The environmental price to pay for heavy goods traffic

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New methods of production and consumption, as well as ongoing economic growth in the European region in recent decades, have led to an increasing demand for faster and more flexible transport modes, often favouring road freight. This trend is mainly sustained by the fact that environmental costs are not internalised (included) in road transport prices. Developing and switching to more environmental-friendly transport modes will require major efforts in all European countries.

Economic development in a global economy (relocation of production, EU expansion) as well as new consumption habits, have been leading to increased freight volumes being transported over longer distances. With a 78% market share (2004), road transport dominates the inland freight transport market, growing steadily over the past decade at the expense of rail and inland waterway transport. This has been occurring despite the latters’ significant carrying capacity and relatively low greenhouse gas emissions per kilometre compared to road. Transport volumes by road are high in Europe: the absolute rate increased by 35% over the past 15 years for countries covered by the European Environment Agency (EEA; pers. comm.).

The road transport system offers great flexibility (e.g. doorstep delivery), but has had a negative influence on the optimisation of load factors (truck load). For example, a survey conducted in Alsace, France, showed that 23% of trucks travelled empty. In EEA countries, this figure for 2005 falls in the range between 20 and 30% (2). This situation is only viable because distance-related charges (fuel taxes and infrastructure charges) levied on road transport are well below the minimum estimate of marginal external costs that remain for civil society (air pollution, climate change, health - see p. 2).

Individual road transport for both day-to-day purposes and leisure travel has also increased. To avoid disadvantages of the urban environment, people are living further away from their work places and depend more on individual transport to cover longer distances. Although new car engine efficiency in the EU-15 has gained 13% in the past eight years, this has been offset by the increased number of cars per inhabitant (+18.5% for the same period).

Today, road transport in Europe depends 98% on petrol and diesel fuels and accounts for 31% of total energy consumption (Fig. 2): pollutant emissions are closely linked with transport demand. The environmental challenges caused by transport are a vivid reality in a European Union that now extends to 27 members.
**Causes of increasing road transport**

### New consumption habits
Globalisation of trade, with relocation of manufacturing to lower production cost areas, has two consequences: longer distances between consumers and production centres, and lower item prices leading to higher volumes of merchandise purchased and therefore transported. It also induces a change in consumer habits (e.g. exotic fruits, vegetables and many other products available any time of year, such as lamb from New Zealand or wine from Chile). This requires long distance (but rapid) transport and is only possible given low transport costs.

### Oil costs “externalised”
Oil prices can be considered artificially low as they only include extraction, refining and distribution costs. Furthermore, the use of petroleum products does not include any cost for cleaning up pollution impacts on the environment or human health costs, during these three phases or after fuel use. These other costs from road transport were estimated at 650 billion euros for the EU-15, Switzerland and Norway in 2000\(^1\).

**Road transport emissions**

### Greenhouse gases (GHG)
In the EU-15, transport now accounts for 21% of total GHG emissions (mainly CO\(_2\), excluding international aviation and maritime transport) of which 92% is from road transport (Fig.3). While GHG emissions of many other sectors are decreasing due to stronger regulations and technological improvements, the contribution from transport continues to grow (+23% between 1990 and 2003), offsetting to a large extent reductions of emissions from other economic sectors\(^5\).

### Fine particles, ozone and health
Ground level ozone is a cause of respiratory problems and allergies. Ozone (O\(_3\)) is not emitted as such, but results from the interaction between exhaust gases and atmospheric ones when exposed to solar radiation. Fine particles are either directly emitted by exhaust\(^6\), or result from road and tire deterioration\(^5\). The “Clean Air for Europe” (CAFE) programme estimates that 370 000 people die prematurely due to air pollution each year, mainly from fine particle matter and ozone\(^6\). The European Commission (EC)\(^6\) estimates that fine particles in the air statistically reduce life expectancy in the EU by more than eight months on average. An effective application of current policies could reduce this number to 5.5 months. Children, elderly and asthmatic persons are more vulnerable. In monetary terms, damage caused to human health alone is estimated as costing 189 to 609 billions euros per year until 2020, depending on various experts’ analysis and opinions.

**Impacts on biodiversity and ecosystems**

Ecosystems continue to be impaired by acidic deposits (NO\(_x\), SO\(_2\) and NH\(_3\)), leading to animal and plant species’ damage and loss. Nitrogen excess can negatively affect vegetation and infiltrate surface water, leading in both cases to a decrease of biological diversity. Ground ozone causes physical damage and retards the growth of crops, forests and plants. The most serious consequences come from road infrastructure which impact on landscapes, and can be an obstacle to animal movements. On average, highway infrastructure disturbs ten hectares per kilometre of road constructed\(^8\), and often leads to even wider ecosystem degradation and fragmentation. Noise from traffic can disturb local fauna as well.

**Potential solutions**

### Sustainable consumption
One solution is to encourage sustainable consumption by, for example, promoting the use of locally-produced and seasonal foods, and reducing consumer goods’ turnover by using longer life-span items, thus also reducing the amount of waste generated\(^9\).

### Combined transport
Rail (average speed 18km/h) and water transport cannot compete with road transport (average speed 56km/h) in terms of rapidity of delivery\(^5\). However, trains and boats are on average more environmentally-friendly than trucks, even if environmental performance generally depends more on installed technology and logistical characteristics than on the mode per se\(^5\). Combined transport appears to be the best solution for simultaneously improving environmental performance, flexibility and efficiency, as long as the appropriate logistical structure and infrastructure have been established.

### Taxation
Existing European highway toll fees and road taxes are generally not based on environmental performance
and are well below marginal costs (costs of measures which can be taken to control environmental effects).

However, some countries have recently implemented road charges for trucks based on environmental performance (Austria, Germany, Switzerland) and some others plan to do so (Czech Republic, United Kingdom). Denmark modified its annual circulation tax to reflect the energy efficiency of vehicles that resulted in a 15% fuel consumption reduction between 1998 and 2005, versus a 10% European average.

Applying a taxation rate for polluting fuels could be beneficial to subsidise renewable energies, "cleaner" transport modes and public transportation, but also to make sure that load factors are optimal, to develop technologies and know-how that could, in the long run, lead to a society less dependant on fossil fuels.

New technologies

European car makers have committed themselves to reduce average CO₂ emissions to 140 grammes/km in 2008 (2009 for Japanese and Korean) and 130 grammes/km in 2010. Even if CO₂ emissions have already begun decreasing, a mid-term evaluation shows that greater efforts are needed if targets are to be met (Fig.5). The EU is in the process of including these stricter objectives in its legislation.

Many different low-energy concepts have been developed for passenger cars but are also used in freight vehicles. Electric cars still remain a niche market and environmental performance depends on the impact caused by the electricity production. One of the most successful concepts is the combination of fuel or gas engine with electrical energy ("hybrid"), leading to a reduction of CO₂ emissions of around one-third. A conventional system can also be optimized to reduce the amount of fuel needed and particles emitted.

Other new technologies include particle filters, exhaust gas recirculation, selective catalytic reduction, direct injection, lightweight materials, low-resistance tyres and lubricants. They have the potential to significantly reduce emissions of fine particles in road transport inland and sea shipping, as well as rail transport. Such technological solutions can only be effective in the long-term, as it takes around 20 years for a new technology to be adopted by the broader car market.

Biofuels

Currently, the GHG emission balance for biofuels remains negative due to high levels of emissions during biomass cultivation. Biofuel crop production also competes with food production, and large amounts of land are required to cultivate the biomass needed. Finally, it generates by-products that currently remain unused. Production of biofuels on a large scale may affect the intensity of agricultural land use, and may have a negative effect on biodiversity. In order to minimize such negative impacts and reduce the costs of production, second-generation research points towards production of biofuels from oil and wood residues or cereal straw.

Logistical improvements

Haulers try to ensure that their vehicles are as fully loaded as possible for longer distances (average vehicle load in 2004 11.4 t < 500km, to 14.5 t > 2000km). Nonetheless, the load factor of heavy goods has been slightly decreasing to less than 50% overall. Very simple measures such as loading improvement (e.g. removal of air or water, clustering of suppliers and customers) or the use of computerised vehicle routing package software to cut transport costs and distance travelled can in some cases reduce transport volumes significantly. However, in the long run, consumption patterns and levels will have to be addressed as well.
EU objectives
The European Commission addresses traffic volume directly for the first time in the newly proposed Marco Polo II programme. The “traffic avoidance” part of the programme sets a target of 10.5 billion tonne-km to be avoided between 2007 and 2013, without economic disadvantage. This corresponds to 0.7% of the roughly estimated 1.5 billion tonne-km transported by trucks in the EU-25. The programme also proposes to develop innovative concepts such as the “maritime highway” that focus on developing intermodality (i.e. freight containers being easily transferred from one mode of transportation to another without being unpacked).

However, there remains a fundamental difference between European wishes as written in a recent “White Paper” and actual European policies. Many decisions are still being taken from an economic rather than a sustainable development perspective. Perhaps fundamental changes will need to come via a truly holistic strategy, including both a modification of current production and consumption habits, and changes in the budgetary and fiscal policies by integrating real external costs, both environmental and social.

Conclusion
Currently, more than half the overall expenditure on transport infrastructure, including the Cohesion Fund and loans from the European Investment Bank have, at the request of Member States, favoured road over rail, despite opposite European orientations found in the “White Paper”. The EC also mentions that “significant negative impacts will persist even with effective implementation of current legislation”.

The European freight transport system would need major changes to be consistent with sustainable development objectives. Any modifications in the transport system would have to be made along with a change of European consumers’ habits. Such an objective may indeed be attainable, as 69% of Europeans are in favour of an “ecotax” and agree with the “polluter pays” principle.

European policies are often said to be examples for developing and transitional countries and those looking forward to joining the EU, where environmental concerns (including climate change) are high on the policy agenda. These existing guidelines and further measures are options for Western countries to adapt that would benefit affected sectors and set an example to the wider continent, and even the rest of the world.

The environmental burden of rail freight is much less significant than the one of road transport. This mean of transport is, however, still underused in Europe.