Vision Paper: The future of transport in the EU
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The future of transport in the EU

- Transport in the EU today

- 94% transport is fuelled by oil refined liquid fuels

- GHG emissions from transport

- Urban air quality - impact of pollutants emissions from transport

- FuelsEurope post-2020 transport policy proposal
Transport in the EU today

Transport performs a fundamental service to society, offering the ability to move goods, people and services. Affordable mobility is a key contributor to the quality of life of European citizens and is intrinsically linked to economic growth.

IN 2014, TRANSPORT SERVICES 1 IN THE EU ACCOUNTED FOR ABOUT € 696 BILLION 5% EU GROSS DOMESTIC PRODUCTION

MORE THAN 15 MILLION 2 PEOPLE EMPLOYED

37.6 MILLION HEAVY DUTY VEHICLES

36000 Planes

877 MILLION 5 PASSENGERS

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1 European Commission, Joint Research Centre, Transport sector economic analysis, 2016
3 ACEA, Automobile Industry Pocket Guide 2015-2016
4 Eurostat, EU-28 total number of passengers carried in Europe (arrivals plus departures) in 2014
5 Eurostat, EU-28 total number of passengers carried in Europe (arrivals plus departures) in 2014
93000 SHIPS

= 4.3 BILLION TONNES FREIGHT HANDLED AND TRANSPORTED

FUELLED AT 94% BY OIL REFINED PRODUCTS

€ 270 BILLION TAXES

1 ACEA, Automobile Industry Pocket Guide 2015-2016
2 Eurostat, EU-28 gross weight of seaborne goods handled in ports (goods unloaded from vessels plus goods loaded onto vessels in 2014)
3 European Commission, Communication “A European Strategy for Low-Emission Mobility, 2016”
94% of the transport sector is fuelled by oil refined liquid fuels
Since their first appearance on the scene more than one century ago, liquid petroleum fuels have marked a milestone in the history of transport, creating the conditions for an unprecedented step change in performance and affordability of transport on land, sea and in the air. While alternative technologies are increasingly used in transport, refined petroleum fuels are - and will remain for many years - the prominent energy source, due to a combination of factors such as superior energy density, easier transportability/storability, established infrastructure and comparatively lower cost.

The main societal challenges facing the continued use of petroleum liquid fuels are twofold; the pressure to reduce GHG emissions and for transport to play its part, and also the need to meet air quality standards, in particular in urban areas.

Liquid fuels: a success story with challenges
Transport is a contributor to GHG emissions. All transport fuels and energy will produce GHGs to a varying extent based on the emissions generated during their life cycle. Transport GHG emissions in the EU are however already on a reducing trend as a consequence of vehicle efficiency which has been achieving significant improvements, including through contributions of high-performance petroleum-derived fuels.

GHG EMISSIONS BY SECTOR IN THE EU

- 30% Energy Industries
- 20% Transport
- 16% Other Sectors
- 11% Manufacturing Industries and Construction
- 10% Agriculture
- 8% Industrial Processes and Product Use
- 3% Waste Management
- 2% Fugitive Emissions from Fuels

\[^4\]Emissions from international bunkers and multilateral operations are not included in total emissions (They are not covered by the reduction targets under the Kyoto Protocol).

Source: European Environment Agency
Data for year 2013
Updated: 1 December 2015

The potential for further increases in the carbon efficiency of Internal Combustion Engines (ICE) is far from being exhausted. In combination to improvements in the motor itself, the oil industry is continuously investing in R&D for ever more efficient fuels and ever lower friction lubricants. Further improvements in these technologies, in addition to vehicle fleet renewal, and smarter mobility behavior will deliver further reductions in GHG emissions.

Beyond efficiency measures, further reducing the GHG intensity of transport will require substitution of petroleum, with either biofuels, biogas, hydrogen, LPG, natural gas or electrification. The electrification of transport can take many forms starting with hybridization, e-bikes and small vehicles, but substantial replacement of petroleum fuels in light transport will require extensive use of large batteries. Of particular concern are the high costs of GHG emission reduction through electrification using large batteries.
THE RANGE OF EU ETS PRICE FORECASTS TO 2030 IS SIGNIFICANTLY LOWER THAN ABATEMENT COSTS ASSOCIATED WITH TRANSPORT MEASURES

Note: Bars represent ranges of estimates based on the foregoing analysis; as a result, our conclusions incorporate sensitivities to the extremes of these estimates. EUA Price forecast range based on Carbon Pulse 2015. Ranges for petrol ICE emissions targets costs are based on the low fuel price scenario outlined above. Biofuel policy cost ranges are for the UK and Germany only; range based on variation in 2016 fuel prices. EV MAC and policy costs are for full battery EVs.

Source: Vivid Economics

* Biofuels marginal abatement cost
EUA Price Forecast Range 2016-30

Petrol ICE Emissions Targets

Biofuels MAC* Biofuel Policy Costs

Short Range EV MAC Short Range EV Policy Costs Long Range EV MAC Long Range EV Policy Costs
There have been many measures targeting air pollution in the last 10 years, including among others changes in fuels and vehicle regulation, and there have been significant improvements in European air quality. However, non-compliance with the Ambient Air Quality Directive persists in several areas, in terms of specific ambient air quality limit values being breached either occasionally or more recurrently in many cities.

For two key pollutants, particulate matter (PM) and nitrogen oxides (NO\textsubscript{X}), road transport and diesel vehicles in particular have been targeted for emission reductions. Therefore it is of utmost importance to better understand the real contribution of road transport, in order to assess the possible outcomes from measures under consideration.
EU27: PM$_{2.5}$ EMISSIONS AGGREGATED BY KEY SECTOR

Source: IIASA GAINS TSAP16 CLE WPE Scenario
EU27 NO\textsubscript{x} EMISSIONS BY KEY SECTOR

Source: IIASA GAINS TSAP16 CLE WPE Scenario
PRIMARY PM$_{2.5}$ AND PM$_{10}$ EMISSIONS FROM ROAD TRANSPORT

The implementation of Euro standards, in particular from Euro 4 onwards, has dramatically reduced PM levels from diesel vehicles. These reductions have occurred both in the official certification tests and in real driving conditions.

Looking ahead, in a recent study$^8$ commissioned by Concawe$^9$ the results from modelling show that primary PM emissions (PM$_{2.5}$ and PM$_{10}$) from road transport, that are already today a small contributor to the total primary PM emissions, will keep decreasing between now and 2030. The major contribution to the total primary PM emissions is and will be the domestic sector. By 2020, the major part of primary PM emissions from road transport will consist of non-exhaust emissions from tyres, brake wear and road abrasion.

### CONTRIBUTION FROM ROAD TO TRANSPORTS TO TOTAL PM EMISSIONS EU27 - KILO TONNES (% OF TOTAL)$^{10}$

<table>
<thead>
<tr>
<th>Year</th>
<th>Road transport exhaust emissions</th>
<th>Road transport non-exhaust emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>77 (4%)</td>
<td>149 (7%)</td>
</tr>
<tr>
<td>2020</td>
<td>38 (2%)</td>
<td>186 (9%)</td>
</tr>
<tr>
<td>2025</td>
<td>21 (1%)</td>
<td>199 (11%)</td>
</tr>
<tr>
<td>2030</td>
<td>15 (1%)</td>
<td>208 (11%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Road transport exhaust emissions</th>
<th>Road transport non-exhaust emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>77 (5%)</td>
<td>50 (4%)</td>
</tr>
<tr>
<td>2020</td>
<td>38 (3%)</td>
<td>53 (4%)</td>
</tr>
<tr>
<td>2025</td>
<td>21 (2%)</td>
<td>54 (5%)</td>
</tr>
<tr>
<td>2030</td>
<td>15 (1%)</td>
<td>56 (5%)</td>
</tr>
</tbody>
</table>

*Source: Aeris Europe, Urban Air Quality Study, March 2016*

By 2030 the primary PM emissions from road transport will be originated essentially from these non-exhaust emission sources which do not depend on the powertrain technology (whether internal combustion engine or electric motor) of the vehicle.

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$^8$ Study conducted by Aeris Europe, to better understand the air quality compliance issues for PM and NO$^2$ in the EU-27 countries, with a particular focus on the urban environment.

$^9$ Concawe was established in 1963 by a small group of leading oil companies to carry out research on environmental issues relevant to the oil industry.

$^{10}$ All road transport exhaust emissions are PM$_{2.5}$—this fraction is included in the PM$_{10}$ emissions total.
NITROGEN OXIDES (NO\textsubscript{X}) EMISSIONS FROM TRANSPORT

It is widely recognized that the implementation of Euro standards has not been as successful at reducing NO\textsubscript{X} as it has been at reducing PM. Whilst reductions have been recorded in the official certification tests, these same reductions have not been achieved in real driving conditions. This is now generally understood to be a consequence of the large differences between the official New European Drive Cycle (NEDC) test drive cycle and real driving conditions, and the differences in the operating conditions of the vehicle in these widely varying conditions.

However, the recently implemented Euro 6 standard will bring significant reductions of NO\textsubscript{X} emissions. Concerns that some vehicles may keep having higher emissions in real on-the-road conditions are being addressed through two measures:

- A transition to a the new World Light Duty Testing Protocol (WLTP) drive cycle,
- The compliance with the “Real Driving Emissions” (RDE) test that will ensure that emissions performance on the road are progressively better aligned with the EURO 6 emission standards. This will happen through the adoption of a steadily diminishing “conformity factor”, that sets the ratio of a “not-to-exceed” limit under a RDE test procedure to the original EURO 6 standards.

The mentioned study commissioned by Concawe has also modelled the evolution of urban NO\textsubscript{2} ambient levels and the compliance with the limit value. The results indicate that the percentage of the EU population living in zones of non or uncertain compliance (modelled concentration above 35 µg/m\textsuperscript{3}) in 2015 is approximately 31%. The study however anticipates that the number of these non or uncertain compliance zones will continue to decline between 2015 and 2030. Correspondingly, the share of the population living in those zones will reduce from 31% to 7% in the assumption that there is a regular fleet turnover and that the compliance factor (ratio between real driving emissions and Euro 6 limit) is equal to 2.8 on average over the period. Therefore by 2030 the population living in ‘likely compliant’ zones increases to 93% and the pattern of residual non-compliance evolves from large contiguous areas to discrete islands of non-compliance.

The fact that these remaining non-compliance zones are located in urban areas strongly supports the implementation of targeted, specific mitigation measures rather than sweeping or wide-ranging measures.
BASE CASE - NO$_2$ - AIR QUALITY MANAGEMENT ZONE COMPLIANCE - 2025

Source: Aeris Europe, Urban Air Quality Study, March 2016
BASE CASE - NO\textsubscript{2} - AIR QUALITY MANAGEMENT ZONE COMPLIANCE - 2030

Source: Aeris Europe, Urban Air Quality Study, March 2016
One study scenario modelled the removal of all diesel exhaust emissions (from Heavy Duty Vehicles (HDV), Light Duty Vehicles (LDV), passenger cars (PC) and Buses) from the urban environment. This theoretical “zero diesel” scenario corresponds in practice to replacing all of the above mentioned diesel vehicles by fully electric vehicles.
The practical implementation of zero diesel scenario is questionable given the issues to address: timing to effectively achieve the fleet switch, public acceptance, infrastructure, and costs.

In the Base Case the level of population living by 2030 in likely compliant areas increases to 93% vs 95% for the zero diesel scenario.

In fact, the Base Case sees significant improvements in compliance by 2025 which reduces as time progresses the incremental benefit in compliance terms even for this zero diesel scenario.
The graph above shows that, whilst the “zero diesel” scenario achieved a higher compliance in the interim period 2020-2025 than any other scenario, its incremental benefit progressively declined towards 2025 with respect to the scenario of regular turnover to Euro 6 of the diesel vehicles fleet. In other words, if a theoretical immediate removal of all diesel exhaust emissions from the urban environment would improve in the short term the compliance with the NO$_2$ limit value, the study indicates that the incremental benefit is relatively low in comparison with the case of regular fleet turnover to Euro 6 (which already delivers improvements) and further declines after 2025. A more efficient alternative would consist therefore in the adoption of targeted measures specifically for urban environment as before detailed:

- Vehicle fleet renewal schemes accelerating the uptake of EURO 6/RDE compliant vehicles
- Targeted use of low or ultra-low emission zones in a technology neutral way
- Targeted measures (including retrofitting) for fleets operating in urban area (e.g. buses and taxis)
- Focus on keeping the emission performance at its standards level by adequate maintenance and enforcement of prohibition of poorly maintained vehicles to circulate

The key factor behind the results of the modelling exercise is the high degree of “cleanliness” of EURO 6 diesel vehicles with respect to all previous emission control systems, a fact which is often overlooked by those promoting electrification as the only sensible solution on air quality grounds.

We should also consider that the transition of all urban transport to electrification would pose serious challenges. The necessary build-up of an extensive grid and charging infrastructure would be very expensive and require a significant time. Moreover, the change in performances and capabilities of the electric versus the internal combustion engine vehicles requires acceptance and a shift in preference from the consumers, which is not guaranteed and will in any case require time. Conversely, the transition of the current car park to EURO 6 vehicles would likely be at lower cost and may be achieved in a much shorter time, resulting in earlier real air quality benefits.
GENERAL PRINCIPLES FOR A SUSTAINABLE TRANSPORT POLICY

The EU’s transport policy should be holistic, and include in addition to low carbon fuels and vehicles, traffic demand, infrastructure improvements, and driver education and behaviour. Such measures can play an important role in meeting air quality and GHG reduction targets in the transport sector at a comparatively low cost.

Over the long term, transport policy for fuels and vehicles should take an integrated approach involving all actors (vehicle manufacturers, fuel providers, infrastructures and consumers) in the transport sector. Those policies should be cost-effective, technology neutral, and predictable to ensure safeguarding of the internal market. We therefore support the Council conclusion to adopt a technology-neutral approach to the reduction of GHGs in transport. We also support the objectives of the Ambient Air Quality Directive.

REDUCTION OF GHG EMISSIONS

To ensure a fair comparison between transport energy sources and vehicles, it is important to take account of life cycle analysis of GHG emissions entering the atmosphere when making policy decisions.

An economy-wide / cross-sectorial approach to decarbonisation is more cost-effective than a sectorial one and will deliver value for the planet at the lowest cost for citizens. The regulatory approach currently in place is sectorial, and the implicit cost for decarbonisation in transport can be much higher than in other sectors due to technological immaturity of alternatives.
If a convergence to an economy-wide/cross-sectorial approach with a uniform carbon price is not considered realistic in the short term, then a regulatory transition should be examined, leading to the eventual convergence of the cost of decarbonisation in transport with other sectors. During the transition, FuelsEurope supports a sensible implementation of the sectorial approach in transport in the short and medium term, including:

1) A continuation of efficiency targets on vehicles, in line with the following points:

   a. In respect of the technology neutrality principle, the targets should be cost-effective, realistically set and achievable through different technologies;
   b. An alternative compliance mechanism referenced to carbon price could be considered as a marginal compliance option for vehicle manufactures;
   c. The revenues from the alternative compliance mechanism may be used preferentially to support R&D and scale-up phases for new promising technologies in respect of the technology neutrality principle to support development towards cost-efficient GHG reduction routes.

2) We acknowledge that the European Commission does not think it is appropriate to establish new EU wide targets post-2020 for renewable energy or the GHG intensity of fuels used in the transport sector. We think that mandates might not be a cost-effective method for reducing GHG emissions. However, where biofuel blending mandates are enforced by Member States (in support of their national agriculture and/or their national energy security and/or their contribution to CO₂ reduction), they should:

   a. Aim to create consistency to maintain the single market;
   b. Only support biofuels that have established science based sustainability credentials on a well-to-wheel basis;
   c. Set achievable targets;
   d. Keep current fuel grades to ensure vehicle compatibility.

3) No extension of fuel-specific GHG intensity reduction targets post-2020, i.e. FDQ 7a.

Incentives for the development of alternative fuels and electricity should be based on well-to-wheel assessment of the GHG emission, and should be limited in time and cost. Eventually, every technology / fuel and energy combination should compete on its own
merit in a market regulated by a uniform carbon price. Where blending of biofuels is mandated post-2020, the resulting GHG reduction should be recognized in the vehicle regulations “CO₂ in cars” and the corresponding regulation for light commercial vehicles, on the basis of the EU average carbon intensity.

MEETING THE NOₓ LIMIT VALUE IN URBAN AREAS

We support the objectives of the Ambient Air Quality Directive and specifically, continuing measures at EU level to minimise the emissions from use of petroleum fuels in transport. All such measures should be implemented in a technology-neutral way.

Specifically, we support:

- Robust implementation of EURO 6 for all vehicles, passenger cars, light and heavy commercial vehicles and also appropriately stringent standards for construction equipment in cities;
- Introduction and transition to the new WLTP drive cycle;
- Measures to ensure that Real Driving Emissions (RDE) are consistent with official certification tests;
- A regime of robust and effective in-use vehicle emissions checks, with measures to enforce maintenance of emissions performance, and removal from use of “super-emitter” non-compliant vehicles.

We also believe that the following national and local measures may be beneficial to bring earlier air quality improvement in urban areas:

- Fleet renewal schemes encouraging the uptake of Euro 6/RDE compliant vehicles
- Targeted use of low-emission zones in cities, for transport and other emission sources, in a technology neutral way;
- Targeted measures for fleets e.g. buses and taxis;
- Prohibit circulation of poorly maintained vehicles.