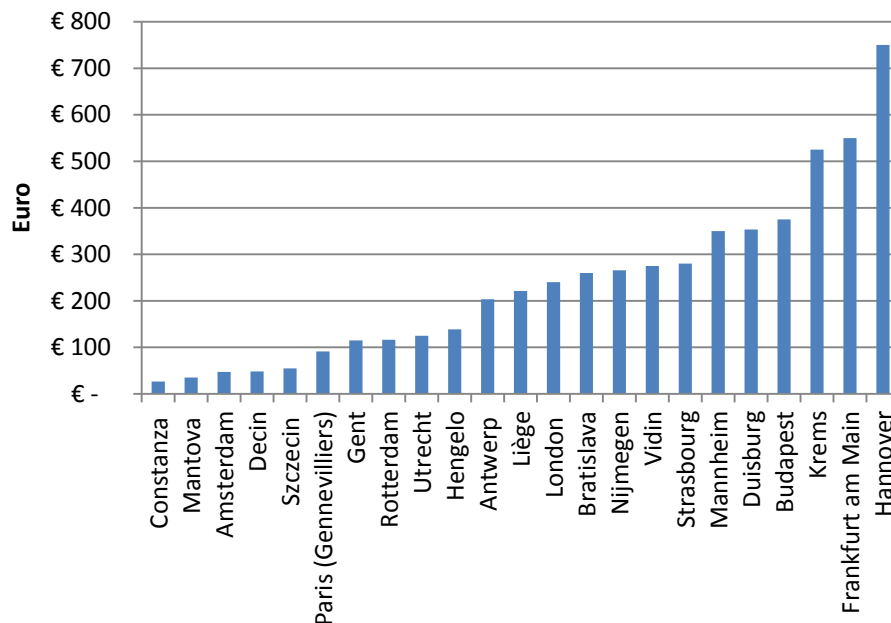
Table 40 gives a comparison of the different charge levels, taking into account the type of ships the ports are able to handle. For instance, the port of Mantova is situated among a class IV fairway, and thus is only capable to receive the M5 ship.

From the table we can conclude that there are large differences in port dues. The tariffs for German ports are high compared to other Member States, while the lowest tariffs can be found in the Romania and Italy. Figure 8 presents an overview for the port charges for a M5 vessel from the lowest to the highest charges. In all ports, the tariff increases with the size of the ships.

Table 40 Charge level of port dues for the representative vessel types

PORT DUES		M5 - Self-propelled motor vessel (MGS)	M8 - Self-propelled motor vessel (MGS)	C3-I. - Motor vessel +1 pushed barge (MGSS)	BII-4 - Push boat + 4 barges (MSS)
AVERAGE COST in €					
City - Port	Country	CEMT III - 1250 tons	CEMT Va - 2500 tons	CEMT Vb - 5200 tons	CEMT VIb - 9200 tons
Krems	AT	525	1050	2184	3864
Antwerp	BE	203	370	635	1175
Gent	BE	115	203	450	863
Liège	BE	221	443	920	not applicable
Vidin	BG	275	525	1065	1865
Decin	CZ	48	48	not applicable	
Duisburg	DE	353	707	1470	2601
Frankfurt am Main	DE	550	1100	2288	not applicable
Hannover	DE	750	1500	3120	not applicable
Mannheim	DE	350	700	1456	2576
Le Havre	FR	Free of charge			
Lyon	FR	Charge is included in the commercial handling charge			
Paris (Gennevilliers)	FR	91	183	380	673
Strasbourg	FR	280	560	1166	2061
Budapest	HU	375	750	1560	2760
Mantova	IT	35	not applicable		
Mertert	LU	Charge is included in the commercial handling charge			
Amsterdam	NL	47	94	196	346
Hengelo	NL	139	not applicable		
Nijmegen	NL	266	531	1105	1955
Rotterdam	NL	116	233	484	856
Utrecht	NL	125	250	520	not applicable
Szczecin	PL	55	not applicable		
Constanza	RO	27	53	111	196
Bratislava	SK	260	513	1071	1906
London	UK	240	487	987	not applicable

Figure 8: Comparison of port due levels for M5 motor vessels (1250 tonnes)



Annual revenues

When comparing revenues of different ports, great differences can be observed. These are caused by the size and location of the port. Looking into more detail, differences between ports handling about the same amount of ships on a yearly base can be explained by the differences in the different charges. Table 41 presents an overview. Charges are considered as a general income for the local government or the port itself. Port dues are mostly used in order to cover the costs of operating the port and for maintenance and development of the infrastructure.

Table 41 Annual revenues from port dues for the selected ports

Port	Country	Revenues (2011)
Krems	AT	n/a
Antwerp	BE	€ 10,000,000
Gent	BE	€ 2,618,284
Liège	BE	€ 2,900,000
Vidin	BG	n/a
Decin	CZ	n/a
Duisburg	DE	€ 10,000,000
Frankfurt am Main	DE	n/a
Hannover	DE	n/a
Mannheim	DE	€ 2,700,000
Le Havre	FR	€ 0
Lyon	FR	n/a
Paris (Gennevilliers)	FR	n/a
Strasbourg	FR	n/a
Budapest	HU	€ 188,455
Mantova	IT	€ 200,000
Mertert	LU	n/a
Amsterdam	NL	€ 7,000,000
Hengelo	NL	€ 350,000
Nijmegen	NL	€ 550,000
Rotterdam	NL	€ 14,853,000
Utrecht	NL	€ 500,000
Szczecin	PL	€ 3,000,000

Constantza	RO	€ 1,650,796
Bratislava	SK	n/a
London	UK	n/a

Note: The total revenues for all countries for which data is available amounts to €56,510,535.

Administrative costs

Information about administrative costs was not easily retrievable and not always available. The table below gives an overview of administrative costs of the ports, i.e. the amount of persons working in order to collect the dues. The number of employees that are required for the process heavily depend on the amount of ships that are entering the port daily. Therefore, there is a large correlation between the size of the port and the amount of personnel needed.

Table 42 Required personnel for collecting port dues in the selected ports

Port	Country	Employees
Krems	AT	N/A
Antwerp	BE	N/A
Gent	BE	N/A
Liège	BE	3.5 FTE
Vidin	BG	N/A
Decin	CZ	N/A
Duisburg	DE	5-10 FTE
Frankfurt am Main	DE	N/A
Hannover	DE	N/A
Mannheim	DE	5 FTE
Lyon	FR	1 FTE
Paris (Gennevilliers)	FR	N/A
Strasbourg	FR	N/A
Budapest	HU	1 FTE
Mantova	IT	N/A
Mertert	LU	N/A
Amsterdam	NL	4 FTE
Hengelo	NL	1 FTE
Nijmegen	NL	2 FTE
Rotterdam	NL	14 FTE
Utrecht	NL	3 FTE
Szczecin	PL	1 FTE
Constantza	RO	N/A
Bratislava	SK	N/A
London	UK	2 FTE

To gain insight on the administrative costs for shippers, interviews were held with shipper's stakeholder organisations and with individual Dutch shipping companies. The administrative costs for shippers are dependent on the sailing pattern of the vessel. There is a large difference between the costs for ships that enter a different port every day and trans-ship a few containers and ships that travel for a week and then

load/unload all containers at once. The administrative costs thus depend heavily on the number of ports visited.

Because the administrative process in most ports is automated, a shipper only has to register the ship when entering a port, and then gets an invoice afterwards. It is estimated that shipper spends one hour a week on paying these invoices.

4.4. Fairway dues

The following table shows an overview of the existence of fairway dues in the different Member States. Many countries do not have fairway dues for inland navigation. Fairway dues are applied in Belgium, France, Germany, Luxembourg and Romania. However, also in these countries, the fairway dues only apply for certain rivers and canals in the network. Due to the Mannheim and Danube Conventions, charges on the Rhine and the Danube and their attributes are not allowed.

Table 43: Fairway Dues implemented in the different Member States

Country	River/Canal	Fairway Dues Applicable
Austria	Danube	
Belgium	Brussel-Schelde Canal	X
Belgium	Meuse	X
Belgium	Other Belgium fairways	
Bulgaria	Danube	
Czech Republic	Elbe	
France	Rhine	
France	Other fairways	X
Germany	Danube	
Germany	Elbe	
Germany	Oder	
Germany	Rhine	
Germany	Other German fairways	X
Hungary	Danube	
Italy	Po	
Luxembourg / Germany	Mosel	X
Netherlands	All fairways	
Poland	All fairways	X
Romania	Danube	
Romania	Danube	
Romania	Cernavoda Canal	X
Romania	Salina Canal	X
Slovak Republic	Danube	
United Kingdom	Thames	

Comparison of charge base

Table 44 gives an overview of the different charge bases used for freight transport. Most fairway dues use tonne-kilometre as a charge base as well as the type of goods transported. For containers, this charge is based on the number of containers transported. The fairway dues on canals in Romania are based on a fixed access charge.

Table 44: Charge base of the fairway dues in different Member States (freight transport)

	Tonne-kilometre (tkm)	Type of goods	Other
Meuse River (Flemish) – BE	x		
Brussel-Schelde Canal – BE	x		Number of lock passed
Waterways North Germany – DE	x	x	
Rhein-Herne Canal – DE	x	x	
Weser-Datteln Canal –DE	x	x	
Main and Main-Danube Canal – DE	x	x	Percentage of Canal travelled
Neckar – DE	x	x	
Saar – DE	x	x	
Lahn – DE	x	x	
French waterways – FR	x		Fixed access charge dependent on weight of cargo
Mosel River – LU/DE	x	x	Per container
Polish Waterways - FR	x		
Cernavoda Canal –RO			Fixed access charge dependent on ton capacity
Salina Canal – RO			Fixed access charge dependent on ton capacity

Looking at the fairway dues for passenger ships, most used charge bases are the amount of passengers or beds, see Table 45.

Table 45: Charge base of the fairway dues in different Member States (passenger transport)

	Amount of passengers	Other
Meuse River (Flemish) – BE		Vignet
Brussel-Schelde Canal – BE	x	
Waterways North Germany – DE	x	Amount of beds
Rhein-Herne Canal – DE	x	Amount of beds
Weser-Datteln Canal –DE	x	Amount of beds
Main and Main-Danube Canal – DE	x	Amount of beds
Neckar – DE	x	Amount of beds
Saar – DE	x	Amount of beds
Lahn – DE		Not applicable
French waterways – FR		Hotel boat/ other passenger vessel, zones, tariff per m2
Mosel River – LU/DE	x	Amount of beds
Polish waterways - PO		Fixed rate per km
Cernavoda Canal –RO		Not applicable
Salina Canal – RO		Not applicable

There is no direct link between the charge structure and the internalisation of external costs. However, all charge structures are related to the size of the vessel, which is a proxy for the fuel usage of the vessel.

Comparison of charge level

The table below presents the fairway charges per kilometre for two out of four representative vessels (the large vessels are unable to sail in most of the fairways). Furthermore the price per tonne-kilometre is presented. The table shows that there are considerable differences in fairway charges on the different rivers/canals. The price is highest in the Cernavoda Canal in Romania and the Rhein-Herne-Canal and Wesel-Datteln-Canal in Germany.

Table 46: Charge level of fairway dues for representative vessels (Euro per km)

FAIRWAY DUES		M5 - Self-propelled motor vessel (MGS)	M8 - Self-propelled motor vessel (MGS)	
		AVERAGE COST per km in €		(Sand)
River/Canal	Country	CEMT III - 1250 tonnes	CEMT Va -2500 tonnes	Per t/km (€)
Brussel-Schelde Canal	BE	0.31	0.63	0.00025
Meuse (Flemish) River	BE	0.31	0.63	0.00025
Lahn	DE	5.75	11.5	0.0046
Main and Main-Danube Canal	DE	4.89	9.78	0.00291-0.00506
Neckar	DE	6.32	12.65	0.00506
Rhein-Herne-Canal	DE	17.4	31.8	0.01519
Saar	DE	3.375	6.75	0.0027
Waterways North Germany*	DE	8.85	17.7	0.00708
Weser-Datteln-Canal	DE	17.76	32.53	0.0181
Mosel River	DE/LU	3.375	6.75	0.0027
Waterways Poland	PO	1.91	3.81	0.0015
French waterways	FR	1.41	2.32	0.000784 - 0.000993
Cernavoda Canal	RO	13.64	27.27	0.3**
Sulina Canal	RO	1.44	2.88	0.0011 - 0.0023**

* Ruhr / Dortmund-Ems Canal / Küstencanal / Mittellandkanal / Elbe-Seitencanal etc.

** per ton cap.

Annual revenues

The following table presents an overview of the annual revenues of fairway dues. The revenues for Germany are around € 45 million per year. The revenues in France are € 13 million.

Table 47: Annual revenues of fairways dues (Euro per year)

Port – Country	Revenues (2010)
Belgium	n/a
Germany - Waterways North Germany	€ 30,987,000
Germany – Waterways South Germany	€ 14,800,000
France	€ 13,200,000
Luxembourg	n/a
Poland	n/a
Romania	n/a

Note: The total revenues for all countries for which data is available amounts to € 58,987,000.

Administrative costs

No information could be collected on the administrative costs from the government perspective.

Regarding the user perspective, fairway dues are usually paid by freight forwarders instead of the shippers.

These companies usually have large administrative departments responsible for all kinds of financial and administrative issues. The administrative costs are considered to be limited.

4.5. VAT exemptions and discounts

For inland navigation VAT reductions and exemptions exist for passenger transport. All selected Member States have some sort of VAT exemption or reduction for inland navigation. There are considerable differences between the different Member States. The UK is the only country which does not have VAT imposed on passenger and freight transport, while all other countries have VAT imposed on either passenger and/or freight transport, see table below. However, most countries impose a reduced tariff.

Table 48: VAT rates for inland navigation compared to the normal VAT rates

Country	Domestic Passenger Transport	International passenger Transport	Normal high VAT tariff
Austria	10% (reduced)	20%	20%
Belgium	6% (reduced)	6% (reduced)	21%
Bulgaria	20%	Exempted.	20%
Czech Republic	14% (reduced)	Exempted.	20%
Estonia	20%	Exempted.	20%
Finland	9% (reduced)	Exempted.	23%
France	7% (reduced)	7% (reduced)	19,6%
Germany	7% (reduced)	7% (reduced)	19%
Hungary	27%	Exempted.	27%
Italy	10% (reduced)	Exempted.	21%
Latvia	12% (reduced)	Exempted.	21%
Lithuania	21%	Exempted.	21%
Luxembourg	3% (reduced)	Exempted.	15%
Netherlands	6% (reduced)	6% (reduced)	21%
Poland	8% (reduced)	Exempted.	23%
Romania	24%	Exempted.	24%
Slovak Republic	20%	Exempted.	20%
Spain	8% (reduced)	8% (reduced)	18%
United Kingdom	Exempted.	Exempted.	20%

4.6. Charges related to prevention of water pollution

Currently one charge related to water pollution exists within the different Member States.

The Central Commission for the Navigation of the Rhine (CCNR) implemented a waste disposal agreement under the CDNI. The agreement made by the CDNI involves a tax on waste water in the following countries:

Table 49: Overview of countries applying charges related to prevention of water pollution

Country	Waterways
Belgium	All waterways
France	Rhine and the Mosel, up until Metz
Germany	All waterways
Luxembourg	Mosel
The Netherlands	All waterways
Switzerland	Rhine between Basel and Rheinfelden

This central agreement replaces individual taxes made by countries, it replaces national legislation. The CDNI has decided on a waste water surcharge of €7.50 for every 1,000 litres of gas oil. The surcharge

replaces any costs for waste water disposal. Aim of this prepaid surcharge is to counter any illegal disposal of waste water, by making it free of charge. Therefore, it is a direct internalisation of an external cost. The charge is collected through a debit card system.

For an indication of the average charge level, the four representative vessels of the PLATINA project are used. The following charges are the charges per km, based on the fuel consumption of the different vessels:

- M5 – Self-propelled motor vessel (MGS) – CEMT III, 1250 tonnes: € 0.081
- M8 – Self-propelled motor vessel (MGS) – CEMT Va, 2500 tonnes: € 0.134
- C3-L – Motor vessel +1 pushed barge (MGSS) – CEMT Vb, 5200 tonnes: € 0.187
- BII-4 – Push boat + 4 barges (MSS) – CEMT VIb, 9200 tonnes: € 0.246

No information was available on the total revenues or total administrative costs of this measure.

4.7. Conclusions

Port dues are the main charging measure for inland navigation, and can be found in all Member States. Port dues are mostly decided upon by local government, and have a wide range of both charge structure and charge level. Internalisation of external costs is mostly done indirectly through the differentiation in vessel size. Also in 3 out of 25 selected ports there is a discount for environmental friendly engine types, which has a direct link with air quality. All three of these ports are seaports.

Due to Mannheim and Danube Conventions it is not allowed to have direct charges on either the Rhine or the Danube. Therefore, fairway dues are mostly implemented on smaller fairways. Just as with port dues, there is an indirect internalisation element in the charge base due to the differentiation in vessel size. Another effect of the Mannheim and Danube Conventions is that in most Member States all commercial inland vessels are exempted from fuel taxes. However, in some countries there is a (limited) fuel charge to compensate for the waste water treatment costs. These charges were applicable under the Mannheim Convention, because it is not regarded as a user charge, but as a compensation for waste disposal.

5. Maritime shipping

5.1. Introduction

For maritime shipping the following pricing measures have been considered in the study:

1. Fuel taxes.
2. Sea port dues and waste charges.
3. Fairway dues.
4. VAT exemptions/discounts.

The data and information for setting up the factsheets on fuel taxes and VAT exemptions/discount stem from publications of the European Commission (*Taxes in Europe* database, Excise duty and VAT tables). For a selection of ports in the EU, we have set up factsheets on port dues and waste charges; the according data has been taken from publications of the ports and in some cases supplemented by information provided by the ports. Finally, we also prepared factsheets on those national fairway due systems in the EU that cannot be regarded as mere service charge systems, i.e. for Sweden and Finland. . These factsheets are based on the according legal documents.

5.2. Fuel taxes

In all EU Member States, energy products supplied for the use of commercial maritime shipping are exempted from fuel taxes. Commercial maritime shipping makes mainly use of heavy fuel oil. For pleasure/recreational maritime shipping heavy fuel oil is not of importance, here gas oil is mainly used. The fuel tax regime of the different EU countries regarding gas oil is described in greater detail for road transport above (see 2.2).

5.3. Sea port dues and waste charges

The selection criteria of the ports considered are as follows:

1. Consider each of the 22 maritime Member States of the EU.
2. For each EU country in which, according to Eurostat, more than 100 Mt of goods (gross weight) has been handled in all seaports in 2010 two or three TEN-T core network ports are considered.
3. For all other maritime EU Member States the major TEN-T core network port is considered.
4. The choice of the TEN-T core network port(s) considered per Member State is based on the list of the top 40 ports based on tonnes loaded and unloaded (Table 2.4.9 of DG MOVE Statistical Pocketbook 2011).

Based on these criteria, for the following ports a factsheet on sea port dues and waste charges has been set up:

1. Port of Antwerp, Belgium.
2. Port of Zeebrugge, Belgium.
3. Port of Bourgas, Bulgaria.
4. Port of Lemesos, Cyprus.
5. Port of Copenhagen-Malmö, Denmark.

6. Port of Tallinn, Estonia.
7. Helsinki Port, Finland.
8. Grand Port Le Havre, France.
9. Grand Port Maritime de Marseille, France.
10. Ports of Bremen/Bremerhaven, Germany.
11. Port of Hamburg, Germany.
12. Port of Trieste, Italy.
13. Port of Riga, Latvia.
14. Port of Klaipeda, Lithuania.
15. Grand Harbour of Valletta, Malta.
16. Port of Amsterdam, The Netherlands.
17. Port of Rotterdam, The Netherlands.
18. Port of Gdansk, Poland.
19. Port of Sines, Portugal.
20. Port of Constantza, Romania.
21. Port of Koper, Slovenia.
22. Port of Barcelona, Spain.
23. Port of Valencia, Spain.
24. Port of Gothenburg, Sweden.
25. Port of Stockholm, Sweden.
26. Port of Trelleborg, Sweden.
27. Ports of Grimsby & Immingham, United Kingdom.
28. Port of London, United Kingdom.
29. Ports of Tees & Hartlepool, United Kingdom.

For the following four sea ports selected by these criteria no factsheet could be set up, due to a lack of information:

1. Port of Genova,
2. Port of Algeciras,
3. Port of Dublin, and
4. Port of Piraeus.

Regarding the sea port dues we solely took the sea port dues into account that are levied by the respective port authority; we neither considered the port authorities service charges nor the charges that third parties, like for example container terminals, may levy. The data in the factsheets describes all main characteristics of the port dues as well as the maximum charge levels. As the charge structure of many port dues are relatively complex, for all details on the various rates, the reader is referred to the links included in the factsheets.

Note that the governance structure of European sea ports differs greatly. The European Sea Port Organization has held an enquiry amongst European ports regarding their governance structure.³⁸ This survey shows that even if the majority of the port authorities manage only one port, the number of port authorities that manage two or more ports is significant (38%). In some countries (e.g. Malta, Cyprus, Bulgaria and Romania) there are national port authorities that manage all seaports in the country.

³⁸ ESPO (2010), European Port Governance, Report of an Enquiry into the Current Governance of European Seaports.

The ownership of the port authority is often a mixture of different ownership categories, whereby one or the other form of government dominates. Most port authorities in the ESPO sample (216 different ports governed by 116 port authorities in the 22 maritime EU States plus Iceland, Norway, Croatia, and Israel) are publicly owned with the national governments and municipalities representing the two most important ownership categories. However, other ownership categories are also present such as for example independent trusts, natural persons, private companies, employees and former employees etc.

The majority of the port authorities included in the sample have their own legal personality in a commercialised or corporatized form; in the latter case the port authorities have share capital that is in part of fully owned by the government. As to the autonomy of the port authorities the survey shows that most port authorities have the autonomy to set the level and collect port charges. However, government agencies play a relatively significant role in setting the level of the general port dues.

Comparing the structure of the sea port dues of the different ports we have studied, the following can be concluded:

1. In almost every port one component of the port due is a tonnage related component of the vessel that is calling. In most cases the gross tonnage of the vessel is thereby used as the base of the due, only in a few ports (e.g. Port of Helsinki, Grand Harbour of Valletta) the net tonnage is used.
2. In the two French ports considered (Grand Port Le Havre, Grand Port Maritime de Marseille), the vessel related charge is not based on tonnage but on the volume in cubic metres, derived from the overall length, the maximum breadth and the maximum summer draught.
3. Only in the Port of Trelleborg and of Koper neither a charge based on the tonnage nor on the volume is levied.
4. In many ports a due is raised on the cargo that is loaded/unloaded in the port; due base then is the volume of the cargo in tonnes or in units (e.g. vehicles, containers etc.). In the following nine ports of the studied ports no cargo related due is raised:
 - a. Port of Bourgas, Bulgaria.
 - b. Port of Tallinn, Estonia.
 - c. Ports of Bremen/Bremerhaven, Germany.
 - d. Port of Riga, Latvia.
 - e. Port of Klaipeda, Lithuania.
 - f. Port of Gdansk, Poland.
 - g. Port of Constantza, Romania.
 - h. Port of Gothenburg, Sweden.
 - i. Ports of Tees & Hartlepool, United Kingdom.
5. Passenger/passenger cars: In some ports a specific due is raised for passengers and/or passenger cars that are embarking/disembarking.
6. In some ports there is a specific due for making use of quays. The charge base then is either again the tonnage (NT/GT) of the vessel or the length of vessel or the length of the quay used; this due is either raised right from the beginning of the use of the quay or sometimes from a certain time limit on.
7. There are many different kinds of rebates available in the ports. The common element here is that liner-services have to pay less than tramp traffic. In some ports (e.g. Hamburg) the origin

and destination of the vessel also plays a role here. A number of ports grant rebates on environmental grounds. Some ports offer a discount based on the Environmental Ship Index (ESI) Scheme, some based on the Green Award Certificate, and in other ports a NO_x/SO_x discount is offered. In one of the ports studied a sulphur fee is raised. In Table 50 an overview is given on the different regimes.

Table 50: Ports studied with environmental discounts/fees (2012)

	Discount based on ESI	Discount based on Green Award Certificate	NO _x rebate	SO _x rebate	Sulphur fee
Port of Antwerp, Belgium	x				
Port of Zeebrugge, Belgium	x				
Port of Bourgas, Bulgaria					
Port of Lemesos, Cyprus					
Port of Copenhagen-Malmö, Denmark					
Port of Tallinn, Estonia					
Helsinki Port, Finland					
Grand Port Le Havre, France	x				
Grand Port Maritime de Marseille, France					
Ports of Bremen/Bremerhaven, Germany	x				
Port of Hamburg, Germany	x				
Port of Riga, Latvia		x			
Port of Klaipeda, Lithuania		x			
Grand Harbour of Valletta, Malta					
Port of Amsterdam, The Netherlands	x	x			
Port of Rotterdam, The Netherlands	x	x			
Port of Gdansk, Poland		x			
Port of Sines, Portugal					
Port of Constantza, Romania					
Port of Koper, Slovenia					
Port of Barcelona, Spain					
Port of Valencia, Spain					
Port of Gothenburg, Sweden			x		x
Port of Stockholm, Sweden			x	x	
Port of Trelleborg, Sweden			x	x	
Ports of Grimsby & Immingham, UK					
Port of London, United Kingdom					
Ports of Tees & Hartlepool, UK					

Ships can participate in the Environmental Ship Index (ESI) Scheme on a voluntary basis. Under this scheme vessels are marked depending on the extent to which their (air pollutant) SO_x and NO_x emissions are lower than the baseline emissions (current policy requirements) and depending on whether a Ship Energy Efficiency Management Plan, in accordance with IMO guidelines, is used. An ESI score is then calculated according to a specific formula (see <http://esi.wpci.nl/Public/Home/ESIFormulas>). The ports that are affiliated to the system individually determine the discount they grant on the basis of the ESI score of a vessel.

For a ship to receive a Green Award Certificate, the ship and its manager’s office have to reach a certain score in an assessment of crew, operational, environmental and managerial elements. Ports individually determine the discount they grant to vessels holding such a certificate.

In 1998 an agreement between the Swedish Maritime Administration, the Swedish Ship Owners Association and the Swedish Ports’ and Stevedores’ Association the goal was set to reduce emissions of NO_x and sulphur of ships calling at Swedish ports by 75% in the early years of the 21st century. In the Swedish ports studied, the following instruments are used to reach this goal:

- For vessels that can prove that they have reduced their NO_x and SO_x emissions under a certain level (certificate from the Swedish Maritime Administration is needed) can receive a NO_x /SO_x rebate in the ports of Stockholm and Trelleborg.
- In the Port of Gothenburg a fee depending on the sulphur content of the fuel used is levied.

In order to get an indication on the sea port dues that have to be paid by ship owners/charterers, we have calculated for all the sea ports considered in this study the sea port dues for four different types of vessels, i.e. for a

1. Liquid bulk carrier,
2. Dry bulk carrier,
3. Container vessel, and
4. RoPax vessel.

In Table 51 the vessel/cargo characteristics used for the calculation of the sea port dues are given.

Table 51: Vessel types for which sea port dues have been calculated

	Aframax liquid bulk carrier	Panamax bulk carrier	Handy container vessel	RoPax vessel
Dwt/TEU	100,000 dwt	76,000 dwt	1,400 TEU	4,500 dwt
GT (tonne)	55,000	40,500	15,000	40,000
Length (m)	250	230	160	175
Beam (m)	41.7	32	26.3	31
Draught (m)	14.3	14	9.7	6.8
Type of cargo	Crude oil	Grain	Container	Cars and passenger cars
Volume unloaded in port	20,000 tonnes	10,000 tonnes	100 TEU containers	600 passengers 300 passenger cars*

*We assume that the same number of passengers and passenger cars disembarks and embarks in the port.

For the Liquid bulk carrier, the dry bulk carrier and the container vessel, a ship size has thereby been chosen that constitutes, in terms of number of ships, a high share of this ship type in the world fleet (fleet data as given in the Second IMO GHG Study and in Stopford (2009)). The specific characteristics of the bulk carrier considered are taken from Stopford (2009); specifications of the container vessel and the liquid bulk carrier are taken from the Second IMO GHG Study, Stopford (2009), and from the World Shipping Register. From Stopford (2009) we also know that “Whilst RoRo vessels have a limited role on the deep-sea general cargo routes, the design has proved extremely effective in two other unit load areas: Firstly in the vehicle trades using PCCs [pure car carrier] and, more recently, PCTCs [pure car and truck carriers], and secondly, in the short-sea trades where RoRo ferries carrying cargo and passengers now

dominate sea transport over short distances.” We therefore decided to look at a RoPax ferry and used the characteristics of a specific RoPax ferry of one of the world’s largest ferry operators, active in Northern Europe.

Before looking at the results of our calculations, the following should be noted:

1. To our knowledge there is no data available on the average volume of cargo handled in European ports per ship type/size. The volume of the cargo/passenger/passenger cars loaded/unloaded in port therefore has been arbitrarily chosen (the volumes of course do not exceed the maximum loading capacity of the vessels).
2. For simplicity reasons we assumed that only passengers and passenger cars embark/disembark the RoPax vessel in the ports.
3. Service fees and terminal charges are not included in the calculation.
4. Many assumptions have to be made for calculating the sea port dues, e.g. port specific areas have to be chosen. The general assumptions made are as follows:
 - a. No vessel is in liner service.
 - b. The liquid bulk carrier has no segregated ballast tank but a double hull.
 - c. The gross weight of a TEU container is 12 tonnes (which is in line with what the Port of Sines uses).
 - d. The vessels stay in port for 15 hours.
5. Not for each port the most recent rates were available.
6. Sea port dues are, when not regulated, negotiable.
7. A comparison of ports on the grounds of the calculated sea port dues for the four vessel types has a limited informative value since many ship types/sizes are not covered (70 are differentiated in the Second IMO GHG study), since some ship types do not call at some ports and since the ships handle different cargo volumes in the different ports.

The average sea port dues in the selected ports that we derived for the four vessels as specified above amount to:

1. Aframax liquid bulker: €46,000.
2. Panamax bulk carrier: €26,000.
3. Handy container vessel: €7,000.
4. RoPax vessel: € 18,000.

Per harbour the calculated sea port dues are given in Table 52.

Table 52: Sea port dues calculated for exemplary vessels (2012)

	Aframax liquid bulk carrier	Panamax bulk carrier	Handy container vessel	RoPax vessel
Port of Antwerp, Belgium	41,500	24,700	8,800	18,700
Port of Zeebrugge, Belgium	19,800	14,000	4,900	5,800
Port of Bourgas, Bulgaria	30,400	24,500	9,200	14,400
Port of Lemesos, Cyprus	43,500	17,100	9,200	16,300
Port of Copenhagen-Malmö, Denmark	68,100	25,200	9,700	19,400
Port of Tallinn, Estonia	99,000	32,000	11,900	11,000
Helsinki Port, Finland	37,800	23,000	6,000	9,800
Grand Port Le Havre, France	44,100	25,800	3,100	5,900
Grand Port Maritime de Marseille, France	35,300	28,500	3,400	9,500
Ports of Bremen/Bremerhaven, Germany	24,600	11,000	6,000	9,500
Port of Hamburg, Germany	24,200	16,600	3,200	2,300
Port of Riga, Latvia	54,200	35,800	7,000	8,800
Port of Klaipeda, Lithuania	31,900	23,500	8,700	24,400
Grand Harbour of Valletta, Malta	50,800	24,600	9,300	3,900
Port of Amsterdam, The Netherlands	29,500	17,500	3,600	16,300
Port of Rotterdam, The Netherlands	31,700	17,600	5,500	5,200
Port of Gdansk, Poland	30,300	22,300	4,100	4,800
Port of Sines, Portugal	17,000	11,300	2,700	8,100
Port of Constantza, Romania	17,000	7,700	3,800	8,100
Port of Koper, Slovenia	10,700	6,800	2,800	2,900
Port of Barcelona, Spain	21,000	21,400	6,500	18,200
Port of Valencia, Spain	21,500	21,800	6,300	18,400
Port of Gothenburg, Sweden	22,800	16,800	6,200	5,800
Port of Stockholm, Sweden	86,900	27,300	10,300	20,300
Port of Trelleborg, Sweden	36,500	12,700	5,700	3,100
Ports of Grimsby & Immingham, UK	237,600	140,000	14,300	159,300
Port of London, UK	33,000	21,900	7,700	15,200
Ports of Tees & Hartlepool, UK	92,200	67,900	25,100	67,000

The sea port dues that have to be paid by the dry bulk carrier and the container vessel due vary significantly less between the ports. For the RoPax vessels the variation is the highest, since passengers and passenger cars are treated very differently in the different ports.

Some ports have provided information on their revenue from sea port charges; for other ports information on revenues was available from annual reports. In Table 53 an overview of this information is given.

Table 53: Revenues of ports from sea port dues

Port of Antwerp, Belgium.	Total revenue from sea port dues in 2011: approximately € 90,000,000.
Port of Zeebrugge, Belgium.	€19,246,000
Port of Lemesos, Cyprus.	Revenues from general port charges in 2011 amounted to €20,996,566.
Port of Tallinn, Estonia.	Operating income 2011: €89,200,000 of which port dues €53,455,000 cargo fees €10,097,000 and passenger fees €9,977,000.
Helsinki Port, Finland.	Turnover port of Helsinki € 86,700,000 in 2010; Cargo charges: 32% (€ 27,744,000) Vessel charges: 21% (€ 18,207,000) Passenger charges: 20% (€ 17,340,000)
Port of Hamburg, Germany.	Total revenue (incl. revenue from inland navigation and from service and infrastructure charges (for e.g. locks) from port fees in 2010: € 44,200,000 This corresponds to 31% of turnover or 19% of total income, including turnover, subsidies and other income.
Port of Riga, Latvia.	In 2011 annual revenue from sea port dues was € 37,500,000.
Port of Klaipeda, Lithuania.	Revenues in 2011 were €206,723,068, of which 85% (€175,714,608) is revenue from port dues.
Port of Amsterdam, The Netherlands.	Total revenues for the year 2011 were around €40,000,000. (Maritime vessels only)
Port of Rotterdam, The Netherlands.	Total revenues for the year 2011 for sea traffic was €290.562.000.
Port of Gdańsk, Poland.	Revenues of the Port of Gdańsk Authority from sea port dues in 2011 amounted to €10,245,562.
Port of Sines, Portugal.	Operating income 2010: € 38,453,490 of which port charges: € 8,490,527.
Port of Constantza, Romania.	The income of ship services is € 20,643,955 from which 92% maritime (= € 18,992,438). The other 8% income of ship services are related to inland shipping.
Port of Koper, Slovenia.	€ 6,614,546 in total from port dues
Port of Stockholm, Sweden.	Total 2011 revenues from sea port dues: 42,580,138

Very few ports have provided information on their administrative costs related to the levying the sea port dues. In Table 54 the responses of the ports are given.

Table 54: Information of ports regarding administrative costs of levying sea port dues (2012)

Port of Zeebrugge, Belgium.	2 Full time equivalent (FTE)												
Port of Lemesos, Cyprus.	Administrative costs for levying sea port dues are as follows (for the year 2011): <ul style="list-style-type: none"> • salaries and associated expenses: €14,179,840. • office maintenance expenses: €334,481. • maintenance and operational expenditure: €2.208,759. 												
Port of Helsinki, Finland.	Administrative costs of port dues not specified, but total expenses 2011 EUR 78,8 million of which: <table style="width: 100%; border: none;"> <tr> <td>Personnel expenses</td> <td style="text-align: right;">15%</td> </tr> <tr> <td>Rents</td> <td style="text-align: right;">10%</td> </tr> <tr> <td>Procured services</td> <td style="text-align: right;">19%</td> </tr> <tr> <td>Depreciation</td> <td style="text-align: right;">39%</td> </tr> <tr> <td>Financing expenses</td> <td style="text-align: right;">12%</td> </tr> <tr> <td>Supplies and other</td> <td style="text-align: right;">5%</td> </tr> </table>	Personnel expenses	15%	Rents	10%	Procured services	19%	Depreciation	39%	Financing expenses	12%	Supplies and other	5%
Personnel expenses	15%												
Rents	10%												
Procured services	19%												
Depreciation	39%												
Financing expenses	12%												
Supplies and other	5%												
Port of Klaipeda, Lithuania.	The administrative cost of levying seaport dues is not registered separately. Total administrative expenses in 2011 were €22,872,250.												
Port of Gdansk, Poland.	The share of the Port Authority administrative costs in terms measured as total expenditure on salaries (FTEs excluding insurance) in revenues from sea port dues in 2011 amounted to 37%.												
Port of Sines, Portugal.	Roughly speaking administrative costs should account for around 10% - 15% of the dues/revenues. These percentages are highly dependable on the cost accounting approach applied though.												
Port of Stockholm, Sweden.	1 FTE.												
Ports of Tees & Hartlepool, United Kingdom	Administration costs of charging seaport dues were €7,561,656 in 2011.												

As to the administrative costs that accrue to the ship owners/charterers, no information has been found.

As a result of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues, ports in the Member States have to provide waste reception facilities and vessels are, against a waste charge, obligated to make use of these facilities. To avoid illegal discharges, the waste charge system in most cases is set up such that each vessel has to pay a charge per call that does not depend on the actual amount of waste that is discharged and that by paying this charge the vessel has the right to deliver a specific amount of waste free of charge.

In all ports the charge is differentiated according to a certain characteristic of the vessel that is calling. However, the vessel characteristic chosen and the degree of differentiation differ between ports. In the ports considered in this study the differentiation of the waste charge is related to one of the following vessel characteristics:

1. Gross tonnage (e.g. Port of Amsterdam)
2. Net tonnage (e.g. Ports of Grimsby & Immingham)
3. Main engine power (e.g. Port of Rotterdam),

4. Volume of vessel determined on the basis of length, beam, draught (Port of Le Havre and Marseille)

As to the degree to which the waste charge is differentiated, either a few groups are differentiated (e.g. five gross tonnage groups with different rates at the Port of Amsterdam) or the charge is infinitely differentiated in the sense that one rate per unit of the vessel characteristic (e.g. €/GT at the Port of Stockholm) is fixed.

5.4. VAT exemptions and discounts

In all EU countries with international sea passenger transport, the VAT rate for international passenger transport is zero. In most EU countries with domestic sea passenger transport, the reduced general VAT rate applies for domestic sea passenger transport, in five EU countries (Bulgaria, Estonia, Germany (partly), Lithuania, and Romania) however the standard VAT rate is applied. In two EU countries (Denmark and Ireland) domestic sea passenger transport is exempted from VAT; in Malta and the UK a zero rate is applied. See Table 55 for an overview of the different VAT regimes in the EU countries regarding domestic sea passenger transport.

Table 55 Domestic sea passenger transport VAT regimes (2012)

	Domestic sea passenger transport	Standard general rate	Reduced general rate(s)
Austria	Not relevant.	20%	10%
Belgium	6%	21%	6/12%
Bulgaria	20%	20%	9%
Cyprus	8%	17%	5/8%
Czech Republic	Not relevant.	20%	14%
Denmark	Exempted.	25%	-
Estonia	20%	20%	9%
Finland	9%	23%	9/13%
France	7%	19.6%	5.5/7%
Germany	7/19%/exempted.	19%	7%
Greece	13%	23%	6.5/13%
Hungary	Not relevant.	27%	5/18%
Ireland	Exempted.	23%	9/13.5%
Italy	10%	21%	10%
Latvia	12%	21%	12%
Lithuania	21%	21%	5/9%
Luxembourg	Not relevant.	15%	6/12%
Malta	0 %	18%	5/7%
Netherlands	6%	21%	6%
Poland	8%	23%	5/8%
Portugal	6%	23%	6/13%
Romania	24%	24%	5/9%
Slovenia	8.5%	20%	8.5%
Slovakia	Not relevant.	20%	10%
Spain	8%	18%	8%
Sweden	6%	25%	6/12%
United Kingdom	0%	20%	5%

5.5. Fairway dues

National fairway dues exist in Estonia, Finland, Latvia, Denmark and Sweden. The Estonian fairway dues are service charges in the sense that fees that are collected are earmarked for specific purposes, such as lighthouse dues, ice dues and pilotage dues. We therefore did not take these fairway dues into account here. The same holds for Latvia where lighthouse dues and for Denmark where ice dues are enforced. Germany, Poland and the Netherlands do not, in principle, charge sea vessels for costs for providing and maintaining fairways: in Germany only for the Kiel Canal a fairway due has to be paid, in Poland all fairway costs are paid for out of the state budget and in the Netherlands the provision, maintenance of access fairways are paid out of general tax revenue. In Lithuania and in the UK elements of fairway charging exist in the port due system: in Lithuania the national maritime administration can use the income from port's vessel and tonnage dues for provision and maintenance of infrastructure, in the UK

local authorities that are in charge of fairways have the right to charge for the related costs. (Kågeson, 1999) We are not aware of maritime fairway dues in Southern EU countries.

For the national fairway dues that are not directly service related - that is for the Swedish and Finnish fairways dues - we set up a factsheet.

Vessels calling at a Swedish port or vessels carrying out ship to ship operations in Swedish waters are liable for fairway dues. The Swedish Maritime Administration (SMA) raises these fairway dues and uses the revenues for covering the costs for services rendered to merchant shipping, besides services where the individual user of services is identifiable. The Swedish fairway due system has three environmental components:

1. The gross tonnage based component has a maximum level depending on a vessel's NO_x emissions.
2. The rate of the gross tonnage based component is differentiated depending on a vessel's NO_x emissions.
3. A fee depending on the sulphur content of the fuel used.

All three components give an incentive to reduce the air pollutants of a vessel.

In contrast to the Swedish fairway dues, the Finnish fairway dues are not environmentally differentiated. All merchant ships calling at a Finnish port have to pay the fairway due. The Customs Department collects the dues and the revenue is earmarked for the Finnish Maritime Administration for covering costs for channels, lighthouses, icebreakers etc. The charge base is the net tonnage of the vessels and the rate of the due is differentiated according to the ice class of a vessel, favouring vessels with a high ice class.

5.6. Conclusions

In all EU Member States, energy products supplied for the use of commercial maritime shipping are exempted from fuel taxes. Pleasure/recreational shipping, usually uses gas oil and is therefore taxed like road diesel.

The structure of the general sea port dues in the ports studied shows the following pattern:

- In almost every port one component of the port due is a tonnage related component of the vessel that is calling.
- In many ports a due is raised on the cargo that is loaded/unloaded in the port
- In some ports a specific due is raised for passengers and/or passenger cars that are embarking/disembarking.
- In some ports there is a specific due for making use of quays.
- There are many different kinds of rebates available in the ports. The common element here is that liner-services have to pay less than tramp traffic. In some ports the origin and destination of the vessel also plays a role here.
- Thirteen ports of the ports considered in the study grant a rebate on environmental grounds. Some ports offer a discount based on the Environmental Ship Index (ESI) Scheme, some based on the Green Award Certificate, in other ports a NO_x/SO_x discount is offered.
- In one of the ports studied a sulphur fee is raised.

As a result of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues, ports in the Member States have to provide waste reception facilities and vessels are, against a

waste charge, obligated to make use of these facilities. To avoid illegal discharges, the waste charge system in most cases is set up such that each vessel has to pay a charge per call that does not depend on the actual amount of waste that is discharged and that by paying this charge the vessel has the right to deliver a specific amount of waste free of charge. In all ports the charge is differentiated according to a certain characteristic of the vessel that is calling. However, the vessel characteristic chosen and the degree of differentiation differs between ports.

The VAT rate for international passenger sea transport is zero in all Member States, while for domestic sea passenger transport usually the reduced standard VAT rate applies, except for five countries where the regular VAT level applies.

The Swedish fairway due systems is environmentally differentiated, depending on the SO_x and NO_x emissions of the ships, whereas the rates of the Finnish fairway due system depend on the ice class of the vessels.

6. Aviation

6.1. Introduction

For aviation the following pricing measures have been considered in the study:

1. Fuel taxes.
2. Emissions trading scheme.
3. Airport charges.
4. Aviation taxes.
5. VAT exemptions/discounts,
6. Air navigation service charges.

The data and information for setting up the factsheets on fuel taxes and VAT exemptions/discount stem from publications of the European Commission (*Taxes in Europe* database, Excise duty and VAT tables). For a selection of main airports in the EU, we have set up factsheets on airport charges. We therefore have used publications of the airports and have contacted the airports if this information was not sufficient.

We have also set up a factsheet on the Emissions Trading Scheme that includes the aviation sector. This factsheet is based on documents available on the website of DG Climate Action. Finally, we also set up a factsheet with information on the route charges that are collected by EUROCONTROL and on air navigation service charges that are levied at airports. The information for these factsheets stem from EUROCONTROL.

6.2. Fuel taxes

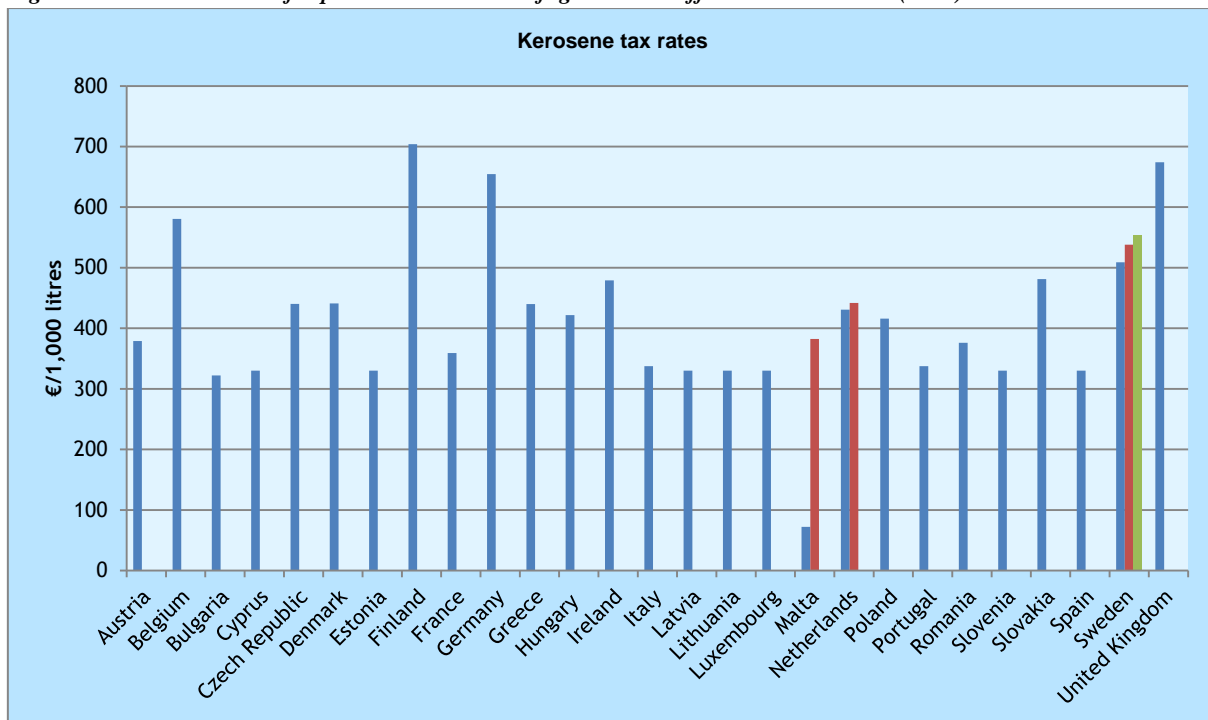
In all EU Member States, energy products supplied for the use of commercial flights are exempted from fuel tax. For energy products supplied for the use of pleasure/recreational flight fuel taxes are raised in all EU countries, see Figure 9. It should be noted that:

- for kerosene used as propellant in non-commercial aircraft a minimum excise duty of €330/1,000 litres applies in the EU,
- the rate given for Belgium includes excise duty, special excise duty and levy on energy,
- the rate given for Finland includes energy content tax, CO₂ tax, stock pile fee,
- the rate given for Ireland includes the CO₂ charge,
- the rate given for Luxembourg includes excise, autonomous excise, and additional excise duty.

The following EU countries have a specific fuel tax rate for aviation gasoline:

- Ireland: € 587.71/1,000 litres (incl. CO₂ charge),
- Finland: €641.2/1,000 litres (incl. energy content and CO₂ tax and stock pile fee),
- United Kingdom: €438.57/litres,
- France: €359/1,000 litres,
- Sweden: €427.98/1,000 litres (incl. CO₂ tax).

Figure 9: Kerosene tax rate for pleasure/recreational flights in the different EU countries (2012)



Notes:

- In Malta a special rate of €72.21/1,000 litres applies for air navigation between Malta and Gozo
- The rate in the Netherlands is differentiated to the sulphur content of the fuel.
- In Sweden three environmental classes are differentiated.

6.3. Emissions trading scheme

From the start of 2012 on, CO₂ emissions from all domestic and international flights that arrive at or depart from an airport in the EU territory or an EEA-EFTA country (Iceland, Liechtenstein, Norway) will be covered by the EU Emissions Trading System. In the factsheet on the emissions trading scheme we provide a detailed description on the design of the trading system. We estimated the total revenue from 2012 to amount to approximately €322,168,000, assuming that the EUAA price amounts to €10 per tonne CO₂.

As to the administrative costs of the emission trading scheme, the impact assessment from 2006 only gives information on what kind of administrative costs will have to be incurred:

- The cost of applying for, and maintaining, a regulatory permit which (a) signifies the registration of the operator with the relevant Member State competent authority and (b) lists the operator's requirements regarding monitoring and reporting of emissions and the surrendering of allowances.
- The initial cost of setting up monitoring and reporting systems, and the annual cost of collecting and verifying the monitoring data.
- The cost of applying for, and maintaining, a registry account through which allowances can be held and transferred.
- The cost of setting up control systems for trading in the market, and the per transaction cost from trading in the market.

- The cost to Member States from administering aircraft operators under their responsibility.

One of the major European airline companies stated that their annual administrative costs related to the emissions trading scheme is approximately €380,000.

6.4. Airport charges

For the following airports a factsheet on airport charges has been set up:

1. Vienna International Airport, Austria.
2. Brussels National Airport, Belgium.
3. Prague Ruzyně International Airport, Czech Republic.
4. Copenhagen Airport, Kastrup, Denmark.
5. Helsinki Vantaa Airport, Finland.
6. Paris - Charles de Gaulle Airport, France.
7. Paris - Orly Airport, France.
8. Frankfurt Airport, Germany.
9. Munich Airport, Germany.
10. Athens International Airport, Greece.
11. Budapest Ferenc Liszt International Airport, Hungary.
12. Dublin Airport, Ireland.
13. Milan Malpensa Airport, Italy.
14. Rome Fiumicino Airport, Italy.
15. Amsterdam Airport Schiphol, Netherlands.
16. Warsaw Chopin Airport, Poland.
17. Lisbon Airport, Portugal.
18. Barcelona - El Prat Airport, Spain.
19. Madrid - Barajas Airport, Spain.
20. Palma de Mallorca Airport, Spain.
21. Stockholm Arlanda Airport, Sweden.
22. Manchester Airport, UK.
23. London Heathrow Airport, UK.
24. London Gatwick Airport, UK.
25. London Stansted Airport, UK.

For each of the seventeen Member States that are incorporated in the TEN-T airport core network list, we thereby have chosen the airport with the highest number of passengers in 2010 according to Eurostat. For those Member States where two or more airports are included in the top 20 airports, these have also been included.

Comparing the structure of the dues of the different airports studied, three main groups of charges can be differentiated:

1. Charges that are based on the maximum take-off weight, such as e.g.
 - a. Landing and take-off (LTO) charge.
 - b. Parking charge.
2. Charges that are based on the number of passengers, such as e.g.
 - a. Passenger charge.
 - b. Security charge.
 - c. Persons with reduced mobility (PRM) charge.
3. Noise and emissions related charges. The base of these charges is described in greater detail below.

At almost every airport studied the following charges are raised:

- LTO charge,
- Passenger charge,
- Parking charge.

Only at Manchester Airport no LTO charge is levied.

Note that in Directive 2009/12/EC the European Commission has set common principles for the levying of airport charges at Community airports with an annual traffic of over five million passenger movements and with the highest passenger movement in each Member State. This involves a compulsory procedure for regular consultation between airport managing body and airport users with respect to the operation of the system of airport charges, the level of airport charges and, as appropriate, the quality of service provided. As a consequence, the airport charging system is much more transparent than the charging systems at sea ports.

Directive 2009/12/EC requires airport charges not to discriminate among airport users, but allows a modulation of the charges for issues of public and general interest, including environmental issues.

Noise and emission related charges

There are large differences with respect to noise and emission charges among the 25 airports that have been researched in this study. At most airports a noise charge is levied and at some airports also an emission charge has been implemented. At a few airports, namely Dublin airport, Roma Fiumicino, Milano Malpensa, Athens airport and Lisbon airport, no charges are levied at all regarding noise or emissions. Table 56 gives an overview of the noise and emission charges levied per airport.

Table 56: Noise- and emissions related charges per airport (2012)

Airport	Noise related charge	Emission related charge
Vienna International, Austria.	X	
Brussels National, Belgium.	X	
Prague Ruzyně International, Czech Republic.	X	
Copenhagen, Kastrup, Denmark.		X
Helsinki Vantaa, Finland.	X	
Paris – Charles de Gaulle, France.*	X	
Pairs – Orly, France.*	X	
Frankfurt, Germany.	X	X
Munich, Germany.	X	X
Athens International, Greece.		
Budapest Ferenc Liszt International, Hungary.	X	
Dublin, Ireland.		
Milan Malpensa, Italy.		
Rome Fiumicino, Italy.		
Amsterdam Schiphol, Netherlands.	X	
Warsaw Chopin, Poland.	X	
Lisbon, Portugal.		
Barcelona – El Prat, Spain.	X	
Madrid – Barajas, Spain.	X	
Palma de Mallorca, Spain.	X	
Stockholm Arlanda, Sweden.	X	X
Manchester, UK.	X	
London Gatwick, UK.	X	X
London Heathrow, UK.	X	X
London Stansted, UK.	X	

*Noise tax.

Apart from the difference whether a noise or emission charge is implemented or not, also different methods are used to determine the level of the charges. In the next two paragraphs, the differences in noise and emission charges among the airports are discussed.

Noise charge

At 19 out of the 25 airports that have been researched in this study, a noise charge is levied. At Roma Fiumicino, Milano Malpensa, Copenhagen Kastrup, Dublin airport, Athens airport and Lisbon airport, there is no noise charge levied.

At the airports that levy noise charges, noise charges are differentiated for the different noise levels produced by individual aircraft. The International Civil Aviation Organization (ICAO) assigns aircraft to a certificated noise level category (also called noise chapters) according to ICAO Annex 16 Volume 1. At most of the airports studied, a local noise categorization exists which is based on the noise chapters from ICAO. However, the number of noise categories per airport differs substantially. In France (Charles de

Gaulle and Paris-Orly airport), 6 acoustic groups have been distinguished, which are based on the effective perceived noise decibel (EPNdB) at landing and take-off. In Germany (Frankfurt and Munich airport) there are 12 noise categories, depending on aircraft type and engine type, while Schiphol airport has only 4 noise categories (A, B, C, MCC3). The charges are based on these noise categories, where the noisiest aircraft pay higher charges than the relatively less noisy aircraft.

In general, there are three ways in which the airports studied levy their noise charges

- 1.) Noise charge directly related to noise category
- 2.) Noise charge related to LTO charge
- 3.) Noise charge related to noise-threshold

1.) Noise charge directly related to noise category

At Prague airport, Munich and Frankfurt airport a noise charge is implemented which is directly related to noise categories. The aircraft are classified according to different noise categories, depending on their noise levels. For each noise charge applies a different fixed charge. At the lower noise categories a lower charge has to be paid, whereas for high noise levels a higher fee has to be paid. In Germany, also additional charges have to be paid during the night time.

2.) Noise charge related to LTO charge

At many of the studied airports, the noise charge is related to the landing and take-off (LTO) charge. The noise charge can be included in the LTO charge (a), or the LTO charge is multiplied by a noise level coefficient (b.) or is increased by a surcharge in percentage (c):

a. Noise charge included in LTO charge

In the United Kingdom (Heathrow, Gatwick, Stansted airport), the landing charge is differentiated depending on the MTOW and the noise category of the aircraft. The noise charge is thus included in the landing charge. This has as advantage that it simplifies the way of levying charges, but also has as disadvantage that it is less transparent.

b. Noise level coefficient (LTO)

At Paris Charles de Gaulle, Paris-Orly, and Brussels airport the noise charge is determined by multiplying the LTO charge by a noise level coefficient, based on the aircraft's noise classification. At Paris Charles de Gaulle, for example, the noise level coefficient ranges from 0.7 to 1.3 during the day and from 1.05 to 1.95 during the night. In this way a relatively lower charge is paid by aircraft with lower noise categories and aircraft landing during day time.

c. Noise surcharge in percentage (LTO)

A similar method to determine a LTO-related noise charge is to increase or reduce the LTO charge with a surcharge in percentage, depending on the aircraft's noise classification. This method is implemented in Spain (Madrid, Barcelona, Palma de Mallorca), Schiphol airport and at Manchester airport. At Schiphol, for example, a higher charge is levied on aircraft with high noise levels (40-60% increase), while a reduction (-20%) is allocated to aircraft that have relatively low noise levels. In Spain, there are also surcharges for noise during the night, which go up to even 140% of the LTO charge.

d. *Noise charge per MTOW*

At last, noise charges can also be paid per tonne of MTOW. Since LTO charges are often related to the maximum take-off weight (MTOW) of the aircraft, this charge is comparable to the other LTO-related charges. At Warsaw airport a noise charge per tonne MTOW is implemented. Aircraft are classified according to 5 noise categories, depending on their accumulated noise margin in EPNdB. Per category, different charges apply, depending on the time of landing and take-off (day, evening/morning, night). The charge has to be paid for each tonne or part of a tonne MTOW.

3.) *Noise charge related to noise threshold or maximum noise value*

At Stockholm Arlanda, Helsinki Vantaa airport and Vienna Airport, extensive calculation methods are used to determine the noise charge. The charges are based on the difference between the individual noise levels of the aircraft and a threshold which is determined by the ICAO. The larger the individual noise values compared to the threshold or the maximum noise value, the higher the noise charge that has to be paid. The individual noise levels and maximum noise levels are calculated by determining the noise levels for take-off (fly over), approach and full power (sideline, lateral). An example of this noise charge formula is given in Box 1 for Stockholm Arlanda airport.

Box 1: Noise charge formula for Stockholm Arlanda

Formula used to calculate noise charge for one take-off:

$$C_{tot} = C \times (10^{(La-Ta)/10} + 10^{(Ld-Td)/10})$$

Where:

C = unit noise charge, (ranges from €3.28 - €65.51)

La = Approach level of the individual aircraft.

Ta = Minimum threshold at approach = 91 EPNdb.

Ld = Average of the sideline and take-off levels of the individual aircraft.

Td = Minimum threshold at departure = 86 EPNdb.

Emission charge

Only at 6 out of the 25 airports that have been researched in this study, an emission charge is levied. This is, with the exception of Copenhagen Kastrup, at airports at which also noise charges are levied. The airports that have emission charges include Heathrow, Gatwick, Frankfurt, Munich, Copenhagen Kastrup and Stockholm Arlanda.

The emission charge is in all cases based on the emission values of nitrogen oxide equivalent (NO_x) and hydrocarbon (HC) in the landing and take-off cycle. The charge is levied per kg NO_x emitted. Table 57 shows that NO_x charge level for the airports that have an emission charge. For comparison also the estimates for external cost NO_x air pollution costs are included (national averages for the country). For the airports in London and Stockholm the rates are close the cost. In Copenhagen and the two German airports, the rates are considerably lower than the costs.

Table 57: Emission charge level in 2012 and external costs of NO_x emissions³⁹

Airport	NO _x emission charge level	NO _x cost (€ ₂₀₀₈ per kg)
Copenhagen	€ 2.22	€ 5.30
Frankfurt	€ 3.00	€ 12.70
Munich	€ 3.00	€ 12.70
London Gatwick	€ 5.26	€ 5.20
London Heathrow	€ 7.78	€ 5.20
Stockholm	€ 5.46	€ 4.10

The moment at which the charge is levied differs among the airports. In some cases the emission charge is levied for landing (such as at London Heathrow and Gatwick), while in Copenhagen the charge is levied for take-off. In Frankfurt the emission charge is levied on both landing and take-off. The emission charge is calculated using the ERLIG-formula⁴⁰, shown in Box 2. It is based on the certified NO_x and HC emission values per engine in the LTO-cycle pursuant to ICAO Annex 16 Volume II.

Box 2: ERLIG- formula (Airport charges 2012, Frankfurt Airport)

$$NO_x, aircraft[kg] =$$

$$No. of engines \times \sum_{Mode} time [s] \times fuel consumption [kg/s] \times NO_x index [g/kg] / 1,000$$

If HC LTO > 19.6 g/kN, the NO_x, aircraft is multiplied by a factor 'a':

$$a = 1; \quad \text{if } Dp_{HC}/Foo \leq 19.6 \text{ g/kN}$$

$$a = (Dp_{HC}/Foo)/19.6 \text{ g/kN}; \quad \text{if } Dp_{HC}/Foo > 19.6 \text{ g/kN} \quad (a_{max} = 4)$$

The emission value per aircraft = a x NO_x per aircraft engine

In order to get an indication of the airport charges that have to be incurred by the airlines, we have calculated for the airports considered in this study the airport dues for the following three different aircraft types, see Table 58. Three differently sized aircraft types have thereby been chosen, with the latter mainly being used for regional air transport.

Table 58: Selected aircraft types, used for making comparisons

Aircraft type	Boeing 747-400	Airbus A320-232	Embraer 170 STD
Engine type	CF6-80C2B1F	V2527-A5	CF34-8E5
# engines	4	2	2
MTOW (kg)	396,894	73,500	37,500
# seats (standard three class configuration)	470	179	70
Passenger Load Factor = average passenger load factor for European network airlines in 2011 (from	77.5%	77.5%	77.5%

³⁹ External costs estimate are based on NEEDS, source: *External Costs of Transport in Europe*, CE Delft/INFRAS/Fraunhofer-ISI, 2011.

⁴⁰ ERLIG Emission Related Landing Charges Investigation Group, ECAC

AEA)			
# passengers	364	139	54
LTO NOx emissions (kg/LTO)	42.87	10.76	4.44
Average noise (EPNdB)	100.63	90.07	90.13
Take off /Flyover noise (EPNdB)	99.9	83.2	82.2
Sideline / Lateral (EPNdB)	97.9	91.7	92.1
Approach (EPNdB)	104.1	95.3	94.9
Cumulative noise margin (EPNdB)	13.12	18.60	11.10
GIS noise metric (Schiphol)	5,12	1,01	1,01
Scheduled ground time (minutes) ⁴¹	180	120	120

The average airport charges that we derived for the three above specified aircraft amount to:

- Boeing 747-400: €9,800;
- Airbus A320-232: €3,000 ;
- Embraer 170 STD: €1,300.

In Table 59 the airport charges for the three aircraft types are given per airport.

⁴¹ Jetzky 2009, https://extranet.eurocontrol.int/http://prisme-web.hq.corp.eurocontrol.int/ecoda/coda/public/standard_page/codarep/Propogation_Of_Delays_RWTH.pdf

Table 59: Airport charges calculated for three aircraft types (2012)

Airport	Boeing 747-400			Airbus A320-232			Embraer 170 STD		
	Charges 1-6*	Charges 7-9*	Total **	Charges 1-6*	Charges 7-9*	Total **	Charges 1-6*	Charges 7-9*	Total **
Vienna International, Austria	9,770	120	9,900	3,360	50	3,400	1,270	20	1,300
Brussels National, Belgium	10,620	280	10,900	4,070	110	4,200	1,670	40	1,700
Prague Ruzyně International, Czech Republic	10,310	0	10,300	3,570	0	3,600	1,320	0	1,300
Copenhagen, Kastrup, Denmark	8,080	90	8,200	3,050	30	3,100	870	10	900
Helsinki Vantaa, Finland	7,050	70	7,100	1,580	30	1,600	630	10	600
Paris – Charles de Gaulle, France	11,000	420	11,400	1,890	160	2,000	760	60	800
Pairs – Orly, France	11,000	230	11,200	1,890	90	2,000	760	30	800
Frankfurt, Germany	11,490	0	11,500	3,210	0	3,200	1,330	0	1,300
Munich, Germany	9,470	110	9,600	3,200	40	3,200	1,540	20	1,600
Athens International, Greece	9,310	1,150	10,500	3,190	600	3,800	1,110	360	1,500
Budapest Ferenc Liszt International, Hungary	11,400	0	11,400	3,920	0	3,900	1,680	0	1,700
Dublin, Ireland	11,630	70	11,700	3,170	40	3,200	1,480	40	1,500
Milan Malpensa, Italy	5,530	3,160	8,700	1,350	940	2,300	550	50	600
Rome Fiumicino, Italy	5,520	1,190	6,700	1,220	460	1,700	490	370	900
Amsterdam Schiphol, Netherlands	15,500	140	15,600	4,560	50	4,600	1,870	20	1,900
Warsaw Chopin, Poland	9,020	0	9,000	2,610	0	2,600	1,090	0	1,100
Lisbon, Portugal	9,330	790	10,100	2,250	450	2,700	710	410	1,100
Barcelona – El Prat, Spain	7,260	1,660	8,900	1,690	630	2,300	730	470	1,200
Madrid – Barajas, Spain	8,100	1,810	9,900	3,440	550	4,000	1,390	390	1,800
Palma de Mallorca, Spain	6,910	1,730	8,600	1,610	460	2,100	590	320	900
Stockholm Arlanda, Sweden	6,080	280	6,400	2,000	20	2,020	790	10	800
Manchester, UK	7,180	180	7,400	2,510	70	2,600	870	90	1,000
London Gatwick, UK	7,550	70	7,600	3,860	20	3,900	2,460	10	2,500
London Heathrow, UK	17,430	0	17,400	6,390	0	6,400	3,540	0	3,500
London Stansted, UK	6,000	0	6,000	2,200	0	2,200	840	0	900

*see list of charges on the next page.

*8 Numbers are rounded

In Table 59, the following components have thereby been taken into account:

1. LTO/runway charge,
2. Passenger (facility) charge,
3. Aircraft parking charge,
4. Security charge,
5. Noise charge,
6. Emission charge,
7. Air bridge charge,
8. Person with reduced mobility (PRM) charge,
9. Common use terminal equipment (CUTE) charge.

Per aircraft type, the charge components 1-6 and 7-9 of this list are summed up in two columns in Table 59; the third column gives respectively the total sum (for a detailed overview please see Annex C). As can be seen in Table 60, many airports provided information on their revenues from airport charges. However, in some cases, no airport specific information but only information for a whole airport group was available.

Table 60: Revenues from airport charges

Airport	Revenue
Vienna International, Austria	2011 revenues from airport charges: <ul style="list-style-type: none"> • LTO charge: € 65,300,000. • Passenger charge (incl. PRM): € 118,500,000. • Infrastructure charge: € 27,500,000. • Security charge: € 68,100,000. • Passenger and baggage screening: €300,000. • Total: € 279,700,000.
Brussels National, Belgium	Total revenues of MAp group (Sydney, Copenhagen and Brussels) from aeronautical services (2010) : € 235,500,000. Airport charge specific revenue not available.
Copenhagen, Kastrup, Denmark	2011 revenues from airport charges (for group: Roskilde and Kastrup): €246,293,985.86 [DKK 1835,900,000]
Helsinki Vantaa, Finland	2011 revenues from airport charges <ul style="list-style-type: none"> • Landing charges: €33,100,000. • Parking charges: €3,900,000 • Electricity charges: €1,300,000 • Noise charges: €100,000 • Passenger charge: € 55,400,000 • Security charges: €23,800,000 • PRM charges: €1,400,000 • Total: €119,000,000.
Frankfurt, Germany	2011 total airport charges revenues: € 634,700,000.
Athens International, Greece	Revenues from airport charges (2011): € 158,475,431
Budapest Ferenc Liszt International, Hungary	In 2009, Budapest Airport generated revenues of € 173,700,000 of which €100,100,000 is from aviation-related charges.
Dublin, Ireland	2011 revenues from aeronautical services: <ul style="list-style-type: none"> • Passenger Service Charge: €104.074.102. • Landing and Take-off Tonnage: €79.364.366. • Aircraft parking: €13.745.957 • Airbridge Hire: €1.514.012 • Discounts: €-6.213.546 • Total: €192.484.892
Milan Malpensa, Italy	2011 revenues:

	<ul style="list-style-type: none"> • LTO charge: € 35,600,000. • Passenger related charge: € 59,000,000. • Parking charge: € 1,900,000. • Infrastructure charge: € 47,200,000. • Charges for the use of special lighting equipment for runways: € 300,000. • PRM charge: € 5,500,000. • Security charge: € 36,100,000. • Freight charge: € 7,600,000. • Total: € 193,100,000.
Rome Fiumicino, Italy	2011 revenues from airport fees ADR Group (Fiumicino + Ciampino): € 181,600,000.
Amsterdam Schiphol, Netherlands	Total 2011 revenues from airport charges: € 734,000,000.
Warsaw Chopin, Poland	2011 revenue from airport charges: <ul style="list-style-type: none"> • LTO charge: € 33,963,984 • Passenger charge: € 67,877,314 • Parking charge: € 1,089,076 • Noise charge: € 1,468,986 • Hangar charge: € 481,219 • Total: €104,880,581
Lisbon, Portugal	2008 revenues of ANA SA from traffic activities: € 17,000,000.
Barcelona – El Prat, Spain	2010 air traffic revenues of AENA (consolidated): € 1,150,000,000.
Madrid – Barajas, Spain	2010 air traffic revenues of AENA (consolidated): € 1,150,000,000.
Manchester, UK	2011-2012 revenues from airport charges: <ul style="list-style-type: none"> • Runway Charge: €36,761,284. • Air Traffic Services: €13,727,315. • Passenger Facilities: €56,188,925. • Passenger Security: €44,555,607. • Aircraft Parking: €3,0246,626. • Baggage System: €11,982,317. • Total: €166,240,112.
London Gatwick, UK	2010 net revenue from airport charges: €263,737,461.
London Heathrow, UK	2010/2011 net revenue from airport charges: € 1,152,379,852.
London Stansted, UK	2011 net revenue from airport charges: €140,480,591.

Very few airports have provided information on their administrative costs related to the levying the airport charges. In Table 61 the responses of the airports are given.

Table 61: Administrative costs of the airports related to raising airport charges (2012)

Airport	Administrative costs
Helsinki Vantaa, Finland	€ 1.1 million (2011), this includes only direct costs and people at the head office level who are directly involved with pricing and/or airport charges
Dublin, Ireland	Total of 10,5 FTE: <ul style="list-style-type: none"> • Billing: 3.0 FTE • Usage data gathering: 2.5 FTE • IT support: 1.0 FTE • Regulation Team: 4.0 FTE
Milan Malpensa, Italy	Malpensa administrative costs are about 42% of total SEA admin (overhead) costs.
Stockholm Arlanda, Sweden	5-7 FTEs in total, for all 11 airports of Swedavia.
Manchester, UK	4 FTEs

One of the major European airline companies stated that their annual administrative costs related to airport charges amounts to approximately €1.2 million.

6.5. Aviation taxes

In the following countries air passenger taxes are levied in Europe:

1. Austria (Flugabgabe),
2. France (Solidarity tax, Civil aviation tax),
3. Germany (Luftverkehrsabgabe),
4. Ireland (Air travel tax),
5. United Kingdom (Air passenger duty).

Common elements of these taxes are:

1. The tax is levied per passenger (only the French Civil aviation tax not only holds for passengers but also for freight and mail)
2. Except for the air travel tax in Ireland, the rate is differentiated, depending on the final destination of the passenger. The differentiation differs between the countries:
 - a. In **Austria** three groups of destinations are differentiated: short-, medium- and long haul. In the law no general principle for the allocation of the countries to these groups but rather a list of countries falling into the first two groups is given. Roughly speaking the three groups encompass the following regions:
 - i. Short-haul: most European countries, Asian and African countries at short distance (e.g. Israel and Algeria).
 - ii. Medium-haul: some European countries (e.g. Iceland), Asian and African countries at medium distance (e.g. India, Ghana).
 - iii. Long-haul: all other.
 - b. In **France** two groups of destinations are differentiated:
 - i. First group: France (including French overseas departments and territories), other EU States and EEA-EFTA states.
 - ii. Second group: All other states.

- c. In **Germany** three groups of destinations are differentiated:
 - i. First group: domestic flights, flights to EU & EU candidate countries, to EFTA member countries and countries that lie on a comparable distance.
 - ii. Second group: Destinations not falling in group 1 that are located at a distance less than 6000 km
 - iii. Third group: all other destinations.
 - d. In the **UK** four destinations bands are differentiated: 0-2000, 2001-4000, 4001-6000, over 6000 miles; bands are mostly based on the distance between London and the capital city of the destination country/territory.
3. Transit-/transfer passengers are exempted from the tax.

An overview of the revenue that has been raised by these aviation taxes is given in Table 62.

Table 62: Revenues from aviation taxes

Tax	Revenue	Year
Austria, Flugabgabe	€ 59,000,000	2011
France, Solidarity tax	€ 173,000,000	2012
France, Civil aviation tax	€ 398,000,000	2012
Germany, Luftverkehrsabgabe	€ 905,100,000	2011
Ireland, Air travel tax	€ 47,900,000	2011
United Kingdom, Air passenger duty	€ 2,980,591,000	2011

For France two other aviation related taxes have been considered in the study:

1. Airport tax,
2. Tax on air transport noise pollution.

The airport tax is raised for airport financing and has to be paid for passengers, freight, mail embarking/disembarking from French airports. The tax is passenger related thereby differs between airports, depending on the annual work load units embarking/disembarking. 2012 revenue of this tax is expected to be €905,000,000.

The noise tax is levied on aircraft taking off at eleven French airports. The tax base is the maximum take-off weight of the aircraft. The tax level further depends on noise characteristics of the aircraft, the time of take-off and an airport specific rate. The expected 2012 revenues amount to € 59,000,000.

As to the administrative costs of aviation taxes for public administrations, the Office of the Revenue Commissioners, which is the administrative entity in Ireland that is responsible for the air travel tax, stated that their annual administrative cost for administering the air travel is approximately €10,000. According to the German Ministry of Finance, the costs for administering the German aviation tax by the customs authorities amounts to around € 886,000 annually. This is equal to 15 full-time employees.

One of the major European airline companies stated that their administrative costs related to the German air passenger duty amounted to approximately €180,000 for setting up the respective administration and amounts to approximately €2.5 million annually.

6.6. VAT exemptions and discounts

In all EU countries with international air passenger transport, the VAT rate for international passenger transport is zero. In most EU countries with domestic air passenger transport, either the standard VAT rate or the reduced general VAT rate applies for domestic air passenger transport. In one country (Luxembourg) the super reduced general rate is applied. In two EU countries (Denmark and Ireland) domestic air passenger transport is exempted from VAT; in Malta and the UK a zero rate is applied. See Table 63 for an overview of the different VAT regimes regarding domestic air passenger transport.

Table 63: Domestic air passenger transport VAT regimes in the EU

	Domestic air passenger transport	Standard general rate	Reduced general rate(s)
Austria	10%	20%	10%
Belgium	6%	21%	6/12%
Bulgaria	20%	20%	9%
Cyprus	8%	17%	5/8%
Czech Republic	14/20%	20%	14%
Denmark	Exempted	25%	-
Estonia	20%	20%	9%
Finland	9%	23%	9/13%
France	7%	19.6%	5.5/7%
Germany	19%	19%	7%
Greece	13%	23%	6.5/13%
Hungary	27%	27%	5/18%
Ireland	Exempted	23%	9/13.5%
Italy	10%	21%	10%
Latvia	12%	21%	12%
Lithuania	21%	21%	5/9%
Luxembourg	3%	15%	6/12%
Malta	0 %	18%	5/7%
Netherlands	21%	21%	6%
Poland	8%	23%	5/8%
Portugal	6%	23%	6/13%
Romania	24%	24%	5/9%
Slovenia	8.5%	20%	8.5%
Slovakia	20%	20%	10%
Spain	8%	18%	8%
Sweden	6%	25%	6/12%
United Kingdom	0%	20%	5%

6.7. Air navigation service charges

Airspace users pay charges for air navigation services in the EU on the basis of a single charge per flight. The costs for the provision of facilities and services by air navigation service providers are financed through en route and terminal charges.

The EU common charging system is based on Articles 14 and 15 of Regulation (EC) No 550/2004 of the European Parliament and Council of 10 March 2004 on the provision of air navigation services in the single European sky as amended by Regulation (EU) 1070/2009 and is detailed in Commission Regulation (EC) 1794/2006 as amended by Commission Regulation (EU) 1191/2010 laying down a common charging scheme for air navigation services. The common charging scheme is consistent with the Eurocontrol route charges system. Eurocontrol is currently collecting user charges on behalf of Member States.

We set up two factsheets: one factsheet on terminal navigation charges and a second factsheet with information on the calculation method of the route charges and country specific rates. Further information is available at DG MOVE:

http://ec.europa.eu/transport/modes/air/single_european_sky/ans/ans_terminal_en.htm, and
http://ec.europa.eu/transport/modes/air/single_european_sky/ans/ans_enroute_en.htm.

6.8. Conclusions

In all EU Member States, energy products supplied for the use of commercial flights are exempted from fuel tax. For energy products supplied for the use of pleasure/recreational flight fuel taxes are raised in all EU countries.

At all airports studied the following charges are raised consisting of LTO charges, passenger charges and parking charges, except for Manchester which has no LTO charge. Furthermore, 19 of 25 airports have also a noise and 6 have an emission charge (of which five have both). Five airports have neither a noise charge nor an emission charge.

There is a wide range of methods that are used at the European airports to determine noise charges. Noise charges are levied directly related to noise categories, related to the LTO charge, by means of a Quota Count system or by using extensive calculations including noise thresholds. Furthermore, we have seen that the noise charges depend on many different factors like the effective perceived noise level (EPNdB) at take-off, side-line and approach, the time of arrival or departure and the maximum take-off weight of the aircraft. Also the classification of aircraft into noise categories varies widely from 4 to 12 different categories.

With respect to emissions related charges there is much more conformity. Emission charges are all based on the amount of emission value in terms of kg NO_x in the LTO cycle and are calculated according to a general accepted calculation method (ERLIG). Only the tariffs per kg NO_x differ among the airports, ranging from € 2.22 to € 7.78.

Five Member States have an aviation tax on aircraft tickets, and except for one case, these are differentiated according to the destination of the passenger (flight distance).

In all EU countries with international air passenger transport, the VAT rate for international passenger transport is zero. In most EU countries with domestic air passenger transport, either the standard VAT rate or the reduced general VAT rate applies for domestic air passenger transport.

7. Comparison of transport modes and link with internalisation

7.1. Introduction

In this chapter, a brief analysis and synthesis of the results for the various transport modes is made. This includes the following elements:

- How do the fuel taxes of the various transport modes compare?
- How do infrastructure charges of the various modes compare?
- Brief comparison with external costs.
- What options are there for further harmonization of internalisation policy across transport modes?

As the nature of this study is primarily data gathering, no full analysis of all aspects of all transport modes is provided, but just some key comparisons on an aggregated level is given.

7.2. Comparison of fuel taxes in various transport modes

Fuel taxes are in terms of total revenues the most important tax or charge on transport in the EU. The level of fuel taxes varies significant between Member States and transport modes. In road transport all Member States have significant fuel taxes, as this is mandatory by the Energy taxation Directive. Also rail diesel is subject to fuel taxes in most Member States, but often with a lower tax level. Maritime shipping, inland navigation and commercial aviation are exempted from fuel excise duties, except for passenger inland waterway transport in some Member States.

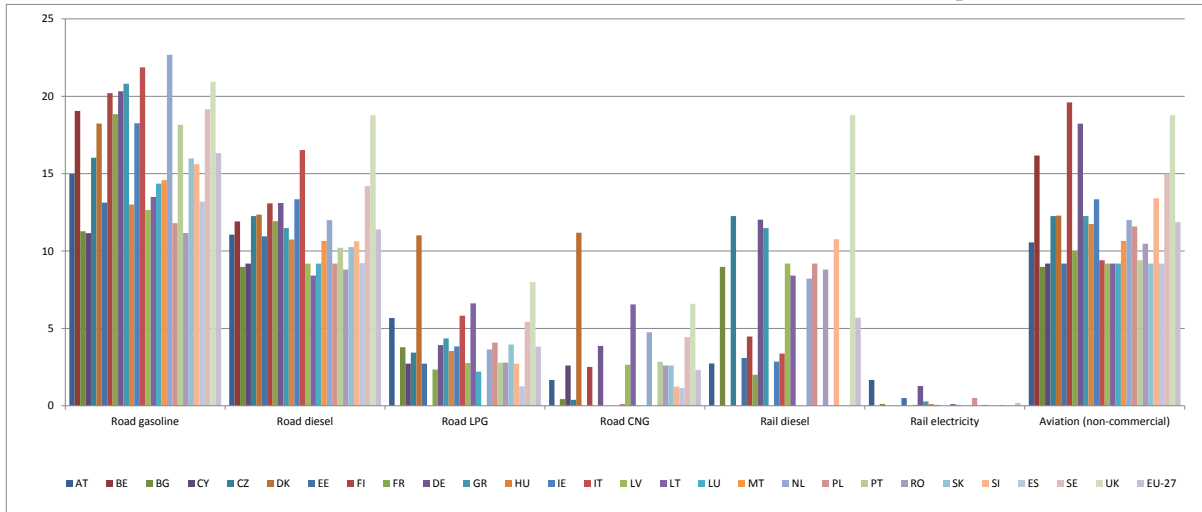
The fuel taxes of the various energy carriers used in road transport, rail transport and non-commercial aviation (pleasure/recreational flights) are compared in Figure 10 and Figure 11.

To compare the various fuel types, the taxes have been expressed in the same unit. In Figure 10 fuel taxes are expressed in Euro per Mega Joule of (primary) energy, while in Figure 11 they are all expressed in Euro per tonne of CO₂, using the carbon content of the energy carrier (well-to-wheel⁴²). The second comparison is relevant when fuel taxes are just seen as internalising climate change costs. Although, in none of the EU Member States, this is the explicit aim of fuel taxation, this allows comparing the current levels with CO₂ emission costs. From the graphs it becomes clear that there is a huge variation in fuel taxation levels across modes and Member States. Road transport fuels have the highest tax rates, particularly gasoline and diesel. The tax level for gasoline and diesel is usually in the range of € 100 to 200 per tonne of CO₂. Gaseous fuels (LPG and CNG) and rail fuel have much lower rates. The fuel tax on kerosene for non-commercial flights is in most countries equal to the road diesel tax level. However, this

⁴² For this comparison a well-to-wheel approach is used to be able to compare fuels with electric energy (for which the greenhouse gas emissions take place during electricity generation).

is of course a relatively small market segment. By far most of the kerosene is used for commercial flights which are exempted from fuel taxation.

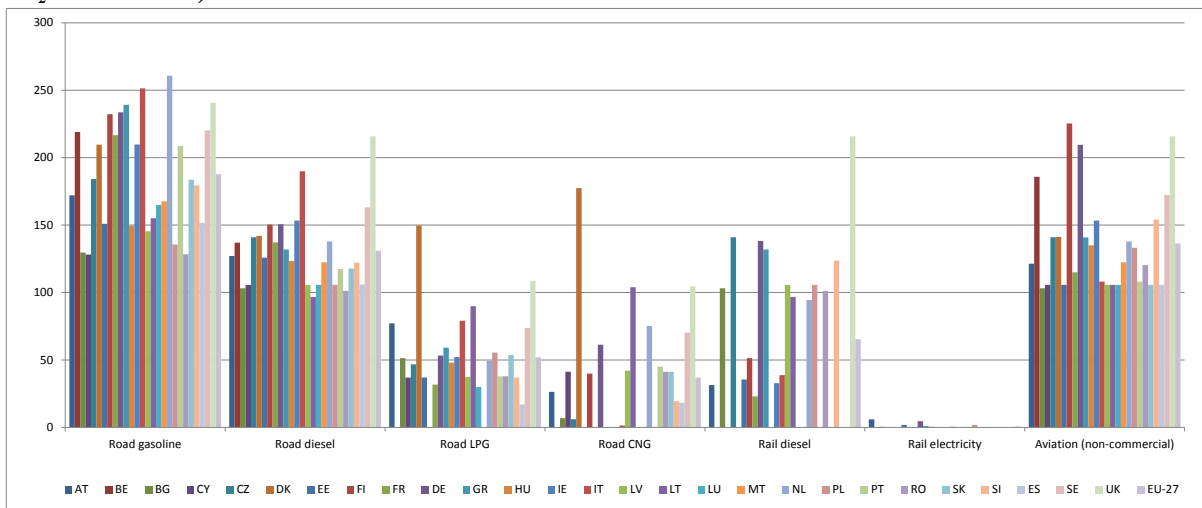
Figure 10: Comparison of energy taxation in EU Member States in different transport modes (€ per kJ)



Notes:

- Maritime shipping, inland navigation and commercial aviation are exempted from fuel excise duties (except for passenger inland waterway transport in some Member States, see relevant sections in chapter 4 to 6).
- For aviation the following values are shown: low-sulphur for Netherlands, mid value for Sweden.
- For electricity, 40% energy efficiency of power generation has been assumed for translating electric energy to primary energy.

Figure 11: Comparison of energy taxation in EU Member States in different transport modes (expressed in € per tonne of CO₂ - well-to-wheel)



Notes:

- Maritime shipping, inland navigation and commercial aviation are exempted from fuel excise duties (except for passenger inland waterway transport in some Member States, see relevant sections in chapter 4 to 6).
- For aviation the following values are shown: low-sulphur for Netherlands, mid value for Sweden.
- For electricity a CO₂ emission factor of 400 g/kWh has been assumed.

7.3. Comparison of infrastructure charges

Infrastructure charging exists for all transport modes. In maritime shipping, inland navigation and aviation, all (air)ports charge users for the use of the (air)port. All these schemes are somehow differentiated to the size of the ships or aircraft used or other parameters that can be expected to be a good proxy for the infrastructure costs. In a significant number of cases charges are also differentiated to environmental performance, such as noise or air pollution. As no data on infrastructure costs is available for these modes, no conclusion can be drawn on cost coverage: to what extent are wear & tear costs and all infrastructure costs covered by the charges.

In rail transport, usage-based infrastructure charges are also applied in all EU Member States. Railway infrastructure charges are in general quite complex, and there are considerable differences among the structures applied in the EU countries. While all countries internalize wear and tear costs, although at different level, and some countries apply access charges including scarcity/congestion costs, only few consider environmental or accidents costs, namely Czech Republic, Finland, Latvia, Sweden and UK. As it lacks an EU wide overview of rail infrastructure costs, it is not possible to estimate the cost coverage.

In road transport, usage-based infrastructure charges are less common than in the other modes. Various countries have motorway tolls for all vehicles on (parts of) their motorway networks. Furthermore, an increasing number of Member States introduced a kilometre charge for HGVs, usually also just on the motorways. In all those cases usually the full infrastructure costs are charged. However, these types of charges do only cover limited parts of the road network. For other roads than motorways hardly any infrastructure charging exists.

There are also a significant number of countries that still applies a time-based scheme (vignettes) for their motorway networks, which means that the charges that a user needs to pay does not well correlate with the external and the infrastructure costs that he causes. Some countries also regard vehicle taxation as a means of paying for infrastructure costs. However, vehicle taxes are not well correlated to infrastructure costs: they do not provide incentives for reducing infrastructure wear & tear costs. In the next section all types an indicative comparison of costs and taxes and charges for road transport is provided.

7.4. Brief comparison with external costs

In this section some high level comparisons with external costs and infrastructure costs are made. A recently published study by CE Delft, INFRAS and Fraunhofer-ISI, commissioned by the UIC, provides a complete and up-to-date overview of the external costs of transport. Table 64 shows the total costs for the various transport modes that are included (road, rail, inland navigation and aviation), split out to the various cost categories.

The average external costs per passenger-km and tonne-km can be found in Annex D. It should be noted that the actual costs per kilometre in specific traffic situations can deviate strongly from these estimates, as they depend strongly on a broad range of parameters, in particular: location (e.g. urban or rural area), time of the day (e.g. peak/off-peak), emission level of the vehicle (e.g. Euro-1 or Euro-6), vehicle size, occupancy rate/load factor and even driver characteristics (safe and fuel efficient versus offensive driving style). Costs in urban areas are much higher than elsewhere. For infrastructure costs also the axle load is a key cost driver.

Table 64 Total external costs of transport in Europe (in million €, in 2008)⁴³

Cost category	Total costs per cost category									Total Mio €/a
	Road					Rail		Aviation	Water- borne (freight)	
	Pass. cars	Buses & coaches	Motor- cycles & mopeds	LDV	HDV	Pass. transport	Freight transport	Pass. transport (cont.)	Inland water- ways	
Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a	
Accidents	157,105	6,839	22,584	18,677	19,604	238	71	223	0	225,341
Air pollution	26,636	3,347	1,696	5,933	12,995	1,092	483	426	782	53,390
Climate change high scen.	84,135	5,060	1,597	14,787	18,845	630	413	22,166	516	148,149
<i>Climate change low scen.</i>	<i>14,407</i>	<i>866</i>	<i>273</i>	<i>2,532</i>	<i>3,227</i>	<i>108</i>	<i>71</i>	<i>3,796</i>	<i>88</i>	<i>25,368</i>
Noise	8,201	865	2,076	2,094	3,537	477	476	457	0	18,183
Fuel/electricity production high scen.	27,679	1,568	523	4,765	5,802	3,354	1,947	3,356	194	49,188
<i>Fuel/electricity production low scen.</i>	<i>16,621</i>	<i>855</i>	<i>325</i>	<i>2,777</i>	<i>3,270</i>	<i>1,633</i>	<i>1,078</i>	<i>1,849</i>	<i>113</i>	<i>28,521</i>
Nature & landscape	3,008	149	75	284	1,293	75	21	296	64	5,265
Biodiversity losses	1,152	212	20	208	893	1	1	40	69	2,596
Soil & water pollution	1,582	485	40	601	1,629	220	164	0	0	4,721
Urban effects	4,814	232	116	1,035	965	229	59	0	0	7,450
Total (high scenario)	314,310	18,757	28,727	48,384	65,564	6,318	3,636	26,964	1,625	578,172

Data include the EU-27 with the exemption of Malta and Cyprus, but including Norway and Switzerland.

High climate cost estimates were based on a CO₂ price of €146 per tonne of CO₂, low estimates on €25 per tonne of CO₂.

Source: External Costs of Transport in Europe – Update study 2008, CE Delft, INFRAS and Fraunhofer-ISI, 2011

For calculating the cost coverage of existing taxes and charges, also total infrastructure cost estimates are needed. Unfortunately, an EU-wide overview of infrastructure cost estimates is lacking. For road infrastructure, some indicative estimates are available from IMPACT Deliverable 2, which place infrastructure costs – construction plus maintenance – at roughly 2% of GDP. For the other modes even such an indicative overview does not exist. As also the revenues from taxes and charges for the non-road modes are incomplete (not all (air)ports are covered, data on revenues from energy taxation for rail is incomplete), the comparisons of revenues with costs can just be made for road transport. Furthermore some of the charges included in this study (e.g. airport charges or port dues) are also payments for certain services. Another complicating factor is that external cost data are only available per Member State, while the pricing measures for (air)ports are only gathered per (air)port. This makes it in that case impossible to make useful comparisons.

⁴³ Please note that this table is only used for indicative purposes and does not prejudice on the relative valuations of the external costs between the various modes of transport as considered by the Commission.

For road transport, the external costs from Table 64 (but then per Member State) and the indicative infrastructure cost estimates for road transport from the IMPACT Deliverable 2) can be compared with the revenues from all road transport related taxes and charges that were gathered in this study. Table 65 and Figure 12 show this comparison for all Member States (except Cyprus and Malta as these are not covered in the external cost dataset). The table shows an overall estimate of external costs⁴⁴ of around 4% of GDP. When adding the road infrastructure costs (about 2% of GDP) and comparing with overall taxes and charges (around 2% of GDP), the cost coverage of the infrastructure and external costs in the EU as a whole is estimated at about 38%. In case only external costs and variable infrastructure costs are considered (so fixed infrastructure costs are excluded) the ratio is about 50%. When very conservative cost estimates are used by considering only the four core external cost categories (noise, accidents, climate change and air pollution) and the low climate change cost values (instead of the higher estimates used in Table 65), the cost coverage for the EU as a whole is still only 50% when full infrastructure costs are considered and 70% when only variable infrastructure costs are considered.

In all these cost coverage estimates, subsidies for road transport (e.g. for company cars, business & commuting travel, bus transport) are not yet included. Also congestion costs⁴⁵ are not included, nor any costs that can be imputed to security of energy supply considerations.

Table 65 and Figure 12 show that the cost coverage ratios vary significantly between the various Member States. The cost coverage when all infrastructure costs are included is highest in Denmark (87%) and lowest in the Baltic states and Hungary (17% or less). So, the table makes clear that in none of the Member States, road transport pays its full costs.

It should be noted that these ratios should be treated with some care as there is quite some uncertainty in the infrastructure cost estimates. Therefore particularly the country estimates should be interpreted with some care.

It should also be noted that from the perspective of internalisation, it is not the overall cost coverage ratio that counts, but rather the level of the price incentive individual transport users face when taking a transport decision. From that perspective there is clear lack of incentives for reducing wear & tear, air pollution, noise, accidents and congestion costs in existing pricing instruments in road transport. Only the kilometre charges that are differentiated to Euro/EURO standard, axle load, location and/or time of the day can be regarded as truly contributing to the internalisation of these costs. In such a scheme, charge level in urban areas would be considerably higher than on rural roads.

⁴⁴ This includes the core cost categories (accidents, noise, climate change, air pollution and emissions from fuel production) as well as the other, smaller cost categories (biodiversity losses, nature & landscape, soil & water pollution and urban effects).

⁴⁵ The cost of congestion has been estimated to be about 150 and 250 billion euro per year (1 to 2% of GDP)

Table 65: Indicative cost coverage ratios for road transport

Member State	Total revenues	Total external costs	Infrastructure & External costs road transport (indicative)		Cost coverage (indicative)	
			excl. fixed infra	incl. fixed infra	excl. fixed infra	incl. fixed infra
	<i>mln Euro per year</i>	<i>mln Euro per year</i>	<i>mln Euro per year</i>	<i>mln Euro per year</i>		
Austria	€ 8,059	€ 13,037	€ 14,261	€ 18,529	57%	43%
Belgium	€ 6,341	€ 12,238	€ 14,362	€ 21,413	44%	30%
Bulgaria	€ 1,124	€ 4,330	€ 4,468	€ 4,927	25%	23%
Czech Republic	€ 3,722	€ 8,233	€ 9,273	€ 12,759	40%	29%
Denmark	€ 5,632	€ 5,177	€ 5,503	€ 6,464	102%	87%
Estonia	€ 316	€ 669	€ 1,157	€ 2,787	27%	11%
Finland	€ 4,285	€ 5,706	€ 6,735	€ 10,273	64%	42%
France	€ 35,062	€ 62,285	€ 66,575	€ 80,517	53%	44%
Germany	€ 48,738	€ 101,551	€ 110,403	€ 141,789	44%	34%
Greece	€ 6,333	€ 7,215	€ 8,408	€ 12,396	75%	51%
Hungary	€ 2,432	€ 6,516	€ 9,123	€ 17,820	27%	14%
Ireland	€ 3,926	€ 2,857	€ 4,253	€ 8,900	92%	44%
Italy	€ 35,490	€ 52,318	€ 56,474	€ 68,944	63%	51%
Latvia	€ 431	€ 1,332	€ 1,616	€ 2,604	27%	17%
Lithuania	€ 550	€ 1,926	€ 2,887	€ 6,148	19%	9%
Luxemburg	€ 983	€ 1,302	€ 1,531	€ 2,294	64%	43%
Netherlands	€ 14,579	€ 17,487	€ 19,070	€ 24,459	76%	60%
Poland	€ 6,390	€ 21,420	€ 24,119	€ 33,169	26%	19%
Portugal	€ 4,831	€ 6,833	€ 7,381	€ 9,270	65%	52%
Romania	€ 2,323	€ 7,234	€ 7,641	€ 9,014	30%	26%
Slovak Republic	€ 1,598	€ 3,850	€ 4,024	€ 4,607	40%	35%
Slovenia	€ 1,400	€ 2,488	€ 3,017	€ 4,786	46%	29%
Spain	€ 16,104	€ 39,796	€ 42,165	€ 50,223	38%	32%
Sweden	€ 5,922	€ 8,432	€ 10,752	€ 15,895	55%	37%
United Kingdom	€ 36,677	€ 67,802	€ 74,314	€ 95,948	49%	38%
Total EU-25*	€ 253,248	€ 462,033	€ 509,514	€ 665,935	50%	38%

* Malta and Cyprus are not included as these are not included in the external cost data set.

Notes:

Infrastructure costs are very rough estimates directly taken from IMPACT Deliverable 2 (for the year 2005). Given the large uncertainty and indicative character of these numbers no correction has been made for translating them from 2005 to 2008 prices.

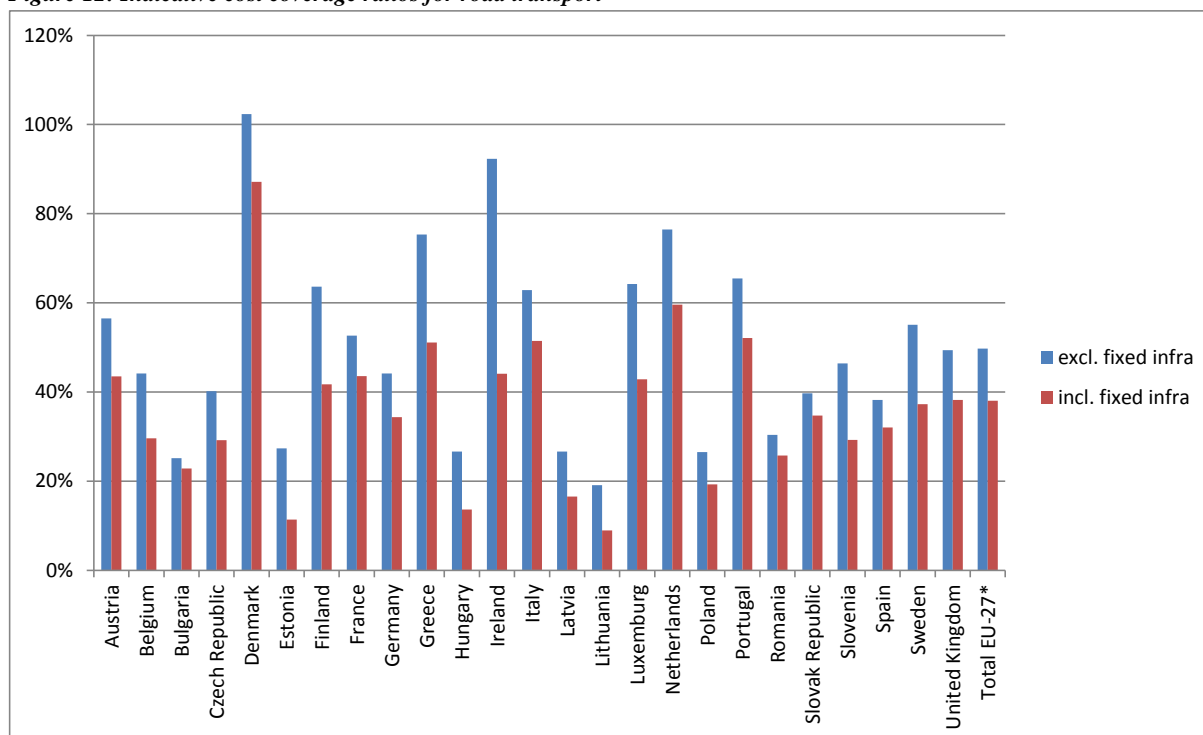
Using high climate cost estimates, based on a CO₂ price of €146 per tonne of CO₂.

Subsidies not included (e.g. for company cars, business & commuting travel, bus transport).

Sources:

- External Costs of Transport in Europe – Update study 2008, CE Delft, INFRAS and Fraunhofer-ISI, 2011
- Road infrastructure cost and revenue in Europe - Produced within the study Internalisation Measures and Policies for all external cost of Transport (IMPACT) – Deliverable 2, CE Delft and Fraunhofer-ISI, 2008
- Factsheets for road transport (see annex report).

Figure 12: Indicative cost coverage ratios for road transport



Notes:

Infrastructure costs are based on very rough estimates directly taken from IMPACT Deliverable 2 (for the year 2005). Given the large uncertainty and indicative character of these numbers no correction has been made for translating them from 2005 to 2008 prices.

Using high climate cost estimates were based on a CO₂ price of €146 per tonne of CO₂.

Subsidies not included (e.g. for company cars, business & commuting travel, bus transport).

Sources:

External Costs of Transport in Europe – Update study 2008, CE Delft, INFRAS and Fraunhofer-ISI, 2011

Road infrastructure cost and revenue in Europe - Produced within the study Internalisation Measures and Policies for all external cost of Transport (IMPACT) – Deliverable 2, CE Delft and Fraunhofer-ISI, 2008

Revenues of road transport are based on data for data gathering in this study, see chapter 2 and underlying factsheets in the annex report.

7.5. Options for harmonisation

The current taxes and charges and the way they contribute to internalisation of external costs differ widely across the various transport modes. Fuel taxation performs the function of internalising climate change costs, since greenhouse gas emissions are directly related to fuel consumption; however there is no clear indication in the excise duties of a specific component devoted to internalising the cost of CO₂ emissions and fuel taxes do have also other functions, e.g. imposing a premium for security of supply. Having said that, the taxes on road transport fuels are generally relatively high compared to other modes. Waterborne transport modes and aviation are for the largest part exempted from fuel taxes, while the fuel taxes on rail diesel are lower than on road diesel, in most Member States. Electricity for rail transport is included in the ETS, but often exempted from taxation. Aviation does not pay fuel taxes, but is included in the EU ETS. There are also significant differences between the various road fuels. Compared to the energy or carbon content, the fuel tax on diesel is relatively low compared to gasoline and this is even much stronger the case for LPG and CNG.

Fuel taxation could be further harmonised across fuel types (diesel and gasoline), e.g. as proposed by the European Commission in the proposal for revision of the Energy Taxation Directive (COM(2011) 169 final). In order to fully internalise climate change costs, fuel taxes in the other transport modes that are exempted from ETS would need to be applied or increased in most Member States.

While the fuel taxes of road transport are much higher than for the other modes, the infrastructure charging is much less developed. In all other modes, transport infrastructure use is charged on the basis of usage. In road transport, infrastructure charging is applied on motorways in some Member States, either by road tolls or by kilometre charges for HGVs. On all other parts of the road networks, infrastructure charging hardly exists. Some Member States have time-based vignettes or regard vehicle taxation as a way users pay for infrastructure. However, as these are not correlated to the main cost driver for infrastructure and most external costs (kilometres driven) they do not give a true incentive to reduce costs and cannot be regarded as internalisation. Therefore for further development of the internalisation of infrastructure and external costs, infrastructure charging for road transport is key. Kilometre charging on the entire road network and for all users is the first best instrument for doing so. Preferably charge levels are differentiated to key cost drivers such as emission class, location, time of the day (and/or congestion level) and axle load (the latter particularly for HDVs).

Although not directly related to total external costs of vehicle usage, differentiated vehicle taxes can be a very effective instrument to stimulate the purchase of fuel efficient cars and so helps manufacturers meeting the CO₂ standards. The same is true for differentiated company car taxation schemes. Also this is something that could be further harmonised across the EU.

Specific charges or charge differentiations based on air pollution and noise are applied in various Member States for rail transport, waterborne transport and aviation. However, this could be further developed and harmonized across the EU.

8. Conclusions and recommendations

8.1. Conclusions

The current taxes and charges and the way they contribute to internalisation of external costs differ widely across the various transport modes. The factsheets developed in this study provide a rich and comprehensive overview of pricing schemes in all main transport modes in the EU, although the enormous complexity and variety of internalisation measures currently in place make it impossible to give a detailed account of each and every one of them. Fuel taxation and infrastructure charging are the main types of pricing measures.

The main conclusions on fuel taxation in the various transport modes are:

- Fuel taxes and ETS are the first best instrument for internalising climate change costs. They do have, however, other functions, including the setting of a premium for security of supply considerations. The various components are typically not specified in legislation.
- Taxes on road transport fuels are relatively high compared to the other transport modes.
- Taxation on electricity for rail transport is particularly low or even zero. The price of electricity does however incorporate ETS payments.
- Aviation is for the largest part exempted from fuel taxes, but is included in ETS.
- Waterborne transport modes are exempted from fuel taxes. Fuel taxes on rail diesel are lower than on road diesel in most Member States. Neither waterborne transport nor rail diesel is subject to ETS.
- Compared to the energy or carbon content, the fuel tax on diesel is relatively low compared to gasoline and this is even much stronger the case for LPG and CNG.
- In order to fully internalise climate change costs, fuel taxes in the non-road transport modes that are exempted from ETS would need to be introduced (if not yet existing) or increased in most Member States.

The main conclusions on infrastructure charging are:

- Usage-based infrastructure charges are the first best instrument to internalise infrastructure costs as well as external costs of noise, air pollution, accidents and congestion.
- In all non-road modes, transport infrastructure use is charged on the basis of usage. Specific charges or charge differentiations based on air pollution and noise are applied in various Member States for rail transport, waterborne transport and aviation.
- Infrastructure charging in road transport is much less developed than in the non-road modes. It is applied on motorways in some Member States, by road tolls or by kilometre charges for HGVs and/or cars. On all other parts of the road networks, infrastructure charging hardly exists.
- Some Member States have time-based vignettes or regard vehicle taxation as a way users pay for infrastructure. However, as these are not correlated to the main cost driver for infrastructure and most external costs (kilometres driven) they do not give a true incentive to reduce costs and cannot be regarded as internalisation.
- For further development of the internalisation of infrastructure and external costs, infrastructure charging for road transport is key. Kilometre charging on the entire road network and for all users is the first best instrument for doing so. Preferably charge levels are differentiated to key cost

drivers such as emission class, location, time of the day (and/or congestion level) and axle load (the latter particularly for HDVs).

Although not internalising the external costs of vehicle use, differentiated vehicle taxes can be a very effective instrument to stimulate the purchase of fuel efficient cars and so helps manufacturers meeting the CO₂ standards. The same is true for differentiated company car taxation schemes.

An indicative estimate of the cost coverage of the infrastructure and external costs of road transport in the EU is 38%. In case only external costs and variable infrastructure costs are considered (so fixed infrastructure costs are excluded) still only half of the costs are covered. However, in both ratios subsidies for road transport (e.g. for company cars, business & commuting travel, public transport) are not yet included. Also congestion costs are not included.

In none of the Member States, road transport pays its full costs. The cost coverage ratios vary however significantly between the various Member States. They are the highest in Denmark (87%) and lowest in the Baltic states and Hungary (17% or less).

For all other modes, it was not possible to derive an indicative estimate of the cost coverage because of problems with data availability.

8.2. Recommendations on policy issues

Given the large differences between Member States and transport modes, there are many opportunities for further harmonising transport pricing across Member States and transport modes. This is particularly true for both fuel taxation and infrastructure charging.

For road transport, there is particularly a need for a further development and harmonisation of infrastructure charging. Further steps are recommended to develop policies that contribute to the implementation of kilometre charging on the entire road network and for both freight and passenger road transport. Preferably charge levels should be differentiated to key cost drivers such as emission class, location, time of the day (and/or congestion level) and axle load (the latter particularly for HDVs).

For road fuels, fuel taxes that better reflect the energy or carbon content of the fuels are recommended.

For the other transport modes, a much stronger and coordinated development of fuel taxation or alternatively introduction of ETS is recommended in order to internalise at least the climate change costs. By taking away exemptions and/or raising the relatively low fuel tax rates, strong incentives can be provided for all types of energy savings in these transport modes.

With regard to vehicle taxes, and VAT exemptions further harmonisation would be beneficial and is recommended.

8.3. Recommendations on data issues

The following recommendations are made with respect to data availability:

- The data basis on infrastructure costs is weak for all transport modes and could be further developed. However, this is a very time consuming effort as it would require an in-depth study on transport infrastructure accounts for each Member State and covering a long period of time.
- Data on (the use of) revenues is not complete and could be further developed.
- For many instruments, there is a clear lack of data on administrative costs, which could be further developed.

Annex A – Index of all factsheets

Transport mode	Pricing instruments	Factsheets
Road	Fuel	EU
Road	Infrastructure	AT, BE, BG, CZ, DK, FR, DE, GR, HU, IE, IT, LT, LV, NL, PL, PT, RO, SK, SI, ES, SE, UK
Road	Insurance	AT, BE, BG, CY, DK, FI, FR, DE, GR, IE, It, LU, MT, NL, PT, RO, SK, SI, ES, SE, UK
Road	Ownership	AT, BE, BG, CY, CZ, DK, EE, FI, FR, DE, GR, HU, IE, IT, LV, LT, LU, MT, NL, PL, PT, RO, SK, SI, ES, SE, UK
Road	Registration	AT, BE, BG, CY, CZ, DK, FI, FR, GR, HU, IE, IT, LV, MT, NL, PL, PT, RO, SI, ES
Road	Company car as a benefit in kind	AT, BE, CZ, DK, EE, FI, DE, GR, IE, NL, PT, ES, SE, UK
Road	Congestion charge	IT, MT, SE, UK
Road	Company car tax	BE, FR, LV
Road	Purchase Premium	LU, SE, UK
Road	Scrappage tax	SI
Rail	Infrastructure Access charges	AT, BE, BG, CZ, DK, EE, FI, FR DE, EL, HU, IE, IT, LV, LT, LU, NL, PL, PT, RO, SI, SK, ES, SE, UK (Network Rail, High Speed 1, Eurotunnel)
Rail	Energy taxation (excises and VAT)	AT, BE, BG, CZ, DK, EE, FI, FR DE, EL, HU, IE, IT, LV, LT, LU, NL, PL, PT, RO, SI, SK, ES, SE, UK
Inland Navigation	Fuel tax exemption	EU
Inland Navigation	Port Dues	Krems, Antwerp, Gent, Liège, Vidin, Decin, Duisburg, Frankfurt am Main, Hannover, Mannheim, Lyon, Paris (Gennevilliers), Strasbourg, Budapest, Mantova, Mertert, Amsterdam, Hengelo, Nijmegen, Rotterdam, Utrecht, Szczecin, Constantza, Bratislava, London
Inland Navigation	Fairway Dues	BE, DE, FR, LU, PO, RO
Inland Navigation	Waste Water discharge	CDNI (BE, DE, FR, LU, NL, CH)
Maritime Shipping	Fuel taxes	EU
Maritime Shipping	Sea port dues and waste charges	Antwerp, Zeebrugge, Bourgas, Lemesos, Copenhagen-Malmö, Tallinn, Helsinki, Le Havre, Marseille, Bremen/Bremerhaven, Hamburg, Trieste, Riga, Klaipeda, Valletta, Amsterdam, Rotterdam, Gdansk, Sines, Constantza, Koper, Barcelona, Valencia, Gothenburg, Stockholm, Trelleborg, Grimsby & Immingham, London, Tees & Hartlepool
Maritime Shipping	Fairway dues	FI, SE
Aviation	Fuel taxes	EU
Aviation	ETS	EU

Aviation	Airport charges	<p>Vienna International Airport, Austria.</p> <p>Brussels National Airport, Belgium.</p> <p>Prague Ruzyně International Airport, Czech Republic.</p> <p>Copenhagen Airport, Kastrup, Denmark.</p> <p>Helsinki Vantaa Airport, Finland.</p> <p>Paris - Charles de Gaulle Airport, France.</p> <p>Paris - Orly Airport, France.</p> <p>Frankfurt Airport, Germany.</p> <p>Munich Airport, Germany.</p> <p>Athens International Airport, Greece.</p> <p>Budapest Ferenc Liszt International Airport, Hungary.</p> <p>Dublin Airport, Ireland.</p> <p>Milan Malpensa Airport, Italy.</p> <p>Rome Fiumicino Airport, Italy.</p> <p>Amsterdam Airport Schiphol, Netherlands.</p> <p>Warsaw Chopin Airport, Poland.</p> <p>Lisbon Airport, Portugal.</p> <p>Barcelona - El Prat Airport, Spain.</p> <p>Madrid - Barajas Airport, Spain.</p> <p>Palma de Mallorca Airport, Spain.</p> <p>Stockholm Arlanda Airport, Sweden.</p> <p>Manchester Airport, UK.</p> <p>London Heathrow Airport, UK.</p> <p>London Gatwick Airport, UK.</p> <p>London Stansted Airport, UK.</p>
Aviation	Aviation taxes	AT, DE, FR, IE, UK
Aviation	Eurocontrol route charges	EU
Aviation	Terminal navigation charges	EU Member States

Annex B – Exchange rates

Throughout the study we have worked with the following exchange rates:

Table 66: Exchange rates (value of national currency in Euro)

	2009	2010	2011	2012
Bulgarian Lev	1.9558	1.9558	1.9558	1.9558
Czech koruna	24.795	25.454	24.469	24.878
Danish krone	7.4612	7.4449	7.4541	7.4423
Pound sterling	0.78355	0.9172	0.8656	0.8596
Hungarian forint	246.1	268.65	272.22	294.5
Lithuanian litas	3.4528	3.4528	3.4528	3.4528
Latvian lats	0.7096	0.7083	0.7092	0.7092
Polish zloty	3.4277	4.2438	3.9483	4.3815
Romanian leu	3.8765	4.277	4.2759	4.3001
Swedish krona	9.7017	10.249	9.2398	9.1592

Source: Eurostat

The exchange rates are taken from Eurostat and are the exchange rates of beginning of October of the respective preceding year; this to be consistent with the exchange rates used for the European Commission's Excise Duty Tables (as from July 2012).

Annex C – Background data on airport charges for 3 aircraft types

Table 67: Airport charges at different European airports for a Boeing 747-400 aircraft

Airport	L/T/LTO/ Runway	Passenger/ Pass. facility	Parking	Security	Noise	Emission	Aerodrome service/ General aviation	Air bridge	PRM	CUTE	Total
Vienna International, Austria	2,420	6,520	360	440	20	0	0	0	120	0	9,900
Brussels National, Belgium	1,410	6,980	0	2,230	0	0	0	0	130	150	10,900
Prague Ruzyně International, Czech Republic	1,760	7,690	780	0	90	0	0	0	0	0	10,300
Copenhagen, Kastrup, Denmark	1,290	4,650	0	2,050	0	100	0	0	0	90	8,200
Helsinki Vantaa, Finland	2,300	2,800	520	1,430	0	0	0	0	70	0	7,100
Paris – Charles de Gaulle, France	2,290	8,020	1,030	0	-340	0	0	0	420	0	11,400
Pairs – Orly, France	2,290	8,020	1,030	0	-340	0	0	0	230	0	11,200
Frankfurt, Germany	1,540	8,300	250	440	700	260	0	0	0	0	11,500
Munich, Germany	1,890	6,710	0	240	500	130	0	0	110	0	9,600
Athens International, Greece	2,020	4,430	1,040	1,820	0	0	300	460	270	120	10,500
Budapest Ferenc Liszt International, Hungary	2,780	5,640 ²	0	2,940	40	0	0	0	0	0	11,400
Dublin, Ireland	6,830	4,450 ³	350	0	0	0	0	70	0	0	11,700
Milan Malpensa, Italy	2,000	2,840	30	660	0	0	0	2,840	210	110	8,700
Rome Fiumicino, Italy	1,990	2,840	30	660	0	0	0	800	330	60	6,700
Amsterdam Schiphol, Netherlands	5,400 ¹	5,390	0	4,710		0	0	0	140	0	15,600
Warsaw Chopin, Poland	4,030	4,990 ⁴	0	0	0	0	0	0	0	0	9,000
Lisbon, Portugal	2,140	4,610	0	2,580	0	0	0	620	170	0	10,100
Barcelona – El Prat, Spain	2,640	3,340	520	760	0	0	1,250	220	200	0	8,900
Madrid – Barajas, Spain	3,000	3,800	550	760	0	0	1,250	360	200	0	9,900

Palma de Mallorca, Spain	2,500 ¹	3,130	520	760		0	1,230	290	220	0	8,600
Stockholm Arlanda, Sweden	1,440	3,580	690	0	130	230	0	0	50	0	6,400
Manchester, UK	2,060 ¹	3,430	0	1,690		0	0	0	110	70	7,400
London Gatwick, UK	2,080 ¹	4,750	500	0		230	0	0	70	0	7,600
London Heathrow, UK	2,240 ¹	14,610	240	0		330	0	0	0	0	17,400
London Stansted, UK	740 ¹	4,180	1,090	0		0	0	0	0	0	6,000

¹Incl. noise charge.

² Incl. PRM and CUTE charge.

³Incl. security charge.

⁴ Incl. infrastructure charge.

Table 68: Airport charges at different European airports for an Airbus A320-232 aircraft

Airport	L/T/LTO/ Runway	Passenger/ Pass. facility	Parking	Security	Noise	Emission	Aerodrome service/ General aviation	Air bridge	PRM	CUTE	Total
Vienna International, Austria	620	2,480	90	170	0	0	0	0	50	0	3,400
Brussels National, Belgium	560	2,660	0	850	0	0	0	0	50	60	4,100
Prague Ruzyně International, Czech Republic	540	2,930	100	0	20	0	0	0	0	0	3,600
Copenhagen, Kastrup, Denmark	470	1,770	0	780	0	20	0	0	0	30	3,000
Helsinki Vantaa, Finland	370	670	0	550	0	0	0	0	30	0	1,600
Paris – Charles de Gaulle, France	370	1,380	190	0	-60	0	0	0	160	0	2,000
Pairs – Orly, France	370	1,380	190	0	-60	0	0	0	90	0	2,000
Frankfurt, Germany	450	2,320	110	170	90	60	0	0	0	0	3,200
Munich, Germany	350	2,430	0	90	290	30	0	0	40	0	3,200
Athens International, Greece	600	1,690	210	690	0	0	300	150	100	40	3,700
Budapest Ferenc Liszt International, Hungary	640	2,150 ²	0	1,120	10	0	0	0	0	0	3,900
Dublin, Ireland	1,260	1,700 ³	210	0	0	0	0	40	0	0	3,200

Milan Malpensa, Italy	270	820	0	250	0	0	0	820	80	40	2,200
Rome Fiumicino, Italy	240	740	0	250	0	0	0	310	130	20	1,700
Amsterdam Schiphol, Netherlands	710 ¹	2,050	0	1,790		0	0	0	50	0	4,600
Warsaw Chopin, Poland	710	1,900 ⁴	0	0	0	0	0	0	0	0	2,600
Lisbon, Portugal	360	1,320	0	560	0	0	0	390	70	0	2,700
Barcelona – El Prat, Spain	490	850	60	290	0	0	230	330	80	0	2,300
Madrid – Barajas, Spain	550	2,530	70	290	0	0	230	240	80	0	4,000
Palma de Mallorca, Spain	460 ¹	790	60	290		0	230	190	40	0	2,100
Stockholm Arlanda, Sweden	570	1,360	0	0	10	60	0	0	20	0	2,000
Manchester, UK	560 ¹	1,310	0	650		0	0	0	40	30	2,600
London Gatwick, UK	1,900 ¹	1,810	100	0		60	0	0	20	0	3,900
London Heathrow, UK	2,240 ¹	3,960	100	0		80	0	0	0	0	6,400
London Stansted, UK	450 ¹	1,590	160	0		0	0	0	0	0	2,200

¹Incl. noise charge.

² Incl. PRM and CUTE charge.

³Incl. security charge.

⁴ Incl. infrastructure charge.

Table 69: Airport charges at different European airports for an Embraer 170 STD aircraft

Airport	L/T/LTO/Runway	Passenger/Pass. facility	Parking	Security	Noise	Emission	Aerodrome service/General aviation	Air bridge	PRM	CUTE	Total
Vienna International, Austria	210	970	30	70	0	0	0	0	20	0	1,300
Brussels National, Belgium	300	1,040	0	330	0	0	0	0	20	20	1,700
Prague Ruzyně International, Czech Republic	110	1,140	50	0	20	0	0	0	0	0	1,300
Copenhagen, Kastrup, Denmark	240	310	0	310	0	10	0	0	0	10	900
Helsinki Vantaa, Finland	150	260	0	210	0	0	0	0	10	0	600

Paris – Charles de Gaulle, France	170	490	100	0	0	0	0	0	60	0	800
Pairs – Orly, France	170	490	100	0	0	0	0	0	30	0	800
Frankfurt, Germany	190	910	60	70	80	30	0	0	0	0	1,300
Munich, Germany	290	950	0	40	260	10	0	0	20	0	1,600
Athens International, Greece	280	460	100	270	0	0	140	150	40	20	1,400
Budapest Ferenc Liszt International, Hungary	390	840 ²	0	440	10	0	0	0	0	0	1,700
Dublin, Ireland	650	660 ³	170	0	0	0	0	40	0	0	1,500
Milan Malpensa, Italy	130	320	0	100	0	0	0	0	30	20	600
Rome Fiumicino, Italy	100	290	0	100	0	0	0	310	50	10	800
Amsterdam Schiphol, Netherlands	360 ¹	800	0	700		0	0	0	20	0	1,900
Warsaw Chopin, Poland	340	740 ⁴	0	0	0	0	0	0	0	0	1,100
Lisbon, Portugal	170	400	0	130	0	0	0	390	30	0	1,100
Barcelona – El Prat, Spain	250	330	30	110	0	0	120	330	30	0	1,200
Madrid – Barajas, Spain	280	960	30	110	0	0	120	240	30	0	1,800
Palma de Mallorca, Spain	200 ¹	260	30	100		0	120	190	20	0	900
Stockholm Arlanda, Sweden	440	310	0	0	10	20	0	0	10	0	8000
Manchester, UK	280 ¹	330	0	250		0	0	0	20	10	1,000
London Gatwick, UK	1,900 ¹	460	70	0		20	0	0	10	0	2,500
London Heathrow, UK	2,240 ¹	1,160	100	0		30	0	0	0	0	3,500
London Stansted, UK	330 ¹	410	100	0		0	0	0	0	0	800

¹Incl. noise charge.

² Incl. PRM and CUTE charge.

³Incl. security charge.

⁴ Incl. infrastructure charge.

Annex D – Average external costs

Table 70 Average external costs of transport in Europe (in 2008)

Cost Category	Average costs per cost category												
	Passenger transport (€/1,000 pkm)							Freight transport (€/1,000 tkm)					
	Road				Rail	Aviation	Total	Road			Rail	Waterborne	Total
	Passenger cars	Buses & coaches	Motorcycles & mopeds	Total road passenger transport	Passenger transport	Passenger transport (continental)		LDV	HDV	Total road freight transport	Freight transport	Freight transport	
Accidents	32.3	12.3	156.6	33.6	0.6	0.5	29.0	56.2	10.2	17.0	0.2	0.0	13.4
Air pollution	5.5	6.0	11.8	5.7	2.6	0.9	5.2	17.9	6.7	8.4	1.1	5.4	7.1
Climate change high scenario	17.3	9.1	11.1	16.3	1.5	46.9	17.6	44.5	9.8	14.9	0.9	3.6	12.1
<i>Climate change low scenario</i>	<i>3.0</i>	<i>1.6</i>	<i>1.9</i>	<i>2.8</i>	<i>0.3</i>	<i>8.0</i>	<i>3.0</i>	<i>7.6</i>	<i>1.7</i>	<i>2.6</i>	<i>0.2</i>	<i>0.6</i>	<i>2.1</i>
Noise	1.7	1.6	14.4	2.0	1.2	1.0	1.9	6.3	1.8	2.5	1.0	0.0	2.1
Up- and downstream high scenario	5.7	2.8	3.6	5.4	8.1	7.1	5.7	14.3	3.0	4.7	4.2	1.3	4.4
<i>Up- and downstream low scenario</i>	<i>3.4</i>	<i>1.5</i>	<i>2.3</i>	<i>3.2</i>	<i>3.9</i>	<i>3.9</i>	<i>3.3</i>	<i>8.4</i>	<i>1.7</i>	<i>2.7</i>	<i>2.4</i>	<i>0.8</i>	<i>2.5</i>
Nature & landscape	0.6	0.3	0.5	0.6	0.2	0.6	0.6	0.9	0.7	0.7	0.0	0.4	0.6
Biodiversity losses	0.2	0.4	0.1	0.2	0.0	0.1	0.2	0.6	0.5	0.5	0.0	0.5	0.4
Soil & water pollution	0.3	0.9	0.3	0.4	0.5	0.0	0.4	1.8	0.8	1.0	0.4	0.0	0.8
Urban effects	1.0	0.4	0.8	0.9	0.6	0.0	0.8	3.1	0.5	0.9	0.1	0.0	0.7
Total (high scenario)	64.7	33.8	199.2	65.1	15.3	57.1	61.3	145.6	34.0	50.5	7.9	11.2	41.7
<i>Total (low scenario)</i>	<i>48.1</i>	<i>24.9</i>	<i>188.7</i>	<i>49.4</i>	<i>9.8</i>	<i>15.0</i>	<i>44.3</i>	<i>102.8</i>	<i>24.6</i>	<i>36.1</i>	<i>5.3</i>	<i>7.7</i>	<i>29.7</i>

Averages for the EU-27 with the exemption of Malta and Cyprus, but including Norway and Switzerland.

High climate cost estimates were based on a CO₂ price of €146 per tonne of CO₂, low estimates on €25 per tonne of CO₂.

Source: External Costs of Transport in Europe – Update study 2008, CE Delft, INFRAS and Fraunhofer-ISI, 2011

