

The Role of Road Charging in Improving Transport

How road charging supports efforts to decarbonise the sector

September 2017

Summary

On 31 May 2017, the European Commission published its proposal to review the ‘Eurovignette’ Directive. The Directive defines how Member States of the European Union can charge vehicles for their use of road infrastructure and was conceived to ensure the proper functioning of the EU transport market. Transport accounts for around a quarter of EU GHG emissions. Meanwhile air pollution from road transport contributes to over 400,000 premature deaths per yearⁱ, 26,000 people die in traffic annually, and the EU economy loses €100 bn every year in congestionⁱⁱ. Road charging is a key instrument to tackle this.

First, distance-based tolls improve transport efficiency. If the cost of a journey is priced according to the trip’s length, road users will make sure that they are performing journeys as efficiently as possible (avoiding empty runs, ride/load sharing, using cleaner modes).

Second, tolls can be differentiated according to the environmental performance of vehicles. This is a very powerful tool to encourage the purchase and use of cleaner vehicles. For example, truck tolls have been instrumental in encouraging the use of EURO V and VI trucks on tolled roads. Environmental differentiation is currently focused on air pollution (EURO standards) but should be extended to incentivise lower CO₂ or zero emission vehicles. This is particularly important for trucks where very few incentives currently exist for zero emission technology.

Third, road charging will become an increasingly important fiscal instrument. As vehicles become increasingly efficient, and ultimately stop burning diesel and petrol, fuel tax revenues will fall. Road charging will be essential to make up for the loss in revenues, but also to manage transport demand and deal with congestion in a world with driverless, zero-emission vehicles.

The Commission proposal goes into the right direction. In particular T&E supports:

1. Mandatory CO₂ differentiation of road charges for all vehicles. In practice, this would mean **that a vehicle’s toll level would be based on its tailpipe carbon dioxide emissions as measured by the EU’s test procedures** (WLTP for cars and vans; VECTO for trucks). CO₂ differentiation for trucks would complement and gradually replace differentiation based on air pollution. For cars Euro class differentiation will continue to play a role but it must be based on Real Driving Emission test results and not on the discredited laboratory tests.
2. A 75% toll discount for all zero emission trucks across Europe. This financial incentive would encourage the purchase of zero emission trucks, which would help create a bigger market for zero emission vehicles. However, the incentive should be medium term and phased down once zero emission trucks achieve 20% of vehicle registrations.
3. The proposed phase-out of time-based vignettes for all road vehicles across Europe. Vignettes are discriminatory and ineffective. Once vignettes are phased out member states

will have the choice whether to evolve to distance based tolls or have no tolls at all. This is not the same as an obligation to introduce distance based tolls and is in line with the directive's original purpose: safeguard the proper functioning of the internal market.

In addition, the Commission's needs to be improved by the following steps:

1. Mandate minimum external cost charges across the entire tolled road network and increase the values provided in the annex to account for all external costs (and not only on certain sections of road and for certain external costs, **as suggested in the Commission's proposal**). Trucks only cover 30% of their external costsⁱⁱⁱ and should be charged to better internalise these external costs, influencing smarter purchase and use patterns.
2. Better separating cars and vans in the revision of the Eurovignette Directive so that all tolls for trucks that start from 3.5 tons must also apply to vans used to transport goods. Vans are increasingly used in freight transport as a means to bypass regulation attributable to trucks – this distortion must be addressed at EU level.

1. The Eurovignette Directive

1.1. Context

According to the latest data available from the European Environment Agency, the transport sector is the largest source of greenhouse gas emissions in Europe^{iv}. The European Commission's plans to tackle the problem of growing emissions from the sector were presented in *The European Strategy for Low Emission Mobility* in 2016 and reaffirmed in the “Europe on the Move” communication of 31 May 2017.

In the Low Emission Mobility Strategy, the Commission acknowledged that policies are needed on both the supply – what manufacturers offer to consumers - and demand side – the framework that influences how people buy and use vehicles. With regard to the supply-side, the Commission outlined plans to review CO2 emission regulations for new cars and vans and a proposal on a monitoring and reporting system for CO2 emissions from trucks and buses, as well as fuel efficiency standards for trucks in early 2018.

On the demand side, the Strategy indicated that “the Commission will revise the Directive on the charging for [trucks] (*Eurovignette*) to enable charging also on the basis of carbon dioxide differentiation, and extend **some of its principles to buses and coaches as well as passenger cars and vans**”. This CO2 differentiation mechanism is intended to increase the uptake of cleaner vehicles and improve the efficiency of transport. Such a holistic approach (supply and demand) will accelerate the transition to a cleaner transport sector.

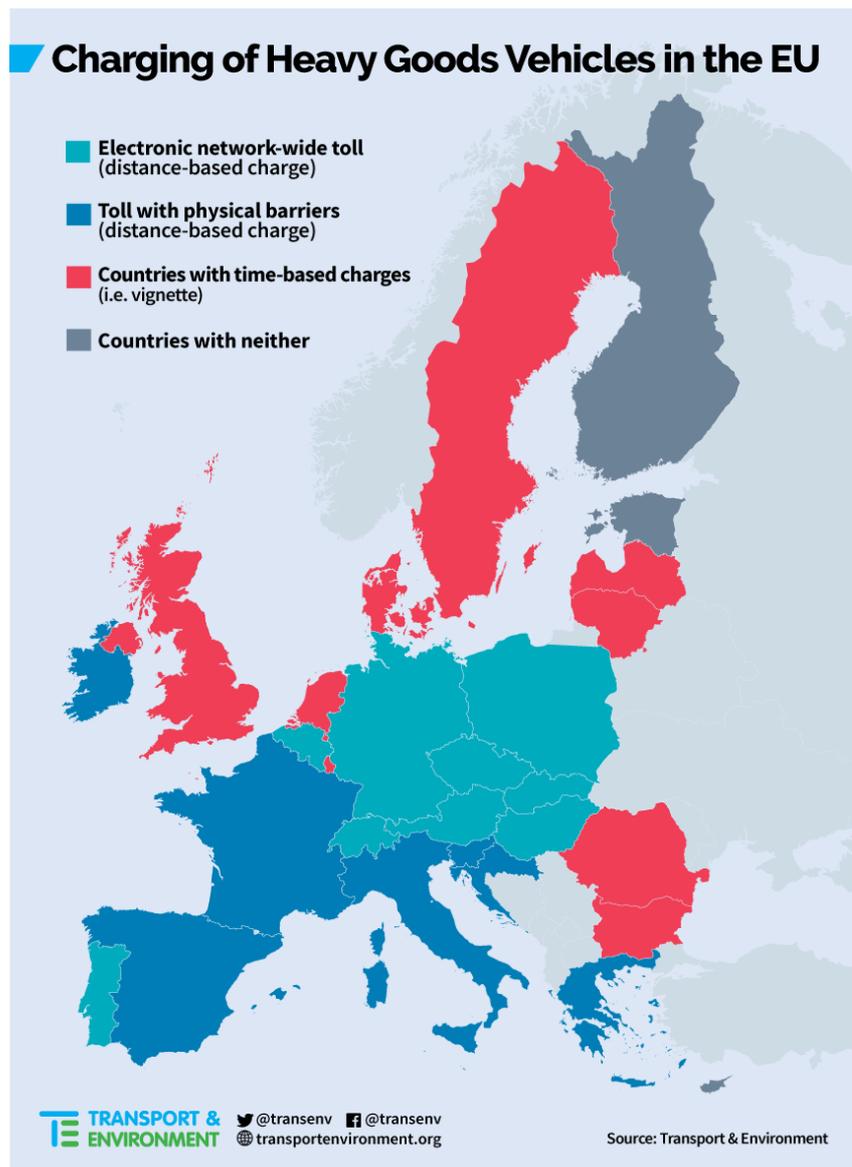
The Commission published its proposal to review the Eurovignette Directive on 31 May 2017. This proposal will now be discussed within the European Parliament, as well as by Member States within the Council. This legislative procedure will take over one year with a final piece of legislation expected in late 2018/early 2019.

Directive 1999/62/EC7 (the ‘Eurovignette’ Directive^{vi}) provides a detailed legal framework for charging heavy goods vehicles (HGVs or ‘trucks’) for the use of certain roads. Its initial purpose was to create a fair and coherent framework for charging across EU member states. The Directive has been revised twice since its inception (in 2006 and 2011). It currently only relates to trucks and no other road vehicle. The current framework allows for countries to apply either a distance-based or time-based road charging system if they choose to adopt such charges in their country. There is no obligation for EU Member States to establish any charging system but if they do decide to do so then countries must adhere to the Directive.

Distance-based charging is when a user pays for every kilometer they drive on roads where tolls apply. There are distance-based tolls that are electronic and automatic and there are distance-based systems that use physical barrier tolls. Time-based charging is when a user pays for a sticker (different durations are available) and is then free to drive as many kilometers as they wish within that time period.

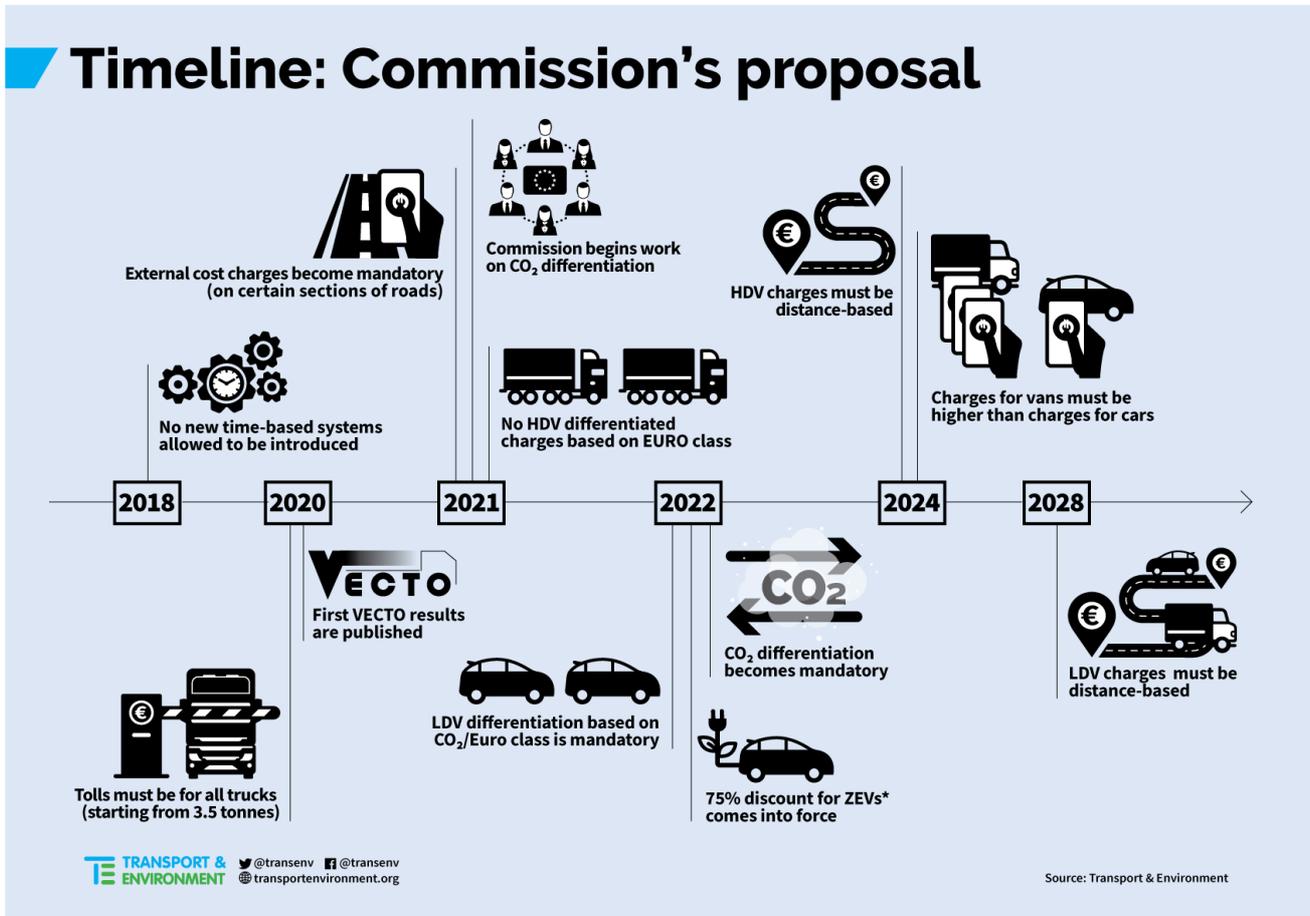
Member States that apply distance-based charges must differentiate such charges by infrastructure damage (based on vehicle weight/number of axles) and EURO emission class (linked to air quality performance). Additional to the aforementioned 'infrastructure' portion of the toll, member states can charge for air pollution and noise as 'external costs' since the 2011 revision. The price limits to which external cost charges may be set are defined in the annex. The Directive has never made explicit reference to CO2 emissions.

Light duty vehicles (cars and vans) are not within the scope of the existing version of the 'Eurovignette' Directive. With regard to these vehicles, the Commission has only taken an approach that non-discrimination and the principle of proportionality (with regard to vignettes) should be respected. There has never been an EU legal framework for cars, vans or buses/coaches. But the proliferation of sticker systems, and in particular the German PKW-Maut, have forced the issue onto the EU agenda.



15 countries have some form of distance-based charging in place for trucks whereas only 8 countries have distance-based charging in place for cars and these only apply to a small percentage of the road network. Estonia and Finland are both planning to introduce a time-based system for trucks in the coming years, which would only leave Malta and Cyprus as the Member States with no system in place for either trucks or cars.

1.2. The Commission's Proposal



In an attempt to reduce emissions from road transport, the Directive proposes to differentiate charges based on CO₂ emissions from vehicles. For trucks, the methodology will be defined in a Delegated Act expected in 2020. The basic concept is to charge trucks that emit more CO₂ than average a higher price per kilometer than trucks that emit less CO₂. The CO₂-related element of the toll will be based on VECTO^{vii} measurements – a procedure developed jointly by the Commission and industry. Under the proposal, all Member States would have to apply CO₂ differentiation to tolls within a year of the methodology being defined. CO₂ differentiation for light duty vehicle (i.e. cars and vans) will be based on the vehicle's CO₂ emissions as measured on the EU's test procedures.

Furthermore, a 75% discount for zero emission vehicles is proposed in order to promote the adoption of such vehicles with no tailpipe emissions. This discount would be 75% less than the highest infrastructure charge (per vehicle class) and would apply to all road vehicles. MAN, Daimler, Siemens, and Tesla (to name a few examples) are all developing zero emission trucks that could benefit from such toll discounts. A 75% discount is intended to increase the uptake of such vehicles and should come into immediate effect.

The proposal phases out time-based systems for trucks by 2024. This would mean that countries with time-based systems would need to change their road charging before the end of 2023. Distance-based systems have long been promoted by the Commission as a means to promote more efficient transport behaviour and generate more revenue than time-based systems for Member States. Time-based systems for cars and vans would need to end by 2028.

The proposal includes cars and vans for the first time with the intention to differentiate charges based on both air pollution and CO₂ emissions. The 75% discount for zero emission vehicles also extends to cars

and vans in an attempt to boost market uptake. Electric, shared and autonomous vehicles will considerably decrease driving costs, make driving more attractive and, without accompanying measures, could lead to an increase in kilometers travelled. Road charging based on distance can effectively manage increasing demand for driving.

EURO class differentiation is proposed to be phased out for trucks because, according to the Commission, it **will become “obsolete” by 2020. This is replaced by** external costs being made mandatory for countries that have distance-based systems **on certain sections of the road network “where environmental damage generated by heavy duty vehicles is higher than the average environmental damage generated by heavy duty vehicles”**. The deadline for applying such an external cost charge is 2021.

Although both heavy duty vehicles (trucks and buses) and light duty vehicles (cars and vans) are covered **within the Commission’s proposal, they are separated with regard to how charges should be set, the method for differentiating toll levels, and the phase-out periods for vignettes.**

2. Role of Road Charging in Reducing Transport’s Environmental Impact

Tolls can contribute to reducing CO2 emissions from transport. They can also play a role in reducing air pollution. This can be done by pricing transport at a level that promotes efficient behaviour while maintaining mobility demand.

2.1. Promote Better Transport Behaviour

Time-based vignettes do not reflect actual road use as users can drive as much as they want within the period that they pay for. Therefore, they are insufficient tools if a country intends to use the toll to influence the efficiency of transport. Distance-based charges are proportional to road use and are far better at improving transport behavior.

Since the introduction of the toll in Germany, distances per tons entered a stable state and started to decline after the onset of the world economic crisis in 2009. It is impossible to separate the impact of the financial crisis and the impact of tolls on this decline. However, if you compare the distances in Germany with France and Italy then you can see that it seems that there is an impact of tolls on distances travelled^{viii}, and thus on logistics efficiency. Furthermore, the introduction of the LKW Maut has contributed to further decreasing the share of empty headings in Germany by 1% to 2%.

Distance-based charging can influence whether trucks are fully or only partly loaded whereas the same user could more easily afford to operate a truck empty in a time-based system. One in every four trucks drives empty in Europe today^{ix}. Distance-based tolls promote logistic efficiency. Time-based systems should, **therefore, be phased out for trucks. This is included in the Commission’s proposal.**

Distance-based systems also remove the potential for charges to be discriminatory as the occasional or foreign user will be charged the same as a frequent or local user as both pay for each km they drive. It is a fair means of charging transport.

Although vans are mentioned in the Directive, they are not sufficiently made to account for their increased use in freight transport. Vans are increasingly being used as a means to bypass social and market regulation for trucks. The trade union that represents transport workers in Belgium announced on the one **year anniversary of the Belgian road toll that** “a year after the introduction of the toll for vehicles over 3.5 tonnes in Belgium, transport shows a marked increase in the number of vans on the road^x”. According to EEA data^{xi}, almost 22.3% of vans registered in 2015 had a maximum permissible laden weight

of 3.4 - 3.5 tonnes, a 17% increase from 2013). Considering 'light trucks' begin from 3.5 tonnes, it's clear large vans are essentially being used as substitutes.

The Eurovignette Directive should ensure that countries are applying tolls on large vans that are used for the purpose of professional freight transport. The inclusion of vans within distance-based tolls would promote the efficient use of such vehicles, as well as cleaner vehicles.

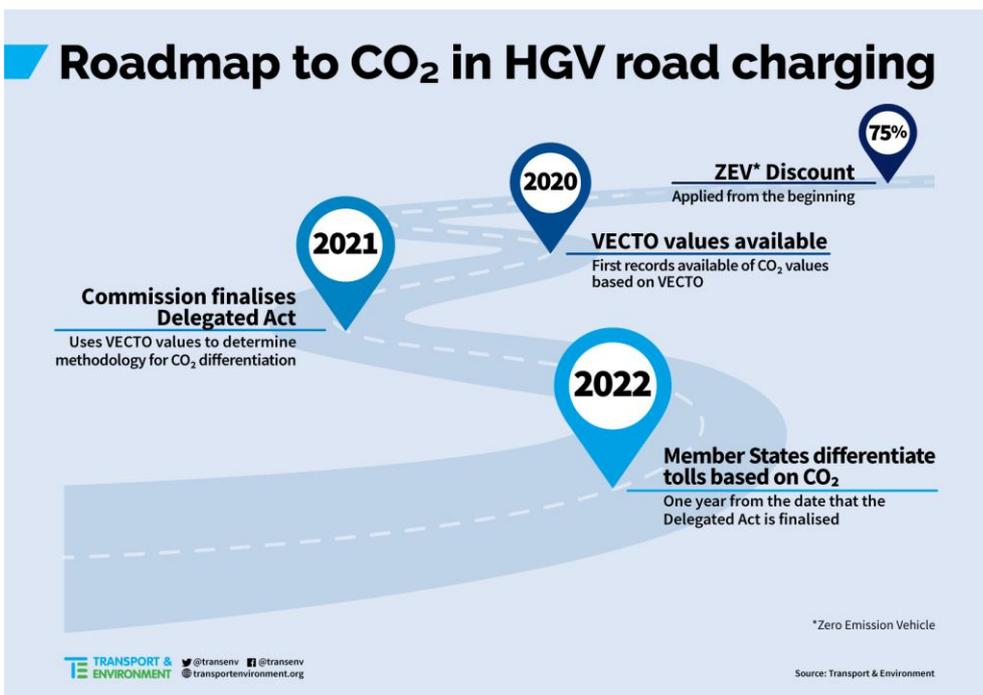
Distance-based charging should also apply to passenger cars^{xii}. Distance-based charging for all vehicles is complementary to fuel taxation. Fuel tax revenue is set to decrease by as much as €57 billion by 2030 due to more efficient cars and electric cars on the road^{xiii}. Distance-based tolls could encourage efficient and clean transport behaviour while generating income for the public budget.

2.2. Reducing Transport's External Costs

In Europe, trucks cause €143 bn in external costs every year. According to CE Delft, only 30% of such costs are internalised through the taxes and charges that the user/polluter pays^{xiv}.

Road haulage is between 25-30%^{xv} of road transport's CO₂ emissions and this share is only set to increase in the coming years. CO₂ emissions from road freight are on-track to rise by 4-10% by 2030 compared to 2010 while a further increase of between 17-40% is expected by 2050^{xvi}.

Differentiating charges based on CO₂ emissions provides a constant reminder for users that they could be saving money if driving a more fuel efficient vehicle. This would promote the purchase of a cleaner model when users buy a new vehicle. This is especially true for trucks where operational costs are so integral to the success of a haulage business. This mechanism would play a role in reducing emissions from road haulage.

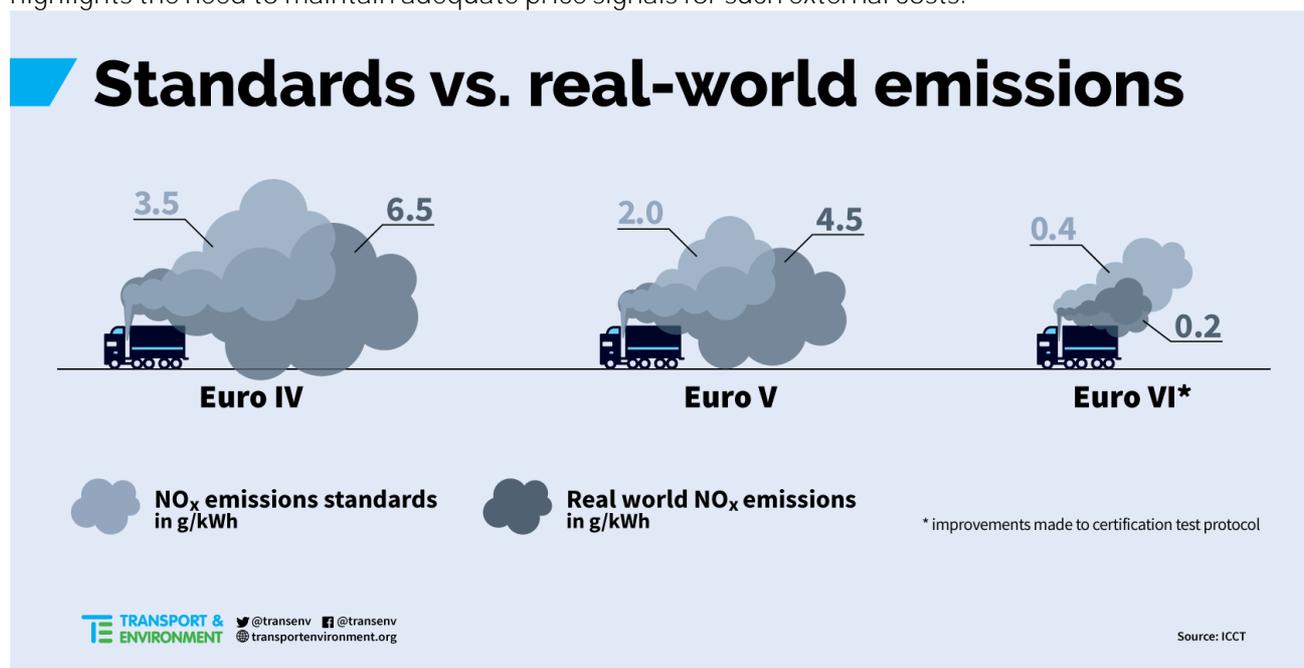


Given the global nature of climate change, it's important that Europe promotes EU-wide methods to reduce CO₂ emissions. Mandating CO₂ differentiation ensures that all Member States are applying the same mechanism to promote the reduction of emissions from road transport. It would also ensure that tolling plays its optimal role in countries meeting their climate targets.

Tolls differentiated by EURO class have had a significant impact in Germany on the truck fleet and vehicle use. TML^{xvii} provide figures on truck use in Belgium by Euro emission standard for the year 2014, which is before Belgium introduced a toll. In Belgium, 27.6% of truck kilometers were performed by Euro V and 16.5% by Euro VI vehicles. In Comparison, the share of truck kilometers in Germany performed by Euro V and Euro VI vehicles is about 90%^{xviii}. This indicates a

strong impact of the German toll on the use of cleaner trucks. Toll differentiation played an important role in the uptake of less polluting vehicles in Germany. Such fleet renewal has a positive impact on air quality. Germany introduced such differentiation in 2007 ahead of the 2010 deadline when it became mandatory for countries with distance-based systems under EU law.

Germany groups together EURO V and VI vehicles, which means that there is no differentiation regarding charges between these vehicles. Austria is the only country that distinguishes between both^{xix} and charges EURO V trucks a higher toll than EURO VI. This lack of differentiation across Europe restricts the uptake rate of EURO VI vehicles, which are significantly cleaner than EURO V. The ICCT tested real world emissions from both classes of truck and found that, in real world conditions, EURO V emits 4.5 grams of NO_x per kWh whereas EURO VI only emits 0.2 grams of NO_x. NO_x emissions are the cause of serious health impacts. According to the EEA, 400,000 premature deaths come annually as the result of air pollution. This highlights the need to maintain adequate price signals for such external costs.



Price signals for purchasing less polluting vehicles must be maintained in tolls post-2020. This can be done by mandating the external cost element as defined in the Commission’s proposal **but** extending it to apply to the entire road network **and transforming the reference values provided in the Commission’s proposal into required minimum values**. A toll for trucks that accounts for air pollution is far from obsolete in most European countries. To say otherwise undermines the air quality problems in many European countries and overestimates the fleet composition.

Furthermore, applying a harmonious means of tolling for external costs across the entire tolled network makes it administratively and technically easier to implement tolling. To start varying air pollution charges based on location requires new infrastructure and administration to determine the kilometers performed on the relevant sections of road.

The reference values in the annex of the Commission proposal for external costs (i.e. air pollution and noise) are based on the external cost values that are calculated in the External Cost Handbook that was developed for the Commission^{xx}. **If we consider that there are more external costs from trucks that aren’t included in the Commission’s proposal (e.g. upstream emissions and accidents) then the external costs must be extended to such externalities and the values must be readjusted accordingly.** CE Delft found that trucks are the result of €143 billion in external costs in 2013^{xxi}. All toll revenue across Europe today (for HDVs) fails even to generate 10% of this amount^{xxii} (the figure increases to 30% if you include revenue from fuel and

vehicle taxes). This highlights how far away we are from the Commission's target of adopting the polluter and user pays principles.

Tolls that incentivise cleaner vehicles are needed for passenger cars and vans, as well as trucks. Air pollution could be addressed through tolls and, additionally, the uptake of more efficient and cleaner vehicles can be promoted through differentiated charges. However, due respect needs to be paid to the fact that real world emissions have been found to far exceed the levels recorded in lab-based tests. Therefore, Member States should not be restricted from using technologies to base LDV tolls on real world emissions rather than being reliant on the vehicle class.

2.3. Road Charging Can Promote Zero Emission Trucks

The uptake of zero emission vehicles is not happening at a rate sufficient to reach our climate targets. Electric vehicles could make up 5% of new car sales in 2020, 15% in 2025, and 40% in 2030. This scenario would mean about 30 million electric cars on EU roads by 2030 (to put that into context, there are some 291 million vehicles on Europe's roads today^{xxiii}). Current new car sales for electric vehicles are about 1%. The uptake could be accelerated through toll discounts, as the Commission proposal provides. A 75% discount at the toll could drive market uptake, which would have benefits for air quality and in mitigating climate change. The discount would be 75% lower than the highest infrastructure charge. This discount should come into immediate effect as from the finalisation of the Directive. There is no need to wait for the Delegated Act that will define the methodology for CO2 differentiation in order for this discount to come into effect.

“Since the total cost of ownership of a zero-emission HDV is still 2 to 3 times that of a conventional diesel, even complete exemption from charges could be justified for these vehicles”^{xxiv}. This discount is especially needed for the Heavy Duty Vehicle segment where zero emission vehicles are virtually non-existent on European roads even though vehicle manufacturers are beginning to produce them. MAN and Daimler both have electric trucks in limited production, Tesla is launching an electric semi-trailer in Sept/Oct 2017, and Siemens is developing a catenary wire system for long-distance electric freight. Several truck makers have also announced they are developing hydrogen trucks. In addition to modal shift, these vehicles are needed to reduce freight emissions. In order to encourage their use, a strong incentive is needed via the toll.

The proposed 75% discount should no longer be mandatory once ZEVs reach 20% of vehicle registrations in a Member State. Member States should be given the possibility to maintain the discount once the 20% share has been reached but it would no longer be a legal requirement. This would ensure fair and efficient pricing.

3. The Impact of Road Charging on the Public Budget

3.1. Cost of Infrastructure

The development of a road charging system carries significant investment costs. However, the potential revenue would largely outweigh these infrastructure (and administrative) costs if the state receives the toll revenue.

Costs to authorities include the deployment of new tolling systems or expanding existing ones for the Member States concerned (one-off investment of €1.2-1.4 billion altogether), and operating costs of €168-200 million/year.

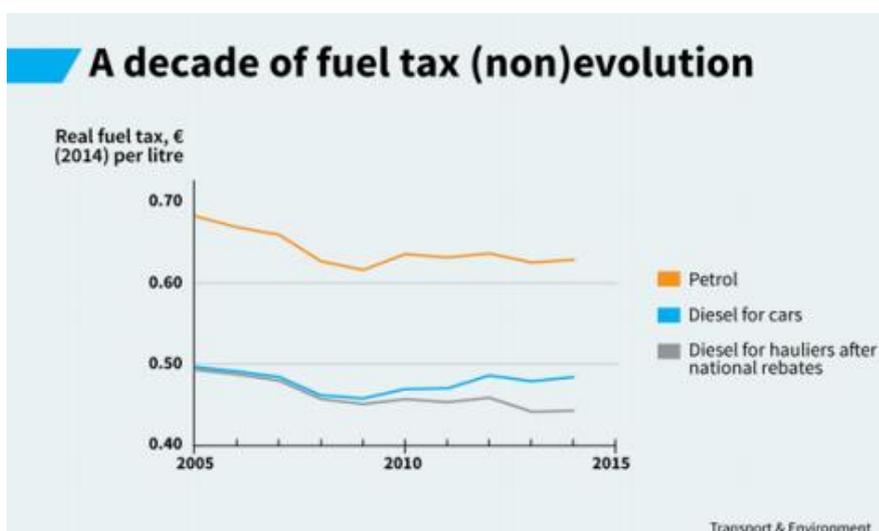
The public sector will benefit from additional revenues, which come at the above cost of investment in the deployment and operation of new electronic tolling systems. The net impact on Member State budgets could amount to **between €39-102 billion per year^{xxv}.**

The net impact referred to above is based on a comparison of the total costs and revenues of the toll system. It does not take into account an additional issue – the coming drop in taxes from traditional motoring – which we address below.

3.2. Revenue from Fuel Taxes Set to Decline

The Commission’s own Impact Assessment on the Eurovignette Directive foresees a 9% drop in fuel tax revenue by 2030 (compared with 2010) with a further 8% decrease expected by 2050 (i.e. total decrease is 17% by 2050).

T&E’s own calculation found that fuel tax revenue in Europe could be €40 billion lower in 2030 compared with 2010, and this is considering a business-as-usual scenario^{xxvi}. If more stringent standards are implemented by 2030 (as are required to achieve EU’s climate targets^{xxvii}), this will imply a further €17 billion in losses by 2030 (compared with a business-as-usual scenario)^{xxviii}.



Across the EU diesel fuel was taxed at, on average, 14 cent less per litre than petrol in 2014. Diesel used by trucks is taxed even more lightly. Trucks pay on average €0.44/l diesel tax in the EU now, €0.04 below the rate cars pay and 15% below the inflation-corrected €0.52/l they paid in 2000. Additionally 10 countries now tax truck diesel at or close to the EU minimum rate of 33 cent per litre. Truck owners received a €4.5 billion rebate in 2014 on diesel fuel tax.

National governments have been reluctant to raise fuel taxes to effectively mitigate road transport’s effects on the public and environment. For trucks this is partially related to the issue of fuel tourism (i.e. truckers filling up e.g. in Luxemburg). In its 2015 study^{xxix}, T&E showed that in real terms fuel taxes have decreased over the years. In 2014, the average road fuel tax paid by both motorists and hauliers, excluding VAT, was €0.52 which, corrected for inflation, is 20% below the 2000 level of €0.64/l. This finding can be explained by: inflation eroding nominal tax rates, a shift from petrol to lower-tax diesel fuel, and diesel tax rebates for trucks that have been introduced by eight countries over the past 15 years.

3.3. Potential Revenue and Economic Impacts of Road Charging

Considering the drop in fuel tax revenues, distance-based road charging could become a more widespread means of charging transport. As noted above, distance-based charges also promote smarter transport behavior.

Fuel taxes should still be increased and the EU minimum excise duties should be increased. However, it needs to be acknowledged that the take-up of zero emission vehicles will necessarily see a drop in such revenue.

For distance-based road charging, the revenue is dependent on the vehicles covered by the tolling system, as well as the levels of such tolls. The expansive distance-based system for trucks in Germany (known as the ‘LKW Maut’) is currently one of the main sources of the Transport Ministry’s budget at roughly €4 billion annually (after toll system costs). The Commission’s own impact assessment^{xxx} finds that the potential

revenue from distance-based charging could range between €39-102 billion depending on the percentage of the network tolled and the vehicles that fall within the scope. How the revenue generated from tolling is spent is rightly left to Member States.

T&E commissioned a study in 2016 on the Economic Impact of Road Charging^{xxx} that found tolls have no considerable impact on consumer prices. For Germany, studies estimate a share of transport costs at production costs between 2% and 3%. Thus, an increase of toll costs that would lead to an increase of transport costs by 15% would only impact the overall product costs by 0.5% on average. Therefore, the impact of the toll on actual product prices is so small that aggregated statistics cannot show an effect.

In the past decade, long distance transport has shown the lowest price increase (11%) in comparison with other transport services. Cost pressure is high in this market sector and aggressive competition lowers the prices. According to the German Trucking Association, the price of operating a truck in Germany is around **€1 per vehicle-km** (including driver, vehicle and fuel). The German toll is approximately 10% of this cost. Hauliers can pass on the majority of tolls for loaded headings to shippers and forwarders, the resulting cost increase remaining with the trucking business is 2% to 5%^{xxxii}. The recent one year anniversary of the Belgian road toll showed how the haulage companies have not been unduly impacted by the toll. Transport & Logistics Flanders reported that 85% of toll costs are passed onto clients^{xxxiii}.

4. Conclusions

The transition to low emission mobility will require changes to transport behaviour and vehicle design. Both require EU-wide policy in order for climate targets to be reached and for the transport sector to have a lesser effect on human health and climate change.

Coupled with other measures at EU and national level, distance-based charging is an effective means to positively influence how people and goods move throughout Europe. Road charging is a means to promote smarter transport behaviour and increase the rate of cleaner vehicle uptake.

First, distance based tolls improve transport efficiency. If the cost of a journey is priced according to the **trip's length, road users will make sure that** they are performing journeys as efficiently as possible (avoiding empty runs, ride/load sharing, using cleaner modes).

Second, tolls can be differentiated according to the environmental performance of vehicles. This is a very powerful tool to encourage the purchase and use of cleaner vehicles. For example, truck tolls have been instrumental in encouraging the use of EURO V-VI trucks on tolled roads. Environmental differentiation is currently focused on air pollution (EURO standards) but should be extended to incentivise lower CO₂ or zero emission vehicles. This is particularly important for trucks where very few incentives currently exist for zero emission technology.

Third, road charging will become an increasingly important fiscal instrument. As vehicles become increasingly efficient, and ultimately stop burning diesel and petrol, fuel tax revenues will fall. Road charging will be essential to make up for the loss in revenues, but also to manage transport demand and deal with congestion in a world with driverless, zero-emission vehicles.

T&E's key asks for the revision of the Eurovignette directive are below. While the first three are already contained in the proposed revision, ongoing support through the legislative process will likely be required:

1. Introduce mandatory CO₂ differentiation of road charges for all vehicles. In practice, this would mean that a vehicle's toll level would be based on its tank-to-wheel emissions.

2. Introduce a 75% toll discount for all zero emission vehicles across Europe. This financial incentive would encourage the purchase of zero emission vehicles, which would have a beneficial impact on reducing emissions from the transport sector.
3. Phase-out time-based vignettes for all road vehicles across Europe. Distance-based systems are a far more effective means of positively influencing transport behaviour.

It's necessary to amend the Commission's proposal to:

4. Mandate the external cost charge across the entire road network - not only on certain sections of road, as suggested in the Commission's **proposal** - and recalculate the reference values to make them minimum and mandatory values. Trucks only cover 30% of their external costs and should be better charged in accordance with their external costs.
5. Better separate cars and vans in the revision of the Eurovignette Directive so that all tolls for trucks that start from 3.5 tons also apply to large vans used in transport. Large vans are increasingly used to transport freight in order to bypass regulation attributable to trucks – this loophole must be addressed.

Further information

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Endnotes

ⁱ <https://www.eea.europa.eu/media/newsreleases/many-europeans-still-exposed-to-air-pollution-2015/premature-deaths-attributable-to-air-pollution>

ⁱⁱ https://ec.europa.eu/transport/media/news/2016-09-16-european-mobility-week_en

ⁱⁱⁱ <https://www.transportenvironment.org/publications/are-trucks-taking-their-toll-ii>

^{iv} <https://www.transportenvironment.org/press/transport-now-europe%E2%80%99s-biggest-climate-problem-eea-data>

^v COM(2016) 501 final: A European Strategy for Low-Emission Mobility

^{vi} Directive 1999/62/EC of the European Parliament and of the Council of 17 June 1999 on the charging of heavy goods vehicles for the use of certain infrastructures, OJ L 187, 20.7.1999, p. 42–50

^{vii} The European Commission is developing the Vehicle Energy Consumption Calculation Tool (VECTO) for Heavy Duty Vehicle CO₂ certification purposes. VECTO is a vehicle simulation tool tailored to estimate CO₂ emissions from heavy-duty vehicles of different categories, sizes and technologies.

^{viii} https://www.transportenvironment.org/sites/te/files/publications/2017_04_road_tolls_report.pdf

^{ix} http://europa.eu/rapid/press-release_IP-14-425_en.htm

^x De Morgen, Fors meer bestelwagens na invoering kilometerheffing voor vrachtwagens, 29 March 2017

^{xi} <https://www.eea.europa.eu/publications/monitoring-co-2-emissions-from>

^{xii} <https://www.transportenvironment.org/publications/road-charging-cars-what-european-commission-should-do>

^{xiii} <https://www.transportenvironment.org/publications/road-charging-cars-what-european-commission-should-do>

^{xiv}

https://www.transportenvironment.org/sites/te/files/publications/2016_03_briefing_Are_trucks_taking_their_toll_II_FINAL.pdf

^{xv} EEA, 2016

^{xvi} Figures based on the European Commission Impact Assessment for Eurovignette, as well as T&E's "Roadmap to climate-friendly land freight and buses in Europe", available at https://www.transportenvironment.org/sites/te/files/publications/2017_06_Roadmap_climate-friendly_road_freight_buses_Europe_2050_final.pdf

^{xvii} TML (2015): Inschatting van de impact van de kilometerheffing voor vrachtovervoer op de voedingsindustrie. Transport & Mobility Leuven.

^{xviii} BAG (2016): Marktbeobachtung Güterverkehr. Bericht Herbst 2015. Bundesamt für Güterverkehr (Federal Office for Freight Transport). Wiesbaden.

xix Figure 10-2 here http://eur-lex.europa.eu/resource.html?uri=cellar:5599cc43-462b-11e7-aea8-01aa75ed71a1.0001.02/DOC_1&format=PDF

xx <https://ec.europa.eu/transport/sites/transport/files/themes/sustainable/studies/doc/2014-handbook-external-costs-transport.pdf>

xxi

https://www.transportenvironment.org/sites/te/files/publications/2016_03_briefing_Are_trucks_taking_their_toll_II_FINAL.pdf

xxii Approximately 13 billion euro is collected from tolls across Europe each year

https://www.transportenvironment.org/sites/te/files/publications/CE_Delft_4D64_External_and_infrastructure_costs_of_HGVs_FINAL.pdf

xxiii <http://www.acea.be/statistics/tag/category/vehicles-in-use>

xxiv European Commission, Annex 11 to the Impact Assessment on Eurovignette (31 May 2017), Brussels.

xxv European Commission, Impact Assessment on Eurovignette (31 May 2017), Brussels.

xxvi Fuel tax revenue losses are estimated based on the level of CO₂ emissions in 2010 and 2030, taken from the European Commission's 2030 reference scenario. Contribution of cars to the emissions level is based on their share of total energy demand in transport. Contribution of vans is assumed to be neutral: use of vans will increase between 2010 and 2030 but they are also expected to become more efficient – the two effects are considered to offset each other. A further split must be done between petrol and diesel vehicles because the tax rate of the two fuels is different (rate used is weighted average for EU28 in 2014 euros for 2030, assumed to be stable in the period analysed - based on T&E's fuel tax report). It's assumed that vans consume only diesel. Cars use both fuels, and the split is based on the Commission's reference scenario for 2010 and 2030 (energy consumption shares by fuel type are converted to fuel consumption shares). Emission factors to convert CO₂ emissions into fuel consumption are retrieved from DEFRA (a weighted emission factor is used for cars).

xxvii T&E's Road to 2030: how EU vehicle efficiency standards help member states meet climate targets :

http://www.transportenvironment.org/sites/te/files/2015%2006%20ESD%20Paper_June.pdf

xxviii The estimation method is similar to the one described in endnote 10. Additional CO₂ reductions in 2030 are based on new CO₂ standards for cars and vans (70gCO₂/km for cars and 100gCO₂/km for vans in 2025, and 55gCO₂/km for cars and 70gCO₂/km for vans in 2030, see T&E's Road to 2030 paper for more information –

https://www.transportenvironment.org/sites/te/files/2015%2006%20ESD%20Paper_June.pdf).

xxix T&E's Europe Tax Deals for Diesel See

https://www.transportenvironment.org/sites/te/files/publications/2015_10_Europes_tax_deals_for_diesel_FINAL.pdf

xxx European Commission, Impact Assessment on Eurovignette (31 May 2017), Brussels.

xxxi Fraunhofer ISI and Universidad Politécnica de Madrid, Economic impact of introducing road charging for Heavy Goods Vehicles (2016) see https://www.transportenvironment.org/sites/te/files/publications/2017_04_road_tolls_report.pdf

xxxii https://www.transportenvironment.org/sites/te/files/publications/2017_04_road_tolls_report.pdf

xxxiii <http://www.transportenlogistiekvlaanderen.be/nl/publicaties/persberichten/1-jaar-kilometerheffing-transporteurs-rekenen-meer-door-dan-verwacht-kl>