

# Are Trucks Taking Their Toll? II

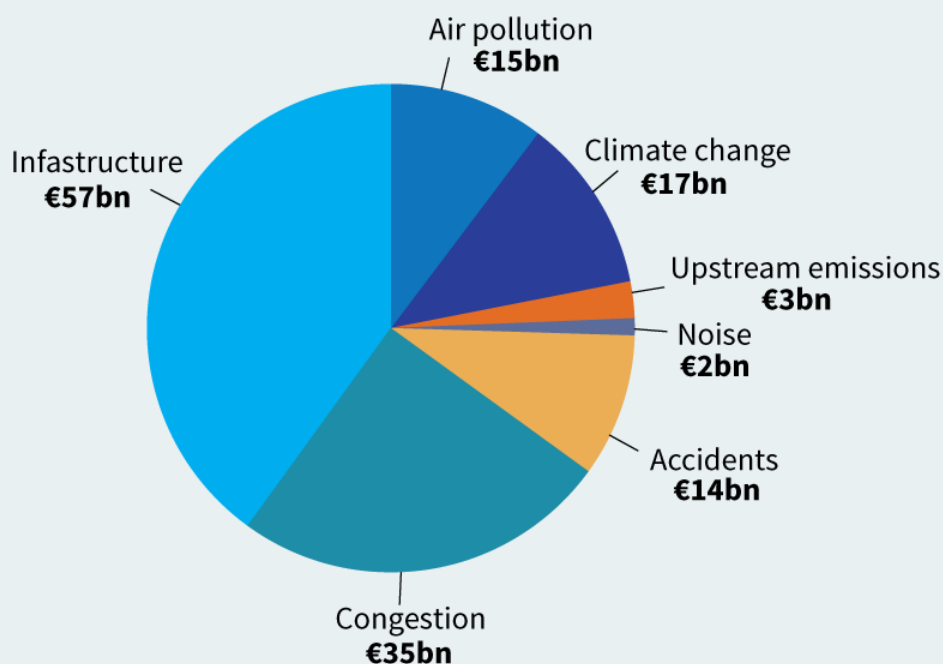
## External Costs of trucks and the review of the Eurovignette Directive

April 2016

### Summary

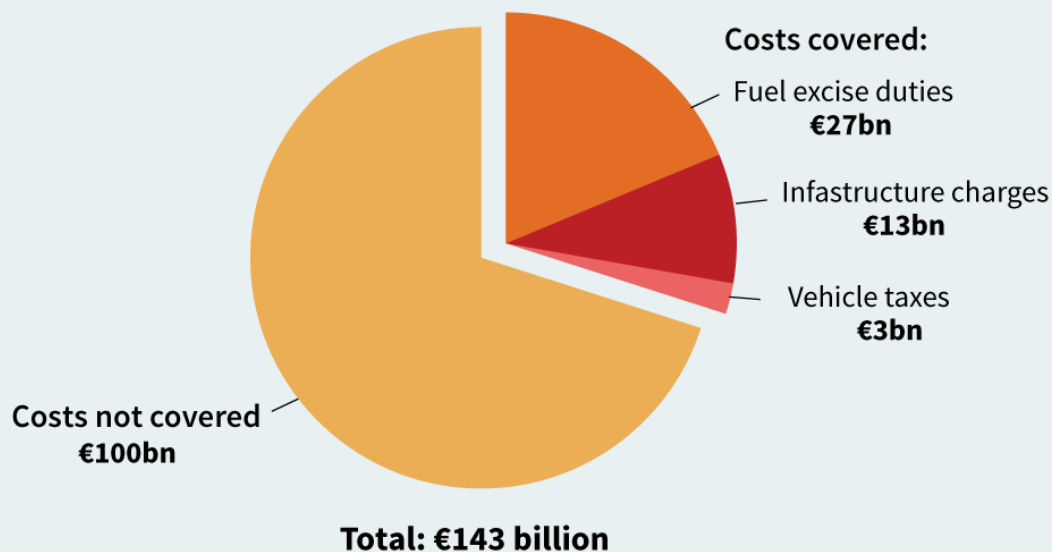
1. It is almost certain that the computer where you found this document or the desk where you are reading it at was, at one stage, on a truck. Trucks play an important role in the modern economy. However, trucks are also the cause of significant negative impacts. These negative effects (or “externalities”) include climate-changing CO<sub>2</sub> emissions, air pollution, congestion, noise, road damage and traffic casualties.
2. These externalities have a cost – for example air pollution makes people sick which causes costs for employers as well as healthcare – which is currently largely paid for by the public. A new study by CE Delft shows how European trucks cover only 30% of their externalities through taxes and tolls. The key external costs are summarised below in figures 1 and 2.

### The external costs of heavy goods vehicles (in bn euro)



3.

## How much of the external costs of trucks are being covered?



- 4.
5. This very low cost coverage – or internalisation of external costs – is harmful for three key reasons:
  1. **It discourages action to reduce negative externalities.** This is why the EU has adopted the polluter pays principle. This is an economic concept that essentially means operators, not the public, should pay for the external costs they cause, usually through taxes or tolls. If taxes and tolls are based on the external costs of that specific vehicle (for example, EURO class of a truck or fuel efficiency), they encourage the purchase and use of less damaging (for example, cleaner) trucks.
  2. **It leads to inefficiency.** Artificially cheap trucking has contributed to a situation where 20% of EU trucks drive around empty<sup>i</sup> and generally payload factors (how full a truck is) hover around 57%<sup>ii</sup>. Higher transport costs, in line with the externalities caused by trucking, incentivise greater logistics efficiency (less empty driving, better routing, etc).
  3. **It undermines fair competition.** While cost coverage is typically quite low for road freight, it is usually greater for other modes such as rail or inland water ways. This leads to a situation where less polluting modes are put at a competitive disadvantage.
6. This briefing summarises a CE Delft study T&E commissioned to monetise the external costs of trucks and to determine whether truck users are now covering a larger share of their external costs than in 2009 – when the first *Are Trucks Taking Their Toll?* report was published. The report finds that while there has been progress, a lot remains to be done, in particular to:
7. **Reduce truck GHG emissions** – trucks are responsible for approximately 25% of the CO<sub>2</sub> emissions from road transport. A reformed Eurovignette Directive should contribute to lowering truck CO<sub>2</sub> by:

- a. **Allowing CO<sub>2</sub> differentiated trucks tolls.** The current framework only foresees differentiation based on air pollution/EURO classes. In the future, CO<sub>2</sub> differentiation – essentially toll discounts for lower carbon trucks – should also be possible. More detail on why this would be beneficial and how it could work can be found in T&E’s [CO<sub>2</sub> differentiated truck tolls](#) briefing<sup>iii</sup>.
- b. **Phasing out time-based vignettes.** Time based systems – where you pay a certain amount and are allowed to circulate freely within that time period – encourage inefficiency (the more you drive, the less you pay). Distance-based charges on the other hand stimulate more rational and more efficient logistics.

8. **Reduce truck air pollution** - trucks are responsible for between 40-50% of NO<sub>x</sub> emissions from road transport.<sup>iv</sup> The latest science shows we have previously underestimated the negative effects and costs associated with air pollution<sup>v</sup>. This needs to be addressed by:

- a. **Increasing the permissible air pollution charge and having greater differentiation.** The €0.02/km maximum charge for EURO VI trucks should be increased to reflect advances in estimating damage from air pollution. At the same time stronger differentiation should be enabled and encouraged to incentivise the use of Euro VI trucks and the phase out of EURO I to V trucks.
- b. **Making external costs a mandatory portion of road tolls.** The current directive allows member states the choice to charge for external costs (namely air pollution and noise). As announced in the 2011 transport white paper, external cost charging should become mandatory. Phasing-out this voluntary approach and making this portion of road tolls mandatory would improve the air quality and noise levels in Europe.

## 1. Context

### 1.1. Covering the damage

This briefing summarises the key outcomes of a study commissioned by Transport & Environment to examine the external costs of trucks<sup>vi</sup> and the extent to which truck users are covering such costs through the charges and taxes that they pay<sup>vii</sup>. Trucks or “Heavy Goods Vehicles” (herein referred to as “HGVs”) are not covering the total external and infrastructure costs that they cause. In a recent CE Delft report commissioned by T&E (2015) the total infrastructure and external costs of HGVs in the EU28 was calculated to be approximately 143 billion euro (see figure 1 above). CE Delft have calculated that only 30% of these costs are internalised through the revenues from the taxes and charges that HGVs pay. The following HGV taxes and charges were considered for the purpose of this exercise: fuel excise duties, road charging, and vehicle taxes. Only these taxes were considered as they intend (in some degree) to account for the externalities of road transport (see figure 2 above).

Excise duties are levied on diesel in all EU countries. Infrastructure charging extends to the tolls placed on HGVs, irrespective of whether they are distance-based or time-based. Annual ownership taxes and registration taxes apply to HGVs in some EU countries so these vehicle taxes were considered for the purpose of this exercise.

## 2. The External and Infrastructure Costs of HGVs in Europe

The total infrastructure and external costs of HGVs in the EU28 (based on 2013 figures) amounted to approximately 143 billion euro (119-167 billion euro). As shown in figure 1, most of this amount comes from infrastructure costs (40%) caused by HGVs. In the external costs categories, congestion contributes the most (25%), followed by climate change costs (12%), with accidents and air pollution both having a share of roughly 10%. A detailed description of the methodology used to reach all of the figures used in this briefing can be found in the CE Delft (2015) report.

### 2.1. Infrastructure Costs

The total infrastructure costs attributable to HGVs in Europe was estimated to be 57 billion euro. 35% of these costs are fixed while the remaining 65% are variable. Fixed costs refer to costs that do not vary with transport volumes while variable costs do vary according to transport volumes. Construction costs and land values are examples of fixed costs, while maintenance is an example of a variable cost. The major portion of the 58 billion euro costs is related to urban roads, while the costs of motorways is 11.9 billion euro.

Under the Eurovignette directive<sup>viii</sup>, which determines how trucks can legally be tolled in Europe, there are two types of infrastructure charging applicable in the EU. There is time-based charging, which is applied in nine EU countries (Bulgaria, Denmark, Lithuania, Latvia, Luxembourg, Netherlands, Romania, Sweden and the UK) and distance-based charging, which is applied in fifteen EU countries (Austria, Czech Republic, Belgium [as of 1 April 2016], Germany, Hungary, France, Greece, Croatia, Ireland, Italy, Poland, Portugal, Slovakia, Slovenia and Spain). It has been found that distance-based charging, particularly electronic network-wide tolls, are a mechanism that recover a greater percentage of infrastructure costs than time-based systems (AEA Ricardo 2014). The burden of the 58 billion euro figure could be reduced through the continuing adoption of distance-based charging systems across Europe, in addition to modal shift efforts being made.

### 2.2. Air Pollution

The total costs of air pollution caused by HGVs was approximately 15 billion euro in 2013. In 2013, HGVs were the biggest emitters of air pollution<sup>ix</sup>, being responsible for up to 40-50% of NO<sub>x</sub> emissions of road transport in Europe<sup>x</sup>. The main costs that come as a result of air pollutants from HGVs are related to adverse health impacts on the cardiovascular and respiratory systems of humans. Other costs that come as a result of air pollution are damage to buildings, crop losses and impacts on biodiversity and ecosystems.

The EURO class legislation has obliged truckmakers to reduce the air pollution from HGVs but they still contribute significant levels of air pollution into the atmosphere in Europe, which results in health problems.

The previous CE Delft (2009) study showed how air pollution was the cause of 16 billion euro in costs in 2008. The calculation method has changed since the first study to a top-down approach, which partly explains why the EURO standards have not had a significant impact on the overall results of the updated study. Whilst better engine and after treatment technology (mandated through EURO standards) have had a positive effect, our understanding of the costs of air pollution is also progressing. For example, the higher and more up to date NEEDS shadow prices<sup>xi</sup> are now used for NO<sub>x</sub>, as recommended by Ricardo-AEA<sup>xii</sup>. Shadow prices for PM<sub>2,5</sub> and PM<sub>10</sub> are based on HEATCO<sup>xiii</sup>. The main costs are related to adverse health impacts (e.g. due to cardiovascular and respiratory diseases). This methodology better reflects the true costs of air pollution.

### 2.3. GHG Emissions

HGVs are responsible for approximately 25% of the greenhouse gas (GHG) emissions from road transport in Europe. This results in HGVs being responsible for 17 billion euro in climate change costs. The costs of GHG emissions relate to the impacts of global warming (e.g. sea level rise, agriculture impacts, health impacts

and extreme weather conditions). The 17 billion euro amount is based on the fact that HGVs emitted roughly 208 Mt CO<sub>2</sub> in the EU28 in 2013. Multiplying these with the shadow prices result in a range from 2.1 billion to 31.2 billion euro. For the purpose of this study, a shadow price of 80 euro per ton has been used in accordance with Kuik et al.<sup>xiv</sup>.

There is little more EU policy to tackle the GHG emissions from HGVs than a planned system to test new truck CO<sub>2</sub> emissions and monitor and report these. Fuel efficiency standards for HGVs, combined with a CO<sub>2</sub>-based differentiation – essentially discounts mechanism in road tolls, would both play a role in greatly reducing the GHG emissions from HGVs.

## **2.4. Emissions from Fuel Production**

It is important to consider the upstream emissions that come from the production of the fuel that powers HGVs. The total external costs from upstream processes of HGVs in Europe is 3.5 billion euro. This is based on the fact that GHG emissions and air pollution occurs as a result of the extraction of the raw materials used, as well as the production and transport of these fuels. There are certain upstream dangers from this process which were not considered in the CE Delft report; oil spills and similar disasters fall outside of the scope of external costs considered in this study.

## **2.5. Noise Costs**

Noise is a significant external cost from HGVs. HGVs are found to be responsible for 1.7 billion euro of noise pollution costs, which is 17% of the total noise costs of road transport. In Europe, almost 80 million people are exposed to noise levels higher than 55db from road transport.

Noise from road transport is said by the World Health Organisation (2011)<sup>xv</sup> to bring significant health impacts. This ranges from noise irritating people, which can lead to responses like anger, depression and exhaustion. Furthermore, noise can increase the risk of cardiovascular disease, cognitive impairment and sleep disturbance. These health impacts have mortality and morbidity costs, which both contribute to the above monetary figure.

The methodology used to calculate the costs of noise in this study are different than that used in the previous study. The noise maps that EU Member States now publish provide more detailed information than was previously available. These maps were not available at the time of the previous CE Delft study. Furthermore, according to CE Delft, there has been a decrease in the number of people exposed to noise as a result of the information in the noise maps, combined with measures taken to reduce noise levels (e.g noise walls). However, noise remains an external cost that causes significant impacts on those who are effected.

## **2.6. Accident Costs**

Total external costs from accidents with HGVs amounted to 13.5 billion euro in 2013. The large size of HGVs results in severe consequences for other road users involved in accidents involving trucks. This means that HGVs collisions largely result in fatalities and accidents with severe injuries. Traffic accidents result in several social costs. Only accident costs that are not anticipated by road users are considered as external costs. This means that the costs covered by insurance are not part of the external accident costs in the CE Delft study. The costs experienced by truck drivers are not taken into account, as these are considered internalised. The costs associated with risks of HGV to other non-HGV road users are considered as external and are responsible for the 13.5 billion euro figure.

## **2.7. Congestion Costs**

The congestion costs of HGVs in the EU28 is 35 billion euro. Congestion is the mutual disturbance amongst road users when they are competing for the limited road capacity. This can bring significant costs as a result of travel time increases, reduction in travel time reliability and additional operational and fuel costs.

Congestion is an external cost as only part of the effects are borne by HGV users themselves. **The main cost of congestion caused by HGVs is imposed on other road users.** The HGV is a significant cause of congestion on the non-HGV road users and this is the reason for them being the cause of 36 billion euro in externalities.

### **3. Recommendations**

#### **3.1. CO<sub>2</sub> differentiation of tolls**

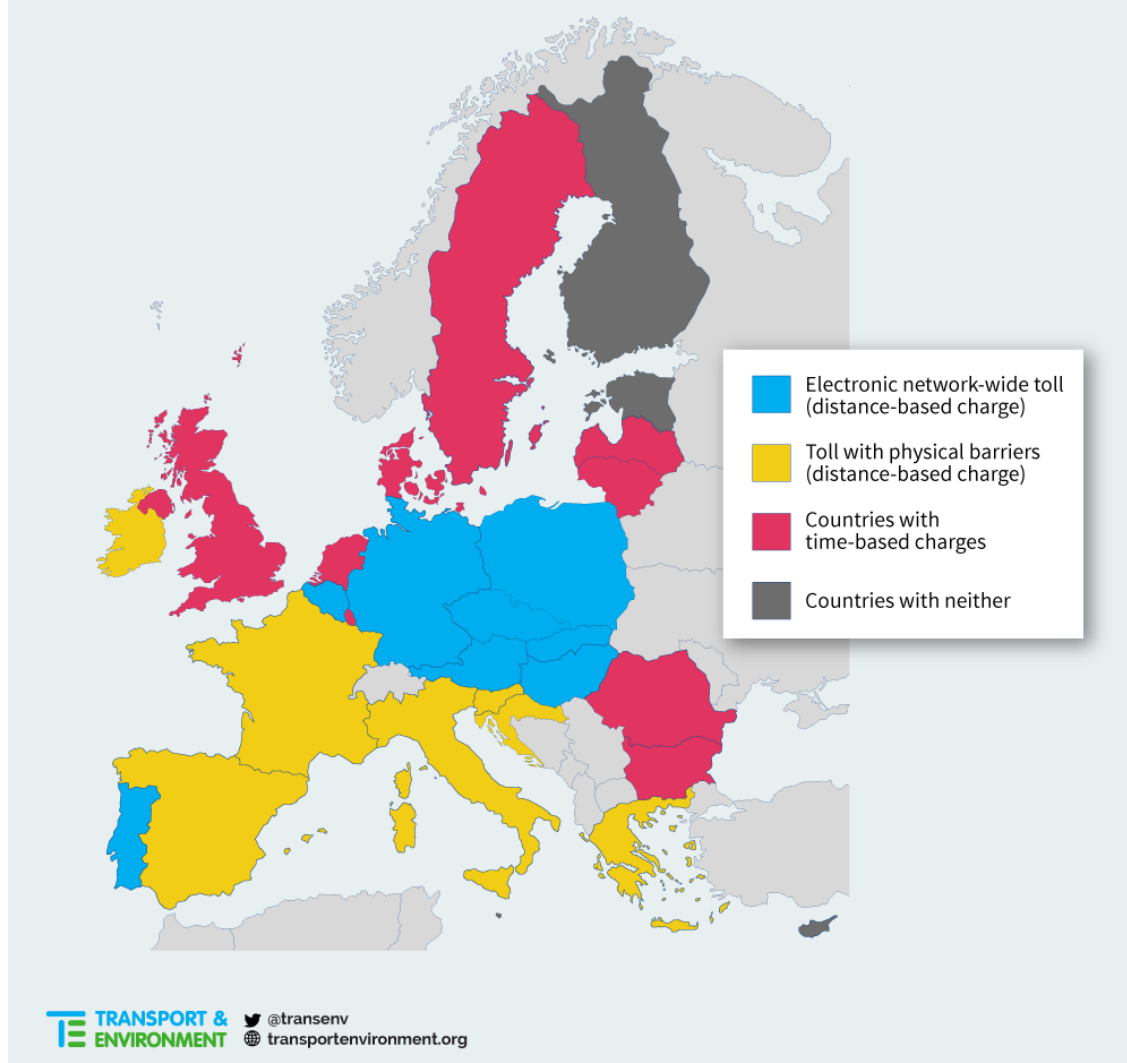
Trucks are responsible for approximately 25% of the CO<sub>2</sub> emissions from road transport. As was shown in Germany with regard to air pollution, tolls can be a useful tool for incentivising the purchase of cleaner vehicles. This German example relates to the differentiation of HGV tolls based on EURO class which was implemented in such a way whereby now 70% of road haulage is done by EURO V trucks. A similar system could be established for CO<sub>2</sub> that would have the same effect but on purchasing more fuel efficient vehicles/technologies.

The Commission should enable countries to **differentiate the tolls applied to HGVs based on CO<sub>2</sub> emissions.** This system could promote the purchasing of cleaner vehicles/technologies and this would reduce the CO<sub>2</sub> emissions from road haulage<sup>xvi</sup>.

#### **3.2. Phasing out time-based charging systems**

15 European countries have implemented national distance-based tolls for HGVs. Belgium is the most recent to adopt a km-based system in April 2016. The 13 countries left to adopt such a toll include the Netherlands and the UK. It is important to note that many of the countries that have distance based tolls have only physical barriers, which limits the country's road coverage and should be changed to network-wide tolls to better represent the damage done by HGVs.

## Charging of Heavy Goods Vehicles in the EU



AEA Ricardo<sup>xvii</sup> found that distance-based systems are a more sophisticated form of tolling HGVs than time-based. By definition, distance-based systems reflect better the true costs that HGVs impose on road infrastructure and on society in general. Additionally, “Revenues from vignettes are very low compared to those collected from distance-based charges”. Distance-based tolling also has a positive effect on air quality: for example, “[i]n Germany, the distance-based toll has led to Euro V trucks being used for the vast majority of mileage (70%) whereas in Sweden it is just half this level”. The Commission should phase-out inefficient time-based charging systems as the benefits of distance-based systems have shown that time-based systems are substandard as they fail to motivate behavior changes amongst HGV users. Distance-based tolls better reduce air pollution, secure more revenue for national governments, and incentivise more the efficient use of trucks.

### 3.3. Increasing the cap on air pollution & strengthening differentiation

Under the current Eurovignette directive, there are only two external costs (air pollution and noise) that can be charged for in addition to the infrastructure portion of the toll (which itself can be differentiated based on EURO class, weight and congestion). The Eurovignette directive allows a maximum charge of 2cts/km for a EURO VI truck on interurban roads from 2018 onwards. The progress in estimating the impacts of truck air pollution seems to warrant an increase of this maximum cap.



Apart from the need to increase the maximum permissible charge, there is also a need to increase the differentiation between EURO classes. As from 2018 the difference in toll, prescribed by the Eurovignette directive, between a EURO V and VI truck would be only 1 cent.

That gap should be widened in order to account for the fact that Euro VI is much better than EURO V when it comes to NO<sub>x</sub>, PM and PN emissions. Moreover, thanks to in-service testing EURO VI delivers not just on paper but also on the road.<sup>xviii</sup> The Commission should change the maximum 1 cent gap that will be implemented in 2017 to become significantly widened in order to enable countries to promote the purchase of Euro VI vehicles.

### 3.4. Phasing out voluntary charging for air pollution

The external costs recognised in the directive should become a mandatory portion of the toll. Currently, the majority of Member States do not have an external cost category to their tolls. Unlike differentiating tolls based on EURO class, which become mandatory in the 2006 review of the Eurovignette directive, the Commission decided in 2011 to make the external cost component of tolls voluntary. If the Commission were to phase-out this voluntary approach towards external costs and make them mandatory then the effect of road charging on externalities would significantly be increased.

According to AEA Ricardo, even after the maximum level was raised to 100% for differentiating the infrastructure portion of a toll based on EURO class, all Member States still apply charge differentiation significantly lower than this level. Given this approach taken by the Member States, the Commission must do more to reduce the air pollution from HGVS. The Commission should phase-out the voluntary nature of external cost categories. Mandatory external cost charging would make tolls a stronger tool in reducing externalities and would better reward clean choices taken by hauliers.

Accidents are an external cost that are not yet recognised in the Eurovignette Directive. In an AEA Ricardo study that was completed for the Commission in 2014, the consultancy researched a fair way to charge trucks for accidents. Accidents as an external cost would only cover costs that are outside of those included in insurance schemes. This means “the so called risk value as a proxy to estimate pain, grief and suffering caused by traffic accidents in monetary values”. The sheer weight of trucks means that accidents involving such vehicles often results in serious injuries or fatalities. Accidents should be added as an external cost in the upcoming review of the Directive as this could become a tool to incentivise safer vehicle design and better driver training.

## 4. Conclusions

HGVs are the cause of 143 billion euro in external costs. The charges which HGVs pay through fuel excise duties, infrastructure charges and vehicle taxes only account for 30% of these costs. This highlights the fact that the externalities from HGVs are far from being fully internalised in Europe. A detailed description of the methodology used to reach all of the figures used in this briefing can be found in the CE Delft (2015) report.

The upcoming review of the Eurovignette directive is an opportunity for tolls to become a better tool to account for these external costs. The Commission should enable Member States to differentiate tolls based on the fuel efficiency performance of vehicles as this would promote trucks with lower CO<sub>2</sub> emissions. This mechanism would work in a similar way as the existing differentiation based on EURO class, which has been shown to clean up the vehicle fleet in countries who properly apply it.

The Commission should also phase-out time based vignettes as they've been shown to be an ineffective method to toll roads. The further adoption by Member States of a **distance-based road charging system** would promote better logistic practices and could reduce the externalities from HGVs. Furthermore, the



Commission should make the external cost category of tolls a mandatory portion of truck tolls in Europe as this would better reward hauliers who make efforts to clean their fleet.

Only 30% of the external costs that HGV cause are currently covered through the taxes and charges that they pay. This highlights the fact that **more policy needs to be implemented in Europe in order to internalise the external costs of HGV transportation**. Measures to internalise such external costs, or to reduce these external costs, are dependent on the implementation of existing EU directives by member states, as well as new policy initiatives from the European Commission.

The updated CE Delft study (2015) highlights how more is needed in order to address the externalities of HGVs. The European Commission have an opportunity with the upcoming review of the Eurovignette directive. The Member States also have the potential to do more through the proper implementation of the existing directive. Both of these are needed in order to reduce the externalities of road transport.

Further information

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## Endnotes

<sup>i</sup> [http://europa.eu/rapid/press-release\\_IP-14-425\\_en.htm](http://europa.eu/rapid/press-release_IP-14-425_en.htm)

<sup>ii</sup> [http://ec.europa.eu/transport/modes/road/events/doc/2009\\_06\\_24/2009\\_gigaliners\\_workshop\\_acea.pdf](http://ec.europa.eu/transport/modes/road/events/doc/2009_06_24/2009_gigaliners_workshop_acea.pdf)

<sup>iii</sup> [http://www.transportenvironment.org/sites/te/files/publications/CO2%20differentiated%20road%20tolls\\_%20what%20the%20EU%20should%20do.pdf](http://www.transportenvironment.org/sites/te/files/publications/CO2%20differentiated%20road%20tolls_%20what%20the%20EU%20should%20do.pdf)

<sup>iv</sup> <http://www.eea.europa.eu/data-and-maps/data/data-viewers/air-emissions-viewer-lrtap>

<sup>v</sup> <http://www.eea.europa.eu/media/newsreleases/many-europeans-still-exposed-to-air-pollution-2015/premature-deaths-attributable-to-air-pollution-showing-how-72,000> premature deaths in the EU28 are caused by NO2 (NOx)

<sup>vi</sup> CE Delft, 2015. External and infrastructure costs of HGVs in the EU28 in 2013, Delft: CE Delft (For Transport & Environment)

<sup>vii</sup> CE Delft, 2016. Revenues from HGV taxes and charges in the EU28 in 2013. Addendum to 'External and infrastructure costs of HGVs in the EU28 in 2013', Delft: CE Delft (For Transport & Environment)

<sup>viii</sup> Directive 2011/76/EU of the European Parliament and of the Council of 27 September 2011 amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures Text with EEA relevance

<sup>ix</sup> CE Delft, 2015, p9.

<sup>x</sup> <http://www.eea.europa.eu/data-and-maps/data/data-viewers/air-emissions-viewer-lrtap>

<sup>xi</sup> NEEDS, 2008. Data file 'External Costs\_per\_unit\_emission\_080821.xls' related to Deliverable D1.1: Report on the procedure and data to generate averaged/aggregated data. In: New Energy Externalities Development for Sustainability (NEEDS). Stuttgart: IER, University of Stuttgart.

<sup>xii</sup> Ricardo-AEA; DIW econ: CAU, 2014. Update of the Handbook on external costs of transport, London: Ricardo-AEA.

<sup>xiii</sup> HEATCO, 2006. Deliverable D5: Proposal for Harmonised Guidelines. In: Developing Harmonised European Approaches for Transport Costing and Project Assessment (HEATCO). Stuttgart: IER, University of Stuttgart.

<sup>xiv</sup> Kuik, O., Brander, L. & Tol, R., 2009. Marginal abatement costs of greenhouse gas emissions: A meta-analysis. Energy Policy, 37(4), pp. 1395-1403.

<sup>xv</sup> WHO, 2011. Burden of disease from environmental noise: Quantification of healthy life years lost in Europe, Copenhagen: World Health Organization (WHO).

<sup>xvi</sup> CE Delft, 2015. CO2-differentiated road charges for HGVs, Delft: CE Delft (For Transport & Environment).

<sup>xvii</sup> AEA Ricardo, 2014. Evaluation of the implementation and effects of EU infrastructure charging policy since 1995, London: AEA Ricardo.

<sup>xviii</sup> ICCT, 2015. Accelerating progress from Euro 4/IV to Euro 6/VI vehicle emissions standards, Berlin: ICCT.