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Introduction of enviornmental cost calculations in the planning and tracing of companies' freight transport:

Results of two sub-projects

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Report Summary

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Introduction of environmental cost calculations in the planning and tracing of companies' freight transport

Results of two sub-projects:

1. What do official documents in Europe and elsewhere say on external costs of freight transportation?
2. What fraction of the external costs of freight transportation is already internalised in different countries and by which measure?

Summary

See below

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Abstract

This report is part of a project addressing the need of companies to assess the external costs of goods transportation Therefore, the project aimed to develop a system for the calculation of these costs. During the start phase of the project, two questions emerged: 1. What do official documents in Europe and elsewhere say on external costs of freight transportation and 2. To what extent are external costs of freight transportation already internalized in different countries?

The analysis of these questions with the help of official documents in Europe shows that there is a vivid discussion on the issue of internalising external costs of transportation. In view of the ongoing debate on climate change and all its aspects, this seems to be an important field influencing future transport decisions. However, these discussions are characterized by contradictions, lack of clarity, insecurity and the pursuit of different industry interests. It is very difficult for transport buyers and transport sellers to prepare for an internalisation of external costs. Even the approach to internalise some external costs into road transport by amending the respective EU Directive seems to have failed as of now. Outside of Europe, information could be obtained only on Australia and on the USA, in the latter case not even directly connected to the subject. The USA seems to prepare for reporting greenhouse gases, without describing which purpose results shall serve at a later stage. Australia in contrast works with the question of internalising external costs of transport but limits it for the time being to land transport (road and rail).

For France and the UK, explicit research reports on the current extent of internalisation of external costs of freight transport are available, saying that especially road transport pays for its external costs to a large degree in these countries. References are made to other European countries paying either much less of their external costs today (e. g. Greece or Cyprus) or as much as the UK (e. g. Germany). However, in-depth-analyses are not available for each European country. Additional lack of clarity with regards to calculation methods, definition of system boarders for the calculation and underlying principles make it impossible to list internalisation approaches in Europe in any other way than fragmented, vague and containing a high degree for failure.

Content:

Background and target of the project

The project addresses a certain need of companies today: that they cannot get acknowledgement for the effectiveness of their environmental measures. It was therefore the intention of the project to develop a system for the calculation of external costs of transports, to adapt existing methods and figures to the systems and needs of those companies, which joined the project, and to create acceptance and credibility for methods and figures among all those working with transportation.

The target was to develop a tool, which helps companies today to do a risk analysis of the consequences of new or changed logistics structures in case all environmental costs are included.

Two questions emerged in the beginning of the project:

1. What do official documents in Europe and elsewhere say on external costs of freight transportation? Is there consensus among different countries with regard to this issue? Do they all follow the same methods?
2. What fraction of extent are external costs of freight transportation already internalized in different countries?

Especially the last question was important for the project in order to be able to estimate the magnitude of future costs of freight transportation. This information would also have consequences for the design of the software tool. The project team thus decided to analysis these questions as two smaller sub-projects, supporting the main target and enabling a more precise forecast of the future of transport price development.

The report is structured as follows: In chapter 1, the subject of external costs of freight transportation is presented, based on official statements of different actors: Authorities, research institutes and individual scientists and branch organisations. Section 1.1 takes up underpricing of freight transportation as a general problem and explains where it stems from. Section 1.2 gives some definitions on the term "external costs". Section 1.3 lists the external transport cost, which are regarded as most important. Section 1.4 refers to different methods to calculate external transport costs and section 1.5 discusses possible ways to internalise them. Section 1.6 presents two different guiding principles for the internalisation of external costs. The concluding section 1.7 gives information on how other countries outside of Europe look at issue.

In chapter 2, different sources are presented who give information on which external costs are already integrated in different countries and by which measures. The chapter is structured in that section 2.1 presents official statements on the subject by European authorities, section 2.2 presents the views of research institutes and individual scientists and section 2.3 concludes with a presentation of positions on the subject of transport branch organisations.

In chapter 3, a discussion of the findings is presented, followed by a summary in chapter 4.

1. What do official documents in Europe and elsewhere say on external costs of freight transportation?

1.1 Underpricing of transportation

In order to understand the discussions on internalisation of external costs, a short introduction of the subject of underpricing of transportation is given, as it is the underlying problem, which shall be solved by internalising external transport costs.

A basic tenet of market theory is that economic efficiency is maximized when prices (defined as perceived, internal, variable costs) reflect total marginal costs, as stated by Todd Litman from the Victoria Transport Policy Institute in Victoria, Canada, 1997. Underpricing also causes inefficient consumer behaviour. Litman takes the example of road transportation, passenger and freight, to point out that once individuals purchase a car [or transport provider a truck], they have little incentive to limit their use, since vehicle owners pay fixed and external costs no matter how much or little they drive. In other words, automobile owners receive only a small portion of the total savings they would produce by reducing their driving. The same holds true for owners of freight vehicles, vessels or aircrafts.

Furthermore, mispricing reduces overall economic efficiency. Increasing prices to reflect a greater portion of total costs would reduce low value driving [and other forms of transportation] and would improve the overall efficiency of the transportation system (Litman, 1997). Efficient pricing is essential for sustainable transport. Even the best new technologies that reduce environmental and social costs will not be implemented unless consumers perceive economic incentives to adopt them.

Litman concludes that as much as possible, vehicle users should pay the full costs they impose on society, and fixed costs should be made variable. One approach heavily discussed in Europe to make users pay their full costs is the internalisation of external costs.

1.2 External costs of freight transport

There are several explanations and even definitions available for the term "external costs" or "externality", which are used in parallel. The following section presents definitions and explanations by authorities, research institutes and individual scientists.

The European Commission's Directorate-General for Research proposed in their report on "External Costs. Research results on socio-environmental damages due to electricity and transport" (2003) the following explanation: "An external cost, also known as an externality, arises when the social or economic activities of one group of persons have an impact on another group and when that impact is not fully accounted, or compensated for, by the first group."

An externality according to the independent researchers Belhaj and Fridell (2008) of IVL Swedish Environmental Research Institute is "an effect of a purchase or use decision by one set of parties on others who did not have a choice and whose interests were not taken into account." Externalities, they point out, arise when an action by an individual or a group implies effects on others, in case of negative externalities for example air pollution, accidents and congestions. When negative externalities are generated they should be internalized into the market economy. The result

is a decrease in production due to the corresponding increase in price, which is the result of internalising the negative externality by a tax for example. Belhaj and Fridell explain that the problem of negative externalities often arises because of market and government failures. Market failures occur because markets for environmental goods and services do not exist, or when the markets do exist, the market prices underestimate their social scarcity values. According to economic theory, Belhaj and Fridell state, the problem of externalities would not occur if property rights were properly defined for both private and public goods. In the case of public goods, this procedure would be impossible or rather impractical such as in the case of the European air, waters and ecosystems.

The American scientist Forkenbrock (1999) postulates similar to Belhaj and Fridell (2008) that externalities constitute a form of market failure because true costs are not taken into account when production and consumption decisions are made. If external costs are greater than external benefits, not considering externalities may lead to over-consumption.

In connection to the term "external costs" or "externality", scientists and politicians also talk about "marginal private costs", "marginal external costs", "average costs" as well as "social costs" of transport. These terms are often used quite imprecisely, which makes a clear understanding of what is really meant very difficult, especially for non-experts. The imprecision may also be a sign of a lack of knowledge by those who use them and indicate that the subject is not fully understood and researched as of today.

A classical definition of average cost is given by the Business Dictionary: "Production cost per unit of output, computed by dividing the total of fixed costs and variable costs by the number of total units produced (total output)." The same dictionary explains marginal costs as "increase or decrease in the total cost of a production-run, from making one additional unit of an item."

The following definition by the Belgium researchers Mayeres et al. (2001) explains marginal costs divided into private and external costs: "When consumers and producers decide whether to make a trip, by which mode and at what time, they evaluate the available alternatives on the basis of the costs and benefits of an extra trip for themselves. These are the so-called marginal private costs and benefits. The costs that are not taken into account are called the marginal external costs."

The Commission of the European Communities (2008) further explains that "the sum of the [marginal] private and [marginal] external costs of transport gives its [full marginal] social cost."

Also Forkenbrock (1999) describes private costs of freight transportation in a different way and without giving any clues on whether he means average or marginal costs: private costs are the direct expenses incurred by providers of freight transportation, like operating costs, as well as investments in capital facilities and rolling stock, which eventually wear out and must be replaced. Operating costs are those that are closely linked to the amount of services provided: fuel, wages, maintenance, user charges, depreciation and insurance.

He also raises the issue of calculability of marginal costs, which this report will take up in section 1.4 below. According to Forkenbrock (1999), it is hard to develop accurate estimates of the marginal social costs of freight transportation. Good data is, however, available for the average accident cost per vehicle mile and for the average cost per ton-mile. In contrast, estimates of marginal social costs are most valid when they pertain to very specific circumstances. He therefore suggests using average costs largely derived from aggregate data. While the estimates would lack the precision of a more specific case study, these estimates should nonetheless provide an overall sense of the magnitude of various types of external costs generated by freight trucks.

The Infras Institute and the IWW Institute for Economic Politics and Economic Research (2004) seem to follow this approach in their Update Report as they describe for each external cost which they examine the difference between marginal and average costs or values: "Marginal noise costs fall below average costs for medium to high traffic volumes. [...] For air pollution, average values are basically similar to marginal values due to linear dose response functions and model calculations. [...] For climate change, average costs are equal to marginal costs. [...] For nature and

landscape, average costs are close to maximum marginal costs. This is plausible since marginal costs are mostly not relevant in the short run. [...]"

The fact that many authors use the above-described terms in a rather unclear way makes understanding difficult, especially of the consequences, which using average costs or marginal costs respectively have for the result of the calculation of external costs. Already here, when dealing with basic terminology, the subject of integration of external costs seems to be a field with many unresolved challenges.

1.3 The most important external transport costs

Even though one could expect consensus at least on what is regarded as external transport costs, different authors state different cost categories as external transport costs. Moreover, they use different technical terms when talking about different external costs, which makes it even more difficult to get a clear picture of what is widely accepted as an external transport cost and what is not. Last but not least, sometimes terms are used to describe external costs of transportation, sometimes to describe effects of these external costs on nature and people, like for example health effects.

1.3.1 Views of authorities

The Commission of the European Communities (2008) stated in their Commission Staff Working Document "Strategy for an internalisation of external costs" that their present impact assessment focuses on the internalisation of the external costs of noise, air pollution, climate change, congestion and accidents from heavy goods vehicles and other transport means. The European Commission referred to the ExternE Project in which external costs were evaluated for human health, effects on crops and materials, noise and ecosystems. Damages caused by global warming provoked by greenhouse gases had been assessed on a global level. With regard to transportation, in addition to air pollution impacts, those from noise, accidents and congestion were analysed. The report stated that air pollution and global warming were the dominating cost categories. The Commission warned that the costs reflected the specific technologies actually used for the transport task described. Other technologies might cause higher or lower costs.

According to the EEA (European Environment Agency, 2002), the most important categories of external costs are accidents, air pollution and climate change. Congestion, they say, is the largest component in many urban areas. The variation of the marginal external costs was as great within transport modes as between modes. This indicated that the level of marginal costs depends heavily on the type of vehicles and the traffic situation considered. The valuation could also vary considerably among different urban areas, depending on the population densities and climatic and geographic characteristics.

1.3.2 Views of research institutes and individual scientists

According to the French scientists from the Panthéon-Sorbonne university in Paris and the Paris XII university, Kopp and Prud'homme (2007), the main external transport costs are congestion costs, accidents, pollution and the green house gas effect, noise, damage to biodiversity or landscape. With regard to other costs, they claim that road accidents are not an externality, contrary to what the European Commission in their preparation of an impact assessment on the internalisation of external costs stated in 2007. The European Commission, they confirm, was right though to say that costs of accidents are already partially internalised by vehicle drivers.

Belhaj and Fridell (2008) mention as external transport costs air pollution, congestion, accidents, road noise, corrosion and damage to the eco system.

The Infras institute and the IWW institute (2004) mention in their "Update study" (an update of the previous study published in 2000) as external transport costs climate change, air pollution, accidents, noise, up- and down-stream processes, costs for nature and landscape and additional urban effects.

Of these, climate change is according to Infras and IWW the most important cost category with 30% of total cost, if high shadow prices (i.e. like a virtual taxation) are used. Air pollution and accident costs amount to 27% and 24% respectively. The costs for noise and up- and down-stream processes each account for 7% of total costs. The costs for nature and landscape and additional urban effects are of minor importance (5%). Total external costs amount to 650 billion € for 2000, being 7.3% of the total GDP in EU 17.

While all other cost categories considered in their study reflecting the external costs imposed by transport on the whole of society, including inhabitants not participating in transport, congestion is a phenomenon within the transport sector. Therefore, congestion costs according to Infras and IWW must not be added up with classical externalities.

The most important transport mode is road transport, causing 83.7% of total costs, followed by air transport, causing 14% of total external costs. Railways (1.9%) and waterways (0.4%) are of minor importance. Two thirds of the costs are caused by passenger transport and one third by freight transport.

The Belgium researchers Mayeres et al. (2001) talk of "main categories of external costs" which include environmental costs, accidents and congestion costs. Later on, they mention the assessment of damages due to emissions including air pollution impacts on human health, crops, materials and global warming. Their analysis included emissions related to the use phase of the transportation means, those related to the supply of transportation fuels and the construction of vehicles and those related to the maintenance of infrastructure. The environmental damages from these emissions were estimated in a bottom-up assessment following the damage function approach of the European ExternE method.

An article by Stead in "European Perspectives" (2003) on "The external costs of transport and electricity generation" confirms that the ExternE studies included damage on human health, damage to buildings, crops and ecosystems, global warming and noise pollution. The external costs for all types of transport not only took into account tailpipe emissions and pollution caused during fuel production but also the environmental impacts of vehicle production and infrastructure building. In terms of road transport, the most significant external costs appear to be accidents and air pollution.

The scientist Piecyk and McKinnon from the Hariot-Watt University in Edingburgh (2007) issued a report in which they tried to assess the degree to which the external costs of road freight transport (note: only heavy goods vehicles over 3.5 gross vehicle weight are looked at) in the UK are currently being internalised by taxation. In this report, they mention as external cost categories congestion, infrastructure, accidents, air pollution, greenhouse gas emissions and noise. They state that overall, 40% of the total external costs were attributable to congestion, 23% to infrastructure, 19% to traffic accidents, 15% to air pollution and greenhouse gas emissions and only 2% to noise. As some gases, such as methane and carbon monoxide, contribute both to global warming and air pollution, it was not possible to split the external costs associated with these emissions between climate change and reductions in air quality. On this basis, climate change costs would represent around 8% of the total external costs of road freight transport in the UK.

Piecyk and McKinnon also refer to the EEA report of 2002, in which the EEA estimated the average value of the full external cost of road freight traffic to be 0.26 Euro per truck kilometre. More than 80% of these external costs in Europe were related to accidents, climate change and air

pollution. Noise and congestion were also included in the calculation and were a substantial proportion of external costs in urban areas.

Forkenbrock (1999) claims in his article "External costs of intercity truck freight transportation" that estimated external costs include accidents (fatalities, injuries, and property damage), emissions (air pollution and greenhouse gases), noise and unrecovered costs associated with the provision, operation, and maintenance of public facilities. External costs related to congestion and air pollution vary substantially among metropolitan areas. Such costs, however, are fairly consistent in rural areas. Congestion, a primarily urban phenomenon, is not addressed in his analysis. With regard to accidents, Forkenbrock states that in 1994 in the USA, general freight motor carriers (large trucks) were involved in accidents that cost society $14,800,000 per 100 million VMT (vehicle miles travelled), without further specification of the type of roads where accidents happened. Large trucks paid compensation totaling $6,091,000 per 100 million VMT, leaving $8,709,000 in uncompensated accident costs. The accident externality equates to 0.59 cent per ton-mile.

His analysis reveals that in the US, external costs are equal to 13.2% of private costs and user fees would need to be increased about threefold to internalize these external costs.

In their article on "External costs of the Belgian interurban freight traffic: a network analysis of their internalisation", which Beuthe et al. (different Belgium research institutes and universities) published in 2002, the results of a simulation of the flows over the Belgian network in 1995 are presented. The simulation allows to estimate some of the costs of several external effects of freight transports: the costs of pollution, congestion, accidents, noise and road damages. Beuthe et al. argue that the cost of damages caused to the roads by trucking must be included as external costs, because no taxes are set for this specific purpose in Belgium. Hence, fuel taxes cannot be considered as a specific payment for the maintenance of roads.

1.3.3 Views of branch organisations

The ADAC (2008), with more than 16 million members Europe's largest automobile club, claims that some cost categories identified in the "Handbook on estimation of external cost in the transport sector" presented by the European Commission in 2008, were not external costs for road transport, in particular congestion charges and risk values for accident costs. These should be regarded as internalised for road users via insurance payments. The club also brings forward the idea to abandon the social marginal costs principle and apply a cost calculation based on average infrastructure costs. Their argument is that combining average infrastructure costs and external marginal costs result in unfair disadvantages for infrastructure users, since based on a marginal costing principle, infrastructure costs are much lower than today's average.

The International Union of Railways, UIC, and the Community of European Railways, CER (2004) refer in their report "The true costs of transport. Time to act" to the Infras and IWW Update Study of the same year. They basically welcome Infras and IWW's initiative and present certain findings of the report. As representatives of the railway sector, they point to the result of the Infras/IWW study saying that, on average, road freight has five times greater external costs than rail, air freight is nearly sixteen times more damaging, while inland waterways are approximately as environmentally friendly as rail.

Table 1: Different external cost categories

	External cost categories														
Author(s)	*Congestions*	*Accidents*	*Air Poll.*	*Env. costs*	*Climate Change / GHG*	*Noise*	*Road damage*	*Effects on ecosystems*	*Effects on biodiversity*	*Effects on landscape and nature*	*Effects on human health*	*Additional urban effects*	*Up- and downstream processes*	*Infra-structure*	*Damage to buildings and crops*
Kopp and Prud'homme (2007)	X		X		X	X			X	X					
Belhaj and Fridell (2008)															
T&E (2008)	X	X	X		X	X			X	X	X				
Infras and IWW (2004)		X	X		X	X				X		X	X		
Mayeres et al. (2001)	X	X		X	X					X	X				
Commission of the EC (2008)	X	X	X		X	X									
EEA (2002)	(X)	X	X		X										
European Commission (2003)	X	X	(X)		X	X		X		X	X				
Piecyk & McKinnon (2007)	X	X	X		X	X								X	
ADAC (2008)	----	----													
UIC/CER (2004)	X	X	X		X	X									
ExternE (European Perspective 2003)		X	X		X	X		X			X				X
Beuthe et al. (2002)	X		X			X	X								

Looking back at the presented views on which cost types fall under the category external costs in transportation and which do not belong there, the mix of slightly or largely differing opinions is confusing. The next chapter therefore looks at how the calculation process for external costs is evaluated by various experts to see if a more pronounced agreement can be found in this area.

1.4 The methods to calculate external transport costs

1.4.1 Views of authorities

EUROPA, the portal site of the European Union (http://europa.eu), provides up-to-date coverage of European Union affairs and essential information on European integration. They also publish press releases, one of which reported in 2008 that the European Commission had released a comprehensive compilation of existing studies on external costs in the transport sector. The Commission intended, according to the press release, to make use of this "Handbook" as one element, which prepares the communication on the internalisation of external costs for all modes of transport that was due in June 2008 and a proposal to review the directive on the charging of heavy goods vehicles. The Handbook assembled best practice methods to estimate and monetize the external costs generated by transport activities. It showed that external costs depend strongly on parameters like vehicle characteristics (EURO standards), location (urban or interurban) and the period of time (peak, off-peak and night-time).

1.4.2 Views of research institutes and individual scientists

The Swedish researchers Belhaj and Fridell (2008) state that "[...] whilst some consensus has been reached with regard to estimating health effects of air pollution, consensus on the external costs related to ecosystems is not reached depending on several factors." They explain that uncertainties would lie in the question whether it is the ecosystem service or the effect on the ecosystem which is of interest and in the fact that the definition of ecosystem services may vary depending on locations and preferences as well as on the establishment (or abolition) of critical loads.

The Belgian researchers Mayeres et al. (2001) point out that uncertainties lie above all in the assessment of impacts of noise on ecological systems and on human health. Therefore, they did not include those in their analysis. Also the analysis of the marginal external accident costs still raises, according to Mayeres et al., many conceptual difficulties, and the same holds true for congestion costs. Last but not least were also their damage estimates for global warming "far from complete". They add that the difference in progress for the various external cost categories corresponds to a large extent to the state of the art in the literature: While the methodology for air pollution costs is

defined relatively clearly, research is still very much in progress for some environmental costs (noise, ecological impacts), for accident costs and for congestion.

The European Commission (2003), as well in contrast as in addition, states that they see the range of uncertainty much higher for global warming impacts than for other damages.

1.4.3 Views of branch organisations

Also according to the ADAC (2008), there still are considerable uncertainties with regard to the calculation of external costs of [road] transportation. The club finds that the studies included in the Handbook extended over a considerable span of quantitative results. The reasons were different pricing policy premises (social marginal costs versus social average or full costs), different estimation methods (bottom-up versus top-down) and some differences in the definition of external and internal cost elements. In addition, the studies used different quantitative bases, especially with a view to the applied costs and evaluation approach for the Value of Statistical Life (VOL) and the Value of Time (VOT), and with a view to the quantitative structures applied (e.g. mileages, emission data).

In contrast to these opinions, UIC and CER found already in 2004 that sufficient information existed to form a reliable basis for a socially-efficient charging policy – based largely on external costs – at the European level.

Obviously, different actors continuously judge the amount of information available on external effects and their translation into monetary terms differently, which adds to the impression that the internalisation of external effects still is a scientific area full of disagreement. If, however, steps are taken towards the internalisation of external effect nonetheless, what could these steps look like? Is there, at least in theory, a larger consensus among scientist and practitioners on how external transport costs could be internalised?

1.5 Possible ways to internalise external transport costs

1.5.1 Views of research institutes and individual scientists

With regard to possible ways to internalise external transport costs, the main aspect mentioned by the authors whose studies were included in this survey seems to be that there is not one pricing form, which covers all external costs. Instead, policy makers should work with a mixture of instruments, like fuel taxes, congestion fees, smog fees, eliminating parking subsidies, marginalized insurance and higher fines for violators, as stated by Litman (1997). Among this mixture, fixed charges like fuel taxes and flexible charging mechanisms, for example kilometre-based charges, should be balanced against each other. Fuel taxes alone cannot be regarded as internalising other external costs because fuel consumption is a very weak proxy for the cost drivers of these external costs, according to CE Delft, an independent research and consultancy organisation in the Netherlands, 2008.

Forkenbrock (1999) supports this view by saying that motor fuel taxes were not able to take into account the specific circumstances in which a vehicle is operating, but that freight truck user charges, unlike motor fuel taxes, would be tailored to reflect the costs actually occasioned on a particular trip. External costs associated with air pollution, noise and accidents could be factored into road segment classifications. A road segment located in an area with relatively high pollution could have a higher air pollution charge. Similarly, proximity to residences, schools, hospitals, or

other activities adversely affected by vehicle noise could be taken into account in the charge for traveling on a road segment. Based on accident data, higher user charges could be levied on road segments where the probability is higher that a truck will be involved in an accident.

Litman (1997) is as well of the opinion that to increase fuel taxes is not the optimal solution since fuel prices do not affect when or where driving takes place, or provide incentives to buy a low polluting car. He points out that over the long run, drivers buy more fuel-efficient cars, but these do not reduce congestion, accidents, parking costs, noise, sprawl, or most air pollutants. One relatively easy strategy according to him is to charge insurance and vehicle registration fees proportionally to vehicle mileage. Furthermore, he presents the idea that the value of having travel choices must be recognized and that also lending institutions should consider the higher transport costs of suburban and exurban residences in mortgage assessments.

Also the research team around Proost et al. (2002), consisting of different universities from Belgium, the Netherlands, Ireland and the United Kingdom, agrees with that view in that they say that the most important requirement of more efficient pricing systems is to adapt them to local transport conditions. This would require that the levels of taxes on road use should not be fully harmonised at a European level, but need to be varied, both between urban and interregional areas and between different cities. However, not only different local transport conditions should be taken into account, but also the time of the day at which a transport takes place: As the congestion problem is directly linked to the flow of transport this is the most successful instrument. Accident externalities according to Proost et al. need to be addressed with specific instruments that pay attention to the driver's behaviour and to the potential of infrastructure and road safety policies.

The extensive studies of the research and consultancy organisation CE Delft et al. (2008) mentioned as primary aim for internalisation to provide optimal incentives for changes. When they looked at different cost drivers, they came, like Todd Litman (1997), to the conclusion that it is important to distinguish different types of taxes and charges: fixed ones which are not related to transport activity, like fuel based taxes, and flexible mechanisms, like kilometre based charges. According to CE Delft, the main recommended approaches are carbon content-based fuel taxes or inclusion in Emission Trading Schemes (ETS) for the internalisation of climate change costs and differentiated kilometre charges for the internalisation of air pollution, noise and congestion costs.

They further add that preferably, charges should be differentiated to location and time of the day. Accident costs could be internalised by either a kilometre based charge or via charging insurance companies based on accident rates. For congestion costs local road pricing schemes could be an alternative to differentiated kilometre based charges. For aviation and maritime shipping, the number of visits to (air)ports could be taken as charge base.

With regard to kilometre charges, CE Delft point out that there are no kilometre charges on urban and metropolitan roads, while kilometre-related costs in metropolitan areas are much higher than in interurban areas, making the gap between charges and costs highest there. In countries with motorway tolls, the fees are generally much lower than the marginal costs in congested areas.

CE Delft propose that for rail transport, marginal external costs can relatively easily be internalised by mark-ups on the existing infrastructure charges, with a focus on noise and, for diesel powered trains, air pollution costs. They say that climate change costs of electric trains could be regarded as internalised by the ETS. Air pollution costs of electric trains should preferably be internalised upstream, within the energy sector. For diesel trains, fuel taxes (or a transport wide ETS) are regarded as the proper way to internalise climate change costs.

For aviation, according to CE Delft, external costs could be integrated with the help of differentiated fees on LTO (landing and take-off) charges, based on external noise, accidents and air pollution costs. Climate change costs of CO_2-emissions by aviation were expected to be internalised soon by an ETS.

For inland and maritime shipping, CE Delft found very few existing charges that could be taken as levy point. They mention kilometre charges, fuel taxes, the inclusion into an ETS and the introduction of harbour dues.

How do these researchers evaluate the consequences of internalisation of external transport costs? Will this process really lead to any substantial reductions of external effects of transportation?

1.5.2 Views of on the consequences of internalisation of external transport costs

CE Delft worked with different scenarios and report that with regard to road freight transport volumes, they could see a decrease in all scenarios. The largest volume decrease was found for the smaller vehicle types. Particularly for long distances, a modal shift to non-road modes (particularly rail and waterborne modes) is likely to occur. The overall fuel consumption decreases in all scenarios. The largest decrease in fuel consumption (at least 10%) can be expected in case of internalisation by fuel taxes only.

Furthermore, the model results showed emissions reductions of 5 to 7% for most scenarios. Charges differentiated to region and emission standard would result in significantly higher reductions. Even when using a rather simple way of internalising external accident costs, fatalities were reduced with about 3%. All internalisation scenarios resulted in lower environmental and accident costs. CE Delft also mentioned that the internalisation of marginal costs in road transport was much more relevant than in other modes as they have by far the biggest impact on society and policy makers should thus prioritise their actions accordingly.

CE Delft also looked at costs of implementation. The implementation costs of the scenarios they developed were estimated in the order of 40 billion for the whole EU (for all modes except maritime shipping). The operational costs were estimated at roughly 10 billion a year. In all scenarios, the implementation costs are mainly caused by the internalisation measures for road vehicles.

Based on various real life examples, CE Delft concludes that internalisation of congestion costs by congestion charges can lead to significant reduction of congestion costs up to 50% or even more.

CE Delft did not carry out a full cost-benefit analysis. What they did find was that earlier studies showed welfare gains from efficient pricing for all modes of inland transport over €30 billion per year, for Germany, France and the UK alone.

Forkenbrock (1999) is cautious with regard to his judgement of the consequences of internalisation of external costs. He says that in case of transportation, including external costs generally will lead to some reduction in the consumption of transportation services, such as by locating production facilities closer to markets. Another impact may be greater use of a competing mode that has less total cost, once external costs are included.

A more outspoken positive result but limited though to road transport is brought forward by Beuthe et al. (2002), a research team of Belgian research institutes and universities, who say that a road pricing policy integrating external factors could be very effective in limiting road congestion, overall pollution as well as the other external effects.

Also Proost et al. (2002) come to the conclusion that on the basis of their case studies, pricing policies for transport could be potentially welfare-improving. The two major elements of the new policies are, as they see it, the overall higher price levels and their degree of differentiation over time and space.

1.6 Principles for the internalisation of external costs

As guiding principles for the internalisation of external costs, two different approaches or methods are generally mentioned in official documents – the Polluter Pays Principle (PPP) and the Cheapest Cost Avoider Principle (CCAP).

The "Encyclopedia of Sustainable Development" explains the Polluter Pay Principle as follows: "This [principle] recognises that the polluter should pay for any environmental damage created, and that the burden of proof in demonstrating that a particular technology, practice or product is safe should lie with the developer, not the general public. Unfortunately, when and how much the polluter should pay is often unclear" (http://www.ace.mmu.ac.uk/esd/Principles/Polluter_Pays.html).

The "Encyclopedia of Earth" explains the principle as "an environmental policy principle which requires that the costs of pollution be borne by those who cause it. In its original emergence the Polluter Pays Principle aims at determining how the costs of pollution prevention and control must be allocated: the polluter must pay. Its immediate goal is that of internalizing the environmental externalities of economic activities, so that the prices of goods and services fully reflect the costs of production. [...] Today the Principle is a generally recognized principle of International Environmental Law, and it is a fundamental principle of environmental policy of both the Organisation for Economic Co-operation and Development (OECD) and the European Community" (http://www.eoearth.org/article/Polluter_pays_principle).

In contrast, the Cheapest Cost Avoide Principle says that "the party which can prevent (or abate) the damage at the lowest cost overall should take action. For example, [...] it would be better for economic and social welfare overall to build a direct-route motorway rather than to make HGVs [heavy goods vehicles] take a detour, simply because the extra economic and environmental costs of the detour are higher than the costs of building the motorway. Another simplified example would be noise emission: When a truck drives through the open fields the question of noise emissions plays only a minor role. However, when the truck uses a road nearby a house there is a conflict of interests. The house owner wants quiet and the truck needs to emit noise. The question that needs to be answered is: Is it more effective to build a sound barrier to solve the noise-problem or does it make more sense to just charge the truck user? The cheapest cost avoider principle is applied in all areas of public decision-making under the heading of 'regulatory impact assessment'. It is not currently employed in the context of the regulation of transport related externalities" (Schmidtchen et al., 2007).

The European Union seems to follow the PPP for the time being, as they announced to base their policy drafts on the findings of the CE Delft studies, which in turn follow the PPP. This approach, however, does not find the approval of certain actors in the EU:

1.6.1 Views of research institutes and individual scientists

The research team Schmidtchen et al. from the Centre for the Study of Law and Economics at the University of Saarbrücken (2007) claim in their assessment of the CE Delft study that their authors would focus too narrow on the "polluter pays approach" which Schmidtchen et al. identify as a "fundamental methodological flaw". External costs should be reduced no further than to a socially efficient level, which takes into account the fact that reducing external costs itself is costly.

Schmidtchen et al. point out that the cheapest cost avoider principle presents a number of clear advantages over the polluter pays principle, and argue as follows:

- CCAP among others guarantees efficiency, i.e. no waste of resources, which is in turn

fundamental in the pursuit of the Lisbon goals of creating jobs and growth. Note: On 13 December 2007, EU leaders signed the Treaty of Lisbon, thus bringing to an end several years of negotiation about institutional issues. The Treaty of Lisbon amends the current EU and EC treaties,without replacing them.

- It studies a broader set of options. It can lead to the choice of innovative projects.
- Its use of cost-benefit analysis makes it take into account a broader range of relevant variables, such as administration costs or moral values.

Schmidtchen et al. therefore find that the CCAP meets all concerns, i.e. valuing non-pecuniary factors such as life, pain and suffering; including "soft variables" (intangibles) such as environmental values, wildlife, mountainous scenery etc.

Belhaj and Fridell (2008) additionally point out that to apply the Polluters Pay Principle would not be an easy task based on the fact that several methods may be used to estimate external costs related to health, the ecosystem as well as the built environment.

1.6.2 Views of branch organisations

UIC and CER think that the recent plans of the European Commission to harmonise the charging of trucks (the so-called Eurovignette Directive) on the trans-European network does not allow Member States to set charges that properly reflect external costs. This would contradict the principle of polluter pays. Getting the pricing right on the "biggest player" in the freight market would produce valuable revenue, which could be used to ensure that the transport sector as a whole is self-financing and could, at least partly, contribute to new infrastructure.

The International Road Transport Union IRU (2008) say that today, basic good governance principles demand that policy making must be based on some form of regulatory impact assessment. Like Schmidtchen et al. (2007), they claim that this would be nothing less than an in-depth cost-benefit-analysis and was central to the EU's "Better Regulation Initiative". However, the PPP would run counter to this established approach since the decision over who should pay had automatically been taken before any cost-benefit-analysis or impact assessment can occur.

They further claim that from an economic point of view, the PPP was an outdated, overly simplistic and narrow approach because it discounted those fundamentals and was not used in daily life or policy decisions. In economic circles, the shortcomings of the PPP had been exposed and its suitability as a sound basis for internalisation policies had been superseded by the CCAP.

CCAP is, as described by IRU, a cost-benefit analysis which can be applied to each situation requiring an internalisation of external costs. A CCAP analysis may result in the polluter being identified as the Cheapest Cost Avoider and thus the right party to pay the associated costs. However, the polluter might as well be the highest cost avoider and thus the least appropriate party to bear the costs. Yet, if the costs are still allocated to this party the economic damage will supersede the economic benefit gained, thus weakening the general efficiency of the economy to meet the challenges of sustainable development as a whole.

With these presentations of views and thoughts on different aspects of the internalisation of external transport costs, the description of the current situation is concluded for Europe. In section 7, some information on activities in this field are assembled for countries outside of Europe, namely the USA and Australia. For the time being it seems that there are hardly any other countries dealing with this subject. Future analysis should try to find as many sources as possible also for Asia, either confirming or refuting the above findings.

1.7 Position on internalising external costs of transportation outside of Europe

1.7.1 USA

Apart from information on the current state of internalising external costs of transportation in Europe, it was difficult to find out if a similar process was going on in other countries, like the USA or parts of Asia. From the information that was obtained via the internet, it seems that the USA are not discussing internalisation of external costs for the time being. The subject that seems to be on the agenda is reporting rules for greenhouse gases. There is a difference between the actions put forward on a federal level and the actions initiated by the State of California.

With regard to federal actions, the "Consolidated Appropriations Act" of 2008 directed the U.S. Environmental Protection Agency (EPA) to develop a draft mandatory reporting rule for greenhouse gases by the end of September 2008; the Final Rule is due to be completed by June 2009. The Rule is expected to require mandatory reporting of greenhouse gas emissions "above appropriate thresholds in all sectors of the economy," with thresholds and frequency of reporting to be determined by the EPA.

The government of California has come forward with a "Heavy-Duty Vehicle Greenhouse Gas Emission Reduction Measure" which can probably be seen as one step further compared to the federal action: Already in 2006, California enacted The Global Warming Solutions Act (AB 32) to address climate change issues within the state. The goal is to develop programs to reduce greenhouse gas emissions to 1990 levels by 2020. To begin fulfilling the commitments made, a list of discrete early action measures was developed and is scheduled to be adopted and enforceable by January 1, 2010. An example of an early action measure is a regulation based on the EPA's SmartWay Program, which will require use of technologies that improve the efficiency of heavy-duty tractors and trailers operating in California. This measure will officially be presented in December 2008.

1.7.2 Australia

The only other country for which information, which was related to the issue "internalisation of external costs of transportation", could be found on the internet was Australia. The National Transport Commission (NTC) issued a "Freight and Mode Share Forecast" in March 2006, which was a review of the report "The Future of Freight" issued in 2005. The latter was released by the Australasian Railway Assocation to review road access charging and other aspects of road and rail intermodal competition. The NTC wished to understand reasons for the differences between freight growth and mode share forecasts compared to other forecasts and to obtain a level of certainty for these forecasts. The review of 2006 found that the report presented a significant amount of information and analysis, but there were some aspects that could be developed further. The NTC regards as externalities of transportation accidents, congestion, pollution (air, noise) and greenhouse effects. Road greenhouse gases and accident externalities are estimated to be the most significant externalities for inter-capital corridors [major roads connecting large cities in Australia]. In rural areas, the accident externality contributes to 70% of total externality costs; greenhouse gases (GHG) contribute to 21% to externality costs; noise and congestion are small contributors. The report even states some concrete figures:

- GHG costs: road $1.4/'000 Net Ton Kilometres (NTK), (low estimate); rail $0.6/'000 NTK
- Accident costs: road $3.2/'000 NTK; rail $0.2/'000 NTK
- Noise pollution costs: road $0.5/'000 NTK (high estimate); rail: $0.2/'000 NTK
- Congestion costs: road $0.8/'000 NTK (high estimate); rail: not relevant.

Even if these figures may differ from figures developed in Europe, this is not the most relevant information. What in contrast is interesting is the simple fact that Australia seems to have started a similar process as Europe, though limited to land transportation. New impulses could come from this end of the world, and it would be interesting to see what a dialogue between European actors in this field and Australian politicians could have for consequences for both.

The next chapter deals with the question which fraction of external costs is already integrated in different countries today and by which measures. Chapter 1 already showed that authorities, researchers and branch organisations have different views on the subject. Such disagreement on the definition of external costs of transportation, methods to calculate them and principles for their internalisation might also lead to very heterogeneous internalisation approaches across different European countries, making it more difficult for market actors to prepare for changes in transport cost structures.

2. Which fraction of external costs are already internalised in different countries and by which measure?

2.1 Views of authorities

The Commission of the European Communities states in their "Summary of the Impact assessment on the internalisation of external costs" (2008) that given its environmental externalities, transport is already exposed to a number of regulatory measures. In addition, transport activities, including vehicle purchase, ownership and use, are subject to numerous taxes and charges, which may overall compensate, and in some cases maybe even over-compensate, for some of their social costs. The Commission points out that although there is some evidence that some degree of internalisation of external costs is already in place, transport users do not bear all costs or they pay in ways not related to external costs. The problem in the Commission's eye is that the structure of existing levies does not give a price signal efficient enough to influence the mobility behaviour. Therefore, the Commission suggests to

- propose a stepwise strategy to promote the internalisation of external costs for all modes of transport, creating incentives for users to make efficient use of transport infrastructure,
- enable and encourage Member States to implement in a consistent way charges on motorways and other roads to support efficient road usage leading to more sustainable mobility. This includes the revision of Directive 1999/62/EC (the "Eurovignette" Directive on charging of heavy goods).

As policy options, the Commission analyzed different scenarios, starting from a so-called reference scenario which does not consider any new proposal to ensure the internalisation of external costs, but takes into account the forthcoming measures aimed at reducing environmental nuisances. The second scenario analyses the impact of charging for external costs in road freight transport, using three variants: a) charging for air pollution and noise costs, b) charging for air pollution, noise and CO_2, c) charging for air pollution, noise and congestion. The third scenario ensures that external costs can be charged not only for road freight transport, but also in all other modes of transport to ensure equal treatment. Two variants were used: 1) charging for air pollution and noise costs in all modes of transport, charging for CO_2 in maritime, inland waterways and railways; 2) charging for air pollution, noise and CO_2 in all modes of transport. The policy options corresponding to charging air pollution, noise and congestion in freight road transport seem to offer the best combination in terms of mobility and sustainability. The main amendments would be to authorise the calculation of road charges on the basis of the external costs, namely air pollution, noise and congestion and to differentiate the charges accordingly.

In practice, the main economic instruments for internalising external costs are according to the Commission taxation, tolls (or user charges) and, in certain circumstances, emission trading. Some external costs relate to the use of infrastructure and vary according to time and place. This is the case for congestion, air pollution, noise and accidents, all of which are highly localised. The use of differentiated charging is, pursuant to the Commission, the best way to take those variations into account. Climate change, on the other hand, has no such local dimension. Emissions of greenhouse gases in general and CO_2 in particular do not vary according to time or place but are linked to fuel

consumption. The Commission therefore regards it as more appropriate to use an instrument directly linked to that consumption, such as a fuel tax or even a CO_2 emission trading system.

The Commission of the European Communities explains in another document, the "Communication from the Commission. Strategy for the internalisation of external costs" (2008), that noise pollution remains a major challenge especially for rail transport. With regard to air transport, from 2011 or 2012, aircraft operators will be required to surrender allowances to cover their emissions according to the "polluter pays" principle. The draft Directive applies not only to intra-Community flights but also to all other flights arriving at or departing from an EU airport. It caps emissions at 100% of the levels obtained during the 2004-06 reference period. In early 2007, the Commission developed a proposal for a Directive on airport charges.

The Commission wishes to include the maritime sector in the post-2012 agreement on preventing climate change and would also like the International Maritime Organisation (IMO) to develop a series of measures over the course of 2009 to reduce greenhouse gas emissions. If the IMO does not make sufficient progress, the Commission will suggest taking action at European level, with one of the possible options being to include the maritime sector in the EU Emission Trading System.

The Commission suggests that the use to which the revenue generated by internalisation is put should take account of the benefits that international traffic has for the Community. In many cases, it is international traffic that generates the revenue. International road transport accounts for almost a quarter of all road traffic in Europe, with that figure rising above 50% in seven Member States (and even reaching 74% in Belgium, 76% in Luxembourg and 85% in Estonia). If this revenue is not earmarked for transport, Member States might use the revenue generated by internalisation to pursue their own interests without considering the advantages of sustainable mobility at Community level.

The European Federation for Transport & Environment T&E (2007) provide detailed information on their website (http://www.transportenvironment.org/) on the EU Directive 2006/38 (former Directive 1999/62/EC, also called "Eurovignette-Directive") which they see as one decisive step towards the internalisation of external costs of road transportation, even though they clearly state that they had hoped for a more stringent regulation. So does neither the current nor the proposed revision of the Eurovignette directive force any Member State to introduce road charging schemes, they only set rules for those that choose to do so. Under current rules, Member States are explicitly prohibited from charging road users in the freight sector for the 'external' costs of their operations (such as environment, noise, congestion and health costs) on TEN-T (Trans-European Road Network) roads.

As one successful example, T&E cite Switzerland as the only country with a km-based charging scheme, which include external costs, applied to lorries using the entire national road network since 2001. The charges include the costs associated with air and noise pollution, climate change and road accident costs. Furthermore, according to T&E, the Swiss experience is particularly valuable since it gives an important indication of the impacts one can expect from internalisation through road charging:

- efficiency gains in the road transport sector,
- negligible impact on consumer prices,
- incentives to buy cleaner vehicles,
- reduction in environmental impact of transport,
- stable number of employees in the sector.

Another clear disadvantage is in T&E's opinion the fact that the Commission's proposal only enables Member States to charge for some external costs, namely air pollution, noise and congestion. This means that European law will continue to prohibit Member States from internalising the costs of road accidents, climate change, land-use and biodiversity impacts and

others. As a result, road charges will be less effective overall. This is particularly important for accident costs and climate change costs. The IMPACT study (**I**nternalisation **M**easures and **P**olicies for **a**ll external **C**osts of **T**ransport, carried out by CE Delft in 2007) for the European Commission provided a methodology to estimate their level in a precise way. Regarding accidents, the IMPACT study clearly showed that there is an external component to accident costs that is not internalised through insurance premiums.

Another disadvantage is according to T&E that the Commission will also propose a 'maximum chargeable external costs' limit which in practice will limit the extent to which Member States can charge for external costs. The proposal as it currently stands caps charges at the average costs identified by the 'IMPACT' study, making it impossible to internalise at least half of the external costs generated by road transport. Last but not least, T&E say that the European Commission also decided to leave untouched the provisions that allow Member States to have time-based charges allowing vehicles to circulate for a given time. In contrast to distance-based charges, they do not encourage transport efficiency or help to meet environmental targets. They are also prone to discrimination against foreign vehicles.

2.2 Views of research institutes and individual scientists

The conclusion of the research of Kopp and Prud'homme (2007) is that road users in France already pay the price that covers their costs. Road CO_2 according to them already paid much more than 25€ per ton of CO_2, to be "shared" with congestion costs, road maintenance etc. With regard to air pollution and green house gases, Kopp and Prud'homme (2007) argue that CO_2 should be managed with the help of a tax and that this tax should be fixed at around 20€ per ton, therefore reduction efforts should be concentrated on where a ton of CO_2 could be avoided at a cost of less than 20€. Implementing a tax would be expensive but tolerable. A tax of 35$ (25€) would be completely coherent with the estimate in Stern's report. The Stern Review on the Economics of Climate Change was published on October 30, 2006 and was lead by Lord Stern, the then Head of the Government Economic Service and former World Bank Chief Economist. The Review set out to provide a report to the Prime Minister and Chancellor by Autumn 2006 assessing the nature of the economic challenges of climate change and how they can be met, both in the UK and globally (http://www.occ.gov.uk/activities/stern.htm). However, especially the magnitude and wide dispersion of CO_2 would demand internalisation of those costs into all types of transport (air, rail, and road).

Congestion according to Kopp and Prud'homme (2007) is usually tackled using taxes (on fuel or by tolling the traffic), which decreases road usage. One would also have to take into account the cost of operating the toll and likely costs of increased public transport congestion, in order to obtain the "net gain" of an internalizing toll. Congestion, they say, is not a homogenous phenomenon but by definition applies to particular times and places.

With regard to accidents, Kopp andPrud'homme (2007) explain that civil responsibility (liability) is a system which enables the reduction of accidents by reducing driver negligence and not the number of kilometres driven. The system of liability and insurance was aiming at internalising an externality to the aggressor, mutualising the cost of risk among drivers, persuading dangerous drivers to modify their behaviour.

The Infras institute and the IWW institute (2004) suggest as internalisation policy different measures: First, they propose a km-dependent HDV (Heavy Duty Vehicle) tax in Europe, which considers not only accident costs but also environmental costs like air pollution, climate change and noise. It would be appropriate to apply such schemes not only for motorways. Furthermore, an introduction of road pricing schemes for passenger cars, primarily in urban areas, should be

introduced to consider capacity problems. An additional differentiation according to environmental criteria (e.g. air pollution) would be appropriate.

Infras and IWW mention as well a minimum rate for a CO_2-tax of 20 € per ton. This should be applied to all means of transportation in order to meet the aims of a long-term climate strategy. Most important is the inclusion of international air transport, in order to reduce tax distortions between transport modes.

Additional measures stated by Infras and IWW could be for road transport hi-tech road management and intermodal information systems to increase effectiveness, moreover environmentally friendly and safe driving styles, supported by traffic calming measures (including speed limits).

With regard to rail transports, Infras and IWW suggest the application of rail track pricing systems considering external costs according to EU Directive 2001/14 on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure. More emphasis should be put on technical progress in improving environmental performance, such as wagon breaking improvements (see UIC Noise Action Plan "Noise reduction for freight wagons", http://www.uic.asso.fr/) and energy efficiciency (see UIC Diesel Action Plan, use of sustainable energy sources).

Last but not least, Infras and IWW point out that it would be a priority to internalise external accident and environmental costs in road and air transportation first, because these cost categories are responsible for large parts of the total external costs.

The research team Mayeres et al. (2001), writing a report on "The External Costs of Transportation" for the Sustainable Mobility Programme of the Federal Office for Scientific, Technical and Cultural Affairs in Belgium, state that there are two main possibilities to decrease the air pollution from transport. Either one needs to continue the technological improvement and introduce new fuels and new technologies or one needs to shift the growing demand for passenger and goods transport to other transport modes. Also an improved information system could help to reduce transportation and to avoid congestion. As Mayeres et al. argue, investments in technologies, which reduce the uncertainty about congestion, can be much more effective in reducing congestion than direct investments in capacity.

The English research team Piecyk and MacKinnon (2007) find that the proportion of the total cost internalised in the UK varied by vehicle class, with the lightest category of rigid vehicles covering only 55% of their allocated costs, but the heaviest rigid vehicles covering 79% of them. In 2006, domestic- and foreign-registered heavy goods vehicles activity imposed external costs of around £7.3 billion based on mid-range valuations. In the case of British-registered heavy duty trucks, 67% of these costs were internalised by duties and taxes paid by road freight operators. Overall, their analysis suggested that taxes on lorries would have to rise by around 50% to fully internalise infrastructural, environmental and congestion costs. If one excludes congestion costs, state Piecyk and McKinnon, it appears that lorries more than cover their infrastructural and environmental costs. At 40% of the total external costs, congestion exceeds the share of costs attributable to environmental impacts (36%) and infrastructure (23%). Moreover, they report that according to the EEA estimates for 2002, taxes levied on heavy goods vehicles in Britain internalised around 88% of the external costs of road freight transport, a higher proportion than in any other EU country. At the other extreme, countries such as Poland, Greece and Luxembourg only internalised around 30% of the external costs arising from road freight transport. This means that the duties levied on diesel fuel in Britain remains according to Piecyk and McKinnon the highest in Europe. In August 2007, the duty on diesel fuel in the UK was 77% higher than the European average and 154% higher than in Cyprus, the EU member state that taxes fuel the least. Piecyk and McKinnon found that taxation in Germany was slightly higher than the UK in 2006 (0.284 Euro per km as opposed to 0.245 Euro per km). Britain is thus according to Piecyk and McKinnon already much closer to full internalisation of the external costs of road freight transport

than most other EU countries. Raising the taxes on road freight operators above current levels would put UK operators at an even greater competitive disadvantage within the open EU market for road haulage services. Taxing road freight operators more heavily to recover a higher proportion of external costs would reduce the financial resources they have available to upgrade their fleets and introduce other 'green' measures.

2.3 Views of branch organisations

The European Shippers Council (ESC, 2008) includes according to their own definition shippers, which are primarily producers of goods and services, which they market, sell and distribute to their customers. As such, ESC say that they represent the interests of some 100,000 companies involved in international trade, within, to and from the EU. In 2008, ESC published a "Position Paper on internalising external costs of transport". In this paper, ESC also comments on CE Delft's report "The Handbook on Estimation of External Costs in Transport" of 2007 and state that CE Delft more or less makes the assumption that external costs are not yet being paid for by users. This assumption is at odds with reality, according to the European Shippers Council. For example, road transport companies pay duty on petrol, road tax, insurance premiums, the special Eurovignette charges and toll charges for particular stretches of road, tunnels and bridges. ESC also refer to Piecyk and McKinnon who concluded that two-thirds of the external costs for road transport is already covered by taxes – but forget to mention that this is only valid for heavy goods vehicles in the UK and just applied to the so-called "base-case scenario".

ESC argues that transport operators and their customers are also paying the costs of congestion through higher operating costs associated with congestion: the more congestion encountered, the higher the fuel consumption and therefore the more fuel duty revenue for the government is collected. Additionally, the more congestion the more equipment, drivers, inventory and other operational costs (fixed and variable) are incurred.

Furthermore, ESC mention that the percentage of external costs paid by rail freight for freight trains was only approximately 2.5 percent, while the percentage for inland-waterway shipping is 2 percent. However, ESC does not give any information on which external costs these figures are based – infrastructure, environmental and congestion costs like at Piecyk and McKinnon? If these two transport modes receive the same treatment as road transport in the internalization of external costs, they will become considerably more expensive in relation to road transport and even less competitive as today.

ESC state that Germany, France and Switzerland already have a levy system for road freight transport, with the subjective of stimulating rail freight transport. However, none of these countries have experienced an increase in goods transport by rail. ESC finds that only 4% of the amount of goods now transported by road can economically be moved by rail. In fact, only 1.22% of goods now transported by road will be moved by rail, if the levy (charge) on road transport is set at € 1 per kilometre, according to a study on the "Influence of truck tolls on the modal split in cargo traffic" by TransCare 2006. ESC believes that if the Commission applied the scheme for internalising external costs to all transport modes, then the amount of goods transported by rail will probably fall drastically.

ESC suggests the following basic requirements aimed at reducing external costs:

- The revenue generated must go towards solving the problem.
- Cross-subsidizing is only warranted, if the other transport mode yields greater economic benefits (the revenues from road transport may only go towards other transport modes, if they produce significantly greater benefits than by investing them into road transport).
- All transport modes need to pay for the external costs. It would only be fair if the

less detrimental transport modes paid less for the external costs.
- Private passenger cars must also be included.
- The benefits should clearly outweigh the administrative costs.
- The road transport sector is paying for more than half of the external costs through petrol duty and toll charges.
- The policy will not create modal shift away from road transport. It will increase the costs of alternative modes and siphon revenue away from remedies that reduce the external damage, and put more revenue towards administration of the charges.
- The policy will not encourage innovative solutions by the transport industry to reduce the external damage it causes or contributes to.

The International Road Federation IRF in their "Position on the Eurovignette Directive. Fair and efficient charging vs. internalization of external costs" (2005) also point towards the Swiss example and state that in June 2001 the Swiss Parliament rejected the principle of internalizing external costs for transport. Acknowledging that other factors, such as indirect benefits, subsidies and the tax burden of motorists, have to be considered too, Swiss deputies concluded that internalization was only acceptable if applied to all transport modes and feared that such a policy may oblige national rail operators to pay, and that the road sector could be entitled to receive a net transfer. One core argument was that railways have not internalized the "external cost" of their heavy subsidies.

Furthermore, IRF say that regarding direct costs, road is currently a net contributor, with users (in the EU15) paying around 350 billion euros annually, of which only a third is reinvested into road infrastructure. They also claim that through a range of taxes and charges (fuel and vehicle tax, insurance etc.) certain externalities of road transport are already internalized. This is not the case for other modes, for example airlines still do not pay tax on kerosene. All transport modes create negative externalities, and it is not acceptable to apply a principle of internalization exclusively to road transport. For the time being, it is impossible to weigh up the negative and positive externalities.

The IRF insists that "internalization of external costs" be rejected in favour of promoting focused and efficient measures to reduce the negative externalities of transport, such as
- fiscal incentives targeting engines with reduced vehicle emissions,
- sound barriers to reduce noise pollution,
- safe equipment to mitigate road accidents.

For a rough overview of transport and environmental taxes or charges in EU member states, the following table 2 is presented:

Table 2: Transport and environmental taxes/charges in Member States- transport*

	AT	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FIN	F	HU	IE	IT	LT	LV	LU	MA	NL	PO	PT	SL	SK	SW	UK	RO
Infrastructure Charges																											
Road		■			■					■	■											■		■	■		
Rail											■																
Aviation																			■						■	■	
Parking fees	■																		■								
Vehicle charges																											
Vehicle Tax	■	■			■	■	■	■	■	■	■	■	■	■	■				■	■	■				■	■	
Safety levy	■																										
Noise tax													■							■					■		
Fuel tax	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Air pollution tax										■		■	■		■										■		

Adapted from OECD data base.
No data for Slovenia and Latvia. Missing data for Italy.

*European Commission, Directorate-General for Energy and Transport: Preparation of an Impact Assessment on the Internalisation of External Costs – Consultation Document; 2007)

Table 2, however, does not give any information on which of the charges are regarded as external costs of transportation in which country and, thus, are internalised today.

For more information on charges in different EU-countries, see Annex 1 "Current situation and opportunities in Member States: a comparison", in: T&E (2007): A price worth paying. A guide to the new EU rules for road tolls for lorries (pages 22-32).

3. Discussion

As already mentioned in chapter 1, it becomes clear when reading the publicly available documents on the internalisation of external costs of transportation that there is no commonly agreed-upon definition of what external costs of transportation shall include. However, the categories, which are mentioned the most, are without doubt congestions, accidents, air pollution, greenhouse gases and noise. Even within these categories, though, opinions vary on whether accidents and congestions really fall under external costs of transportation or are at least often regarded as "special" in comparison to the other ones.

Furthermore, the system boarders taken into consideration when calculating external costs of transportation differ according to different experts. Some recommend that for example infrastructure aspects should be included in calculations, whereas others state that they only look at vehicle production or the use phase of the transportation means when estimating external costs (see section 1.3.2).

With regard to the development of acknowledged methodologies for calculating different external costs of transportation, also in this field different actors in Europe have widely deviating opinions on whether such methodologies exist and can be relied upon or not. The European Union seems to feel quite comfortable with the results of the "Handbook" released by CE Delft and others, whereas branch organisations and researchers doubt certain calculation methods of certain external costs, for example in case of greenhouse gases and damage of eco-systems. The latter rather is an effect of external costs than a cost category, another example of the complexity of this issue.

Neither is there an accordance on which principles the internalisation of external costs of transportation should be based upon. The debate circles around the "Polluter-Pay-Principle" (PPP), supported by the "Handbook" and thus the European Commission, and the "Cheapest-Cost-Avoider-Principle" (CCAP), which is favored by certain scientists (e. g. Schmidtchen et al.) and branch organisations. Without any deeper knowledge on either of the two, understanding of the consequences of using PPP or CCAP is hardly possible for non-experts. For the time being, it seems that the European Commission will follow the PPP-approach, despite all criticism.

In view of how external costs of transportation should be internalised, it seems that almost all research institutes and scientists analysed in this report agree to varying degrees on that a mix of different methods should be used. These methods should be divided into flexible mechanisms (e. g. kilometre-based charges) and static mechanisms (e. g. fuel taxes) and should take into consideration time and place of a transport (Litman, 1997; Forkenbrock, 1999; Proost et al., 2002; CE Delft et al. (2008).

The focus of most actors is first of all on land transport, which is regarded as the largest originator of external costs of transportation. The majority of methods and policy options for internalisation is limited to land transport only, even though the European Commission acknowledges the importance of integrating other transport means like maritime shipping, aviation and railway into an overall internalisation strategy and mentions certain respective measures. CE Delft, accordingly, covers all transport modes in their "Handbook on internalisation of external costs of transport" and suggests different policy options for each mode. In this context, the European Directive on the Promotion of Clean and Energy Efficient Road Transport Vehicles is

interesting: it aims at a broad market introduction of environmentally-friendly vehicles, addresses purchases of vehicles for public transport services and requires that energy and environmental impacts linked to the operation of vehicles over their whole lifetime are taken into account in purchase decisions. These lifetime impacts of vehicles shall include at least energy consumption, CO_2 emissions and emissions of the regulated pollutants of NO_x (nitrogen oxide), NMHC (non-methane hydrocarbons) and particulate matter. Purchasers may also consider other environmental impacts.

Taking into account these "external" costs in vehicle purchase decisions will contribute to the environment, climate and energy policies of the Community by reducing energy consumption, CO_2 and pollutant emissions.

If the impacts are monetised for inclusion in the purchasing decision, common rules shall be followed, as defined in the Directive, for calculating the lifetime costs linked to the operation of vehicles. To facilitate the implementation process, the Commission has launched today an internet site on clean and energy efficient vehicles. It includes a legislation guide, a lifetime calculator, information on joint procurement and references to Community funded projects in the field. For CO_2, for example, the calculator asks the user to state the cost in €/t, which must be within the range 30-40€/t. If left blank, the tool uses a default value of 30€/t.

From these findings, it seems most realistic that measures to internalise external costs of transportation will focus on land transport, within land transport on freight transport and within freight transport on heavy trucks. The European Commission came up with a proposal for the amendment of EU Directive 1999/62/EC, also called "Eurovignette-Directive", the new EU Directive 2006/38. The European Federation of Transport & Environment (T&E) welcomed this approach despite its shortcomings (see 2.1) as a step into the right direction. For the time being, however, negotiations of this proposal are very difficult and have even been considered as "deadlocked". The new Czech EU Presidency just tabled a compromise proposal to delay the introduction of congestion charges to lorries by four years in an attempt to open up a new and fresh series of negotiations: "An Council agreement on the revision of the Eurovignette Directive on road charging has been pending since the French Presidency failed to consolidate divergent national views on the internalisation of the external costs of road congestion. Some member states are strongly opposed to including congestion as a chargeable external cost in the EU's 'greening transport' package due to their peripheral geographic location. They fear that countries with key transit routes like France would try to profit from the option of charging, thus hampering competitiveness and access to the internal market. The Czech Presidency, keen to reach a conclusion before June 09 is trying to 'bridge the gap' between those countries in favour of including congestion costs and those against, by proposing to postpone the introduction of these charges by four years. It says the gradual approach is also –appropriate' in the face of the economic downturn. The compromise text tries to pour oil on troubled waters by defining rules which it says ensure that the internalisation of congestion costs does not simply bring additional income without contributing to the development of a sustainable transport system. The text also states that charges which put commercial traffic at a disadvantage are unacceptable. Moreover, the compromise would drop the maximum chargeable congestion costs of vehicles in suburban roads and motorways from 60 to 55 cents per vehicle kilometre during extreme peak periods. The presidency is also proposing to limit the scope of the directive to the trans-European transport network (TEN-T) and other motorway networks in member states.

The Commission originally proposed to extend the rules to cover the entirety of EU national road networks. But the Czechs say member states are divided, with some favouring the legal transparency that comprehensive scope would bring, and others arguing a more limited approach is preferable for reasons of subsidiarity. The Parliament backed the Commission's proposal earlier this month (11 March), saying member states should be obliged to earmark the revenues from

Eurovignette charges to developing greener transport. Considering significant resistance from member states, the Czech Presidency is suggesting that such obligations should not be made, but member states would need to provide information on where they have invested the revenues. Transport ministers will consider the compromise proposal on 30 March." (Euractiv, 2009).

The concluding chapter "Summary" will now take up the research questions guiding this analysis and will try to give answers to them.

4. Summary of findings

Official documents above all in Europe show that there is a vivid discussion on the issue of internalising external costs of transportation. In view of the ongoing debate on climate change and all its aspects, this seems to be an important field influencing transport decisions in the future. However, it also became quite clear that this discussion is characterized by contradictions, lack of clarity, insecurity and, not surprisingly, the pursuit of different industry interests. For the time being, it is thus very difficult for transport buying and transport selling companies to prepare efficiently and effectively for an internalisation of external costs, as no-one seems to know how this process is going to look like, when it will start, with which transport mode, in which countries etc. Even the approach to internalise some external costs, not all (!), into road transport by amending the respective EU Directive seems to have failed as of now. The best thing therefore seems to be to watch regulation carefully, to get a full picture of ones transport emissions and to become familiar with tools, which are able to provide a first estimate of possible future cost developments.

Outside Europe, only information on Australia and the USA could be found with regard to internalising external costs, in the case of the USA not even directly connected to the subject. The USA seems to prepare for reporting greenhouse gases quite generally, with nothing being said on how such report results will be handled at a later stage. Australia in contrast works with the question of internalising external costs of transport but limits it for the time being to land transport (road and rail).

The second research question on what fraction of extern costs of freight transportation is already internalised in different countries and by which means could not be answered in a clear way either. For France and the UK, explicit research reports are available, saying that especially road transport pays for its external costs to a large degree in these countries. References are made to other European countries paying either much less of their external costs today (e. g. Greece or Cyprus) or as much as the UK (e. g. Germany). However, in-depth-analyses are not available for each European country. In order to be able to evaluate the current state of internalisation of external costs in Europe, one would need a more generally accepted definition of external costs of transportation, to begin with. This definition is not available or depends on whom is asked. Additional lack of clarity with regards to calculation methods, definition of system boarders for the calculation and underlying principles make it impossible to list internalisation approaches in Europe in any other way than fragmented, vague and containing a high degree for failure.

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