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"Implications of the Copenhagen accord for the EU climate policy ambition"

Non Technical Paper on Challenges to reduce GHG emissions from Ground Transport

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As a matter of fact, emissions from transport represent a large share of total GHG emissions in the EU. Compared with 1990 levels, in no other sector has the growth rate of GHG emissions been as high as in transport (I).

So far, EU measures have targeted specific areas, responding to various policy objectives but not through a fully integrated approach. Looking at emission projections as compared to BAU, current policies will not be able to reverse the trends, and transport emissions shall not be just compensated by mitigation efforts made by other sectors (II).

This picture urgently calls for the adoption of an ambitious long term EU low carbon strategy in the transport sector. A key challenge will be to better coordinate a number of EU policies and principles (transport/climate and energy/Internal Market/territorial cohesion/EU solidarity) in a more coherent and mutually supportive manner. The EU has a fundamental role to play in providing coherence and efficiency through a more harmonized framework for promoting sustainable mobility of persons and goods, and the EU political agenda for 2010 offers a window opportunity to do this (III).

Transport is a broad and complex sector. This Dialogue should seek to address issues where it can add value to the debate. Looking at the existing research and literature, its purpose is to address long term issues related to the decarbonisation of transport systems and the provision of required infrastructures. This first Dialogue meeting points at the decarbonisation issue, with a particular attention paid to electrification and related impacts on the power sector (IV), whereas the second Dialogue meeting (Warsaw, June 23 and 24) will look at the provision and financing of required infrastructures.

I. GHG emissions and trends in the EU: Facts and figures

In 2006, transport accounted for close to a quarter (23,8%) of total GHG emissions and more of a quarter (27,9%) of total CO2 emissions in the EU-27 (EEA 2008). Transport emissions (excluding international bunker fuels) increased by 28% between 1990 and 2007, with the annual rate of increase going up from 0.97 % between 2005 and 2006 to 1.29 % between 2006 and 2007 (TERM 2009, not yet published). This compares with a reduction of 5 % in emissions across all sectors as compared to 1990 levels (reduction of 11 % from the non transport sectors). In this context, freight and passenger road transport account for 71% of total CO2 transport emissions, against 15.3% for navigation, 12.2% for civil aviation (domestic flights), and 0.6% for railway.

In terms of geographical distribution of GHG transport emissions, most EU Member States continue to increase their emissions, though at different paces (between 1 % and 17 % between 2006 and 2007) whereas only very few countries (Luxembourg, Portugal, Netherlands, France, Germany and Bulgaria) show a decrease of emissions from 2006 to 2007.

Transport is one of the largest energy consuming sectors, accounting for 34% of EU final energy consumption, and transport energy consumption still rises continuously (JRC-EC 2008). As transport still fundamentally relies on fossil fuels (for 97% of its needs), GHG emissions grow in general parallel to GDP growth (between 1995 and 2007, freight has grown roughly 5% more than GDP while passenger transport has grown roughly 5% less than GDP, with the exception of aviation, in the EU 27).

In the long term, energy consumption and greenhouse gas emissions are projected to increase significantly up to 2050. Under business as usual[1], volumes (as ton km and passenger km) in all transport modes are projected to increase substantially. Road freight in the EU is forecast to increase by about 60% between 2005 and 2050, and long-distance road freight (trips longer than 150 km) to more than double (Banister, 2009). Car travel is forecast to increase up to 2050, by about 40% (Petersen et al., 2009) to 70% (Banister, 2009). Projections for rail passenger transport differ significantly, ranging from 30% (Banister, 2009) to double (Petersen et al., 2009), between 2005 and 2050, whereas growth in rail freight ranges from 25% (Banister, 2009) to treble current levels (Petersen et al., 2009).

If increase in GHG emissions from international aviation and maritime have slowed down a bit in recent years (only 2.64 % and 0.92 % increases in emissions between 2006 and 2007, compared with 5.32 % and 6.38 % increases between 2005 and 2006 respectively), long term continued growth is expected (ICAO 2009), with an increase at twice the rate of other modes.

In a wider context, it is worth noting that transport is one of the fastest growing sectors in the EU economy and one the pillars of the EU Internal Market (transport accounts for about 7% of total EU GDP and for 5% of employment). It assists social and economic cohesion, promote competitiveness and contribute to the Lisbon Agenda, though not following sustainable paths in many respects. Transport has also significant societal costs (including environmental costs, congestion, and traffic accidents) which account for up to 7% of the GDP of the EU-15 GDP (EEA, 2006).

Finally, beyond mitigation, one should keep in mind that transport is a highly vulnerable sector both to adverse impacts of climate change and to key external factors (security of energy supply, fuel price fluctuations).

[1] BAU is the normal course of the current economic activity

II. Current EU policies cannot tackle the challenge ahead.

As acknowledged the European Commission in its 2009 Communication "A sustainable future for transport", the 2001 White Paper on Common Transport Policy is outdated and cannot tackle the challenges and opportunities for the transport sector in the long term. So far, EU Policies have targeted specific areas but in a fragmented manner, even the most recent pieces of adopted legislation (Fuel Quality Directive, CO2 Cars, bio-fuels in the renewable Energy), or under discussion, (CO2 from Vans, competitive rail freight transport). Those have been mainly designed as short term policies added on top of the Climate and Energy package or other sectoral EU policies. The focus was particularly put on technological improvements (energy efficiency of vehicles, clean road vehicles, fuel quality including carbon reduction requirements) and demand side and traffic management measures, including through pricing and economic/fiscal instruments (internalization of external costs, taxation of energy products, inclusion of aviation in EU ETS, deployment of Intelligent Transport Services, …etc.), which sometimes conflict one with another because responding to different policy objectives. Alternative fuels, particularly bio-fuels, are now promoted through the Renewable Energy Directive on the condition that sustainable criteria can be met, though still raising high concerns with regard to possible impacts on indirect land use change inside and outside the EU. If each modal policy has proved some relative potential to reduce GHG emissions in each of the targeted areas, each was very much developed in isolation from the others, thus not maximizing the combined potential that could be gained through a fully integrated approach. However, the increase of GHG emissions from transport has occurred despite the fact that fleets have generally improved their energy efficiency for the last two decades because of the marketing of heavier and more consuming vehicles combined with an increase of use (speed) and transport volumes (km/vehicle + number of vehicles/inhabitant).

Infrastructures are mainly dealt with at EU level through the Trans-European Network (TEN-T), a policy defined in 1996 which is also widely recognized as no longer being adapted to nowadays and future challenges (growing mobility needs, urban development, scarcity of fossil fuels, climate change and environmental protection). Despite the attempt to boost TEN-T development through the EU economic recovery plan, TEN-T policy is not driven by genuine EU objectives, resulting from a lack of funding and sovereign responsibility by the Member States in infrastructure planning (subsidiarity), who use first EU Structural Funds for financing highways, thus increasing GHG emissions from passenger road transport. The way TEN-T has been designed so far (network layer + priority projects) does neither integrate the different transport modes nor it does provide for an optimal functioning of transport elements (infrastructures, nodes, ICT applications, network services, operational and administrative procedures), which should work in combination in order to promote co-modality, modal shift and an efficient and effective organization of the whole transport system. Moreover, TEN-T policy is not driven by climate change mitigation and adaptation objectives.

III. What can the EU do?

The Dialogue should clarify what can be respectively done at EU and national levels, and identify where EU policies can make the difference towards an integrated low carbon transport policy while looking for maximized synergies with complementary EU and national policies and measures. From that perspective, it must be taken into account that transport GHG emissions are covered by the Effort Sharing Decision, with the exception of aviation emissions which are covered by the EU ETS.

The EU should develop a long term vision on transport now, considering the long lifetime of fleets, the slow pace of market penetration of new technologies and the long duration of development of infrastructures required for all modes. Heads of States and Governments have already stated their

support to an EU objective for reducing GHG emissions in a range of 80-95% by 2050 as compared to 1990 levels (Presidency conclusions of European Summit of 29/30 October 2009). For his second term, President Barroso recognizes the "*need to maintain the momentum towards a low carbon economy and in particular towards decarbonizing our electricity supply and the transport sector*" (*Political Guidelines for the next Commission, September 2009*). Many studies assume that a long term economy-wide target of -80% would imply a reduction effort ranging from -60 to -80% as compared to 1990 in the transport sector (depending on scenarios used), corresponding to -70 to -90% compared to BAU emission levels (see for example EU Transport GHG 2050). Higher overall targets (90-95%) would require the transport sector to be almost carbon neutral.

The review of both the White Paper of 2001 and the TEN-T Guidelines hopefully coincide in terms of timing. It provides a unique opportunity to take the right orientations in the forthcoming White Papers that will have to be published later on this year by the European Commission. Obviously, there is a need for a "Transport and Climate Package" which should comprise all necessary elements to achieve the transition towards a low carbon transport sector in 2050. But decisions must be taken now to prepare the transition, in order to deliver tangible results between 2030 and 2050 and its full potential in 2050, without prejudice to measures at low costs (e.g. technical options to make road vehicles using less fossil fuels/efficient use and optimization of vehicles -speed limitation, eco-driving, co-driving-, and restrictions on the use of vehicles, in particular in urban areas), which can be implemented as from now on to help achieve the -20% target by 2020 (while keeping in mind the possibility to switch to -30% by 2020 on the basis of the assessment to be made public by the Commission in its forthcoming Communication in June 2010).

Looking at mitigation potentials under various scenarios, it is clear that technological options will not suffice. There is a need to look at both technical and non technical options for all modes (interoperability/interaction = tensions versus synergies), from well to tank (fossil fuel extraction and refinery) to tank to wheel (combustion by vehicles), from both the supply and the demand side (while taking account of different usage values).

There are two main challenges to an integrated approach. The first challenge is to define and find out a balance among the contributions of the various components of the transport value chain. Uneven contributions by these components will be likely to undermine not only the least-cost goal but also, ultimately, political acceptability. Second, any such integrated approach faces the challenge of enforcing commitments on the part of the various components. The failure of one component, for example infrastructure or fuel quality, may have knock-on effects, leading to the underperformance of the entire transport sector[2]. Thus, a particular challenge for policy-makers will be to find a consensus on the contributions of the various components of the transport sector to emission reductions, for example, through assigning specific targets. They may be inspired by lessons learned through stakeholders' initiatives promoting an integrated approach on transport, such as the CAR21 High Level Group.
The EU has the needed competence to develop an ambitious long -term integrated strategy: the EU and its Member States have a shared competence on transport and TEN-T (Art. 4 TFUE), on energy (Art. 194 TFUE) and for fighting against climate change, which is now formally part of environmental policy (Art. 191 TFUE). But the EU Treaties have now clarified that, in areas of shared competence, the Member States shall exercise their competence to the extent that the Union has not exercised its competence (Art. 2.2 TFUE). Moreover, the EU has an exclusive competence to deal with Internal Market issues (Art. 3 TFUE), which is definitely relevant for improving further the energy efficiency of vehicles and/or provide for technical specifications related to the use of alternative fuels, including

[2] Making the most of the G8+5 climate change process accelerating structural changes and technology diffusion on a global scale, CEPS Task Force Report 2008.

electricity in the context of the liberalized energy market. Finally, the EU can usefully exercise its competence to further support research activities on new transport technologies and systems.

A fully integrated long-term strategy should aim at better maximizing co-benefits from sustainable transport (security of energy supply, road safety, air quality, noise, territorial cohesion, traffic management, prevention of congestion…) and develop synergies with other EU policies and legislation, also to reduce transport related societal costs including environmental costs; most important is to develop tools for a strategic coordination between EU policies that interact with the EU transport policy. From such perspective, the electrification of transport systems is a good example.

IV. Why a focus on electrification of passenger and freight road transport

Decarbonization scenarios for Europe clearly indicate that the dramatic emissions reductions required by 2050 can be achieved through the combination of three elements:

1. Further improvement in the efficiency of vehicles, combined with a major conversion to non carbonized fuels, or energy vectors (biofuels, electricity, and possibly hydrogen in the longer term);
2. A more integrated approach of the multimodal development of infrastructures and services (non motorized modes; personal vehicles, new services based on individual vehicles; rail, river and air services;
3. A possible inflexion of the relation between economic growth and mobility increase, taking into account the diverse situation of MS in that respect and the induced catching up to be expected.

Energy price, and therefore CO2 cost internalisation, is an important driver of the long term evolutions in all three areas. In the same time, transportation analysts recognize the need for complementary policies to boost technological innovation, facilitate the adequate development of infrastructures and services, and build a consistent economic and fiscal policy. In return, these policies will ensure that co-benefits are fully integrated in the strategies, and will help minimizing the social costs of the transition.

We suggest that the dialogue, in its forthcoming sessions of April and June, should primarily cover items 1 and 2, where EU polices can make a difference, and the audience bring added value to the debate:

On the decarbonisation of vehicles, EU policies are already in place concerning the improvement of fleet efficiency, and the promotion of biofuels. It appears that the possible contribution of electric/hybrid vehicles to this objective is still unclear and diversely appreciated among MS and stakeholders, and that the strategies to maximize this contribution need clarification. In the same time, what is at stake is the future of the European car industry, but also the synergy between this evolution and the correlative changes to occur in the power sector, both in terms of production and grid services. Finally, the possibility to develop a sustainable, and widely accepted biofuel option depends on internal factors (second and third generation, criteria for international supply) but also on the share of the demand that can be covered by alternative fuels.
On the multimodal approach, literature clearly establishes a distinction between urban and inter-urban/inter-regional mobility. The former is primarily in the hand of local policy makers, and has been recently the subject of numerous initiatives. On the latter, as mentioned above, a clear deficit of strategy and consistency in policy development has been evidenced in recent analysis at three

levels: a poor harmonisation between different modal options (air / rail / road), a lack of global vision between different policy objectives (liberalisation and market integration, environment, energy security, recovery plans) and finally a dispersion of national decisions without a clear European perspective.

V. Focus on the electrification of passenger and freight road transport:

At explained above, suggestion is to focus this first Dialogue meeting on decarbonisation of the use of cars for passengers and freight (in this case, we refer to the use of small vehicles for commercial purposes). Road transport is indeed the dominant transport mode and consumed 82% of total energy in the transport sector in 2005. Private cars represent the dominant transport mean in road transport, accounting for 55.9% of total energy consumed in road transport in 2005 (European energy and transport 2050). For the purpose of this discussion, we assume the decarbonisation of the power sector (up to -90 – 100% by 2050) is a prerequisite for decarbonising transport systems.

The objectives of the session are:

- To elaborate a shared judgement on the technological and industrial model to be backed at EU level based on a common understanding of the market share the EV could represent and the related industrial organisation to be developed on the short and longer-term (2020-2030).

Reduction potentials with technical options range from hybridisation/electrification and improvements of the internal combustion engine to the use of low carbon fuels such as hydrogen and bio-fuels.

Future generations of bio-fuel feedstock and production processes may be more sustainable and cost-effective and have the potential to meet between 10% or 20% of current transport energy demand (Jones 2007; cited in OECD; ITF, 2007).

Sources suggest plug in hybrids will be available to the mass market by 2020 (ERTRAC, 2009). Plug-in hybrid vehicles combine the vehicle efficiency advantages of hybridisation with the opportunity to travel part-time on electricity provided by the grid, rather than through the vehicle's internal recharging system. Plug-ins however require larger batteries than normal hybrids. Another possible plug-in development is EV range extenders presenting a compact combination of combustion engine and generator that produces electricity on demand.

Fuel savings associated with a full hybrid range from 15% to 25% depending on the type of technology and driving conditions (IMPRO-car, 2008). Reductions in CO2 range from 30 %-40 % for full hybrids (IMPRO-car, 2008).

Electric vehicles with a high tank to wheel energy efficiency have the potential to create energy efficiency savings in the range of 60%-80% (ETC/ACC, 2009). They represent a high emission reduction potential if the primary source is non CO2 energy. However, electric vehicles require an extensive power generation and distribution network, with the question marked on whether the grid can support high levels of electric vehicles. In addition, major developments are needed in battery technology.

According to the McKinsey 2009 Study on "Roads towards a low carbon future: reducing CO2 emissions from passengers' vehicles in the global transportation system", a hybrid + electric car scenario can achieve 49% reduction in GHG emissions relative to sectoral baseline, and 22% relative

to 2006 emissions i.e. around 1990 levels (but 60% of abatement costs depends on the emission reduction dependent on low carbon sources of electricity).
A review of projections and scenarios for transport in 2050 (EU Transport GHG: Routes to 2050?, 2010) shows there is a lively debate about the degree of penetration of hydrogen fuelled cars and electric vehicles (EVs). There are twice as many scenarios that rely on electrification as a key low carbon solution of the future (McKinsey, & Company, 2009; Shell, 2008; OECD/IEA, 2009; ERTRAC, 2009) than on hydrogen (WBCSD, 2005; ECN, 2008). Most of studies rely both on electrification and hydrogen options, whereas the latter are likely to develop and make a more substantial contribution on the longer term. IEA has even abandoned the hydrogen scenario, mainly due to the failure of hydrogen technology to live up to expectations and the recent increased development in electric vehicles.

This range of technological opportunities may lead to different development in R&D, business and organisational models. It thus seems relevant to debate at EU level on how to streamline technological and industrial development for EV, consistent with a comprehensive EU low carbon transport strategy. This covers a wide ride of challenges including battery improvement, technology selection, industrial development and harmonisation according to the model(s) that will be adopted (mix of electricity/ conventional fuel, for the use restricted to (peri-)urban areas or extended to longer distances). Taking stock of this discussion, options and models for decarbonisation of heavier transportation mode for freight can also be addressed.

- To enlighten the implications on the energy sector by 2020/2030/2050:

Scenarios can adequately illustrate the impacts on the European global energy demand and mix of a massive adoption of EV technologies. The joint research project “carbon constraint scenarios” (IDDRI, EPE, with LEPII, Enerdata and CIRED) provides results for a scenario incorporating high level of non-conventional vehicles, starting in 2020. The evolution of the fleet initiated in 2020 will start to be substantial in 2030: non conventional vehicles represent 30% of the market share, oil demand in transport decreases by almost 40% compared with 2001 levels. In 2050, the scenario assumes a vehicle fleet composed of a majority of hybrid (55%); the residual being almost equally divided between hydrogen (13%), EV (15%) and conventional vehicles:

- Impact on oil demand in transport and hence on the global oil final consumption is drastic: it represents a reduction of 80% under 2001 levels. It accounts for more than 60% of final oil demand decrease across all sectors over 2001-2050.
- Steep reduction in oil consumption in transport has severe impacts on the EU primary energy demand: it accounts for 65% of the primary oil demand decrease across the economy over 2001-2050. A carbon constraint scenario supposes indeed a reduction of 40% in oil primary demand in 2050 compared with 2001 level (or with oil primary demand in 2050 under a BAU scenario as this scenario anticipates a stabilisation of oil demand at European level on the longer term).
- Conversely, the power demand for transport increases steeply: in 2050, transport power demand could be multiplied by 7, representing around 550 TWh. Under this scenario, it represents almost 20% of the increase in final power demand over the 2001-2050 period and 10% of the final power consumption in 2050.

Reduction in oil consumption in favour of an increase in power demand raises several opportunities and challenges:

- It may answer some EU energy security considerations, whereas it transfers part of the problem on the power sector
- Along with energy efficiency objectives, it is likely to profoundly reshape the energy landscape and supposes an evolution of the EU strategy (pipelines development, contractual issues, …)
- On the EU territory, it questions the capacity to develop new massive investments in power production or also reviews the energy taxation policy to address evolution of primary energy consumption patterns.

These considerations are strongly interrelated with non ETS-targets, as the achievement of energy efficiency targets in other sectors will also considerably impact the global power demand and the required level of new investments (including renewable energies capacities). The development of a set of consistent policies to address the transformation in non ETS sectors seems therefore a prerequisite to adequately adjust the future ETS cap (and related carbon price).

For information, the next Dialogue meeting to be held in Warsaw will address challenges for the provision and financing of infrastructures. In that particular context, it will be appropriate to prolong this discussion on transport electrification, notably on how TEN-T policy could stimulate electric public transport (smart grids + investments in electrified high-speed rail). Obviously, for the wider use of EV, intelligent and sophisticated infrastructures such as smart grids and charging stations at home and parking places need to be put in place. Measures concerning parking areas, taxation of vehicles still using fossil fuels and access to roads will have to be discussed, among others, in order to facilitate the deployment of EV.

Concluding remarks: transport gives a good example of the need to first look at non ETS sectors, in order to determine the needs and capacity for decarbonisation, and then at the EU ETS to adjust the carbon constraint (and price signal?).

VI. Selected questions for the attention of Dialogue participants:

Focus on what the EU can deliver.

1. What are the technical options and timeframe for the transition towards full development of electric cars?
    a. What are the technological options in discussion? Where are the hurdles (battery)?
    - What is the more relevant industrial model to foster: short/long distance? 100% EV / hybrid range extenders/ role of conventional fossil fuels/ bio-fuels?
    - What is the current vision of car constructors? Are strategies synergising with the emergence of an efficient market for EV? What role for hybrids: greenwash or added value?
    - How can this market emerge effectively? How to reach a critical mass? Is it relevant to start with niche-markets easier to target (e.g. commercial vehicle fleets).

2. Taking into account the various business models for electric cars, what are the services to be developed in order to foster their deployment in the context of an EU liberalized energy market?
    - What strategies to prepare a new industrial and organisational landscape?
    - Timeframe: what is needed at the 2020 horizon in order to meet the challenges in 2030
    - What strategies to deploy reloading battery systems?
    - Integration with car usages?
    - International compatibility concerns?
    - New services (power supply…), new value chain?

3. How to manage the transfer and increase of electricity demand while achieving the decarbonisation of the power sector? What adjustment of the ETS role in 2030?
    - Quantification power demand increase, challenges to address related additional investments
    - Quantification of the impacts on the primary mix (reduction of oil consumption)
    - Interrelation with non-ETS sectors targets
    - Implications for the future design of ETS

4. How to develop an ambitious EU industrial (harmonization) + R&D (policy)?
5. What would be the most appropriate instruments to incentivize the shift towards electric cars?
6. A special case for below EU average GDP Member States?