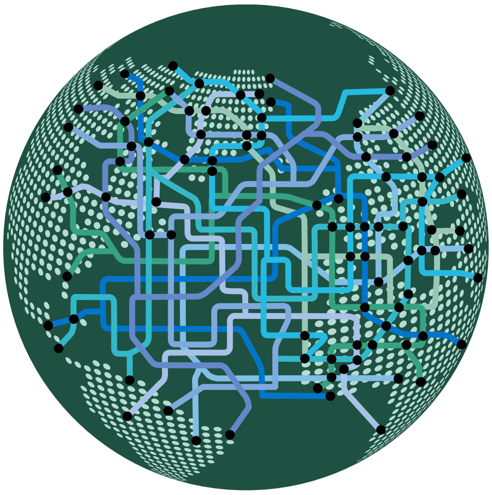
GHG-TransPoRD

Reducing greenhouse-gas emissions of transport beyond 2020: linking R&D, transport policies and reduction targets



Reducing greenhouse-gas emissions of transport beyond 2020: linking R&D, transport policies and reduction targets – Final Conference

Summary Note

http://www.ghg-transpord.eu/ghg-transpord/inhalte/events/Final_Conference.php

Date of preparation: 02.12.2011

Dissemination level: **Public**

Start date of project: 01.10.2009 Duration: 27 months

Lead contractor for this deliverable: **ISI**

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Work package: WP6 Revision: 1.0

Grant Agreement Number: 233828

Contract No: TCS8-GA-2009-233828

Instrument: Coordination and support actions – Support – CSA-SA

Reducing greenhouse-gas emissions of transport

SEVENTH FRAMEWORK PROGRAMME

Project co-funded by the European Commission – DG RTD 7th Research Framework Programme

GHG-TransPoRD

Reducing greenhouse-gas emissions of transport beyond 2020: linking R&D, transport policies and reduction targets

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Project objectives

The GHG-TransPoRD project aimed at **developing an integrated European strategy** that links R&D efforts with transport policies and technological measures **to achieve substantial greenhouse gas (GHG) emission reductions in transport** that are in line with the overall reduction targets of the EU. As part of this strategy, the project proposed GHG reduction targets for transport as a whole as well as for each transport mode for 2020, 2030 and 2050.

Objective of the Final Conference

The purpose of the Final Conference was to present both the project conclusions and the steps to achieve them in a comprehensive manner. Further, the international context was reflected by looking at the GHG mitigation approach in California. After the opening by the European Economic and Social Committee (EESC) and the European Commission the final conference commenced with a project overview and the findings of our analysis of R&D activities and the innovation system in the transport sector. Second the portfolio of potential GHG reduction measures for all modes was explained. Third, in a panel session the GHG reduction scenarios analysed in detail and consisting of bundles of measures were presented and discussed. Finally, the recommendations on R&D and transport policy were summarized and conclusions on suitable GHG reduction targets were drawn. Information on previous four workshops of GHG-TransPoRD can be found at:
http://www.ghg-transpord.eu/ghg-transpord/inhalte/events.php.

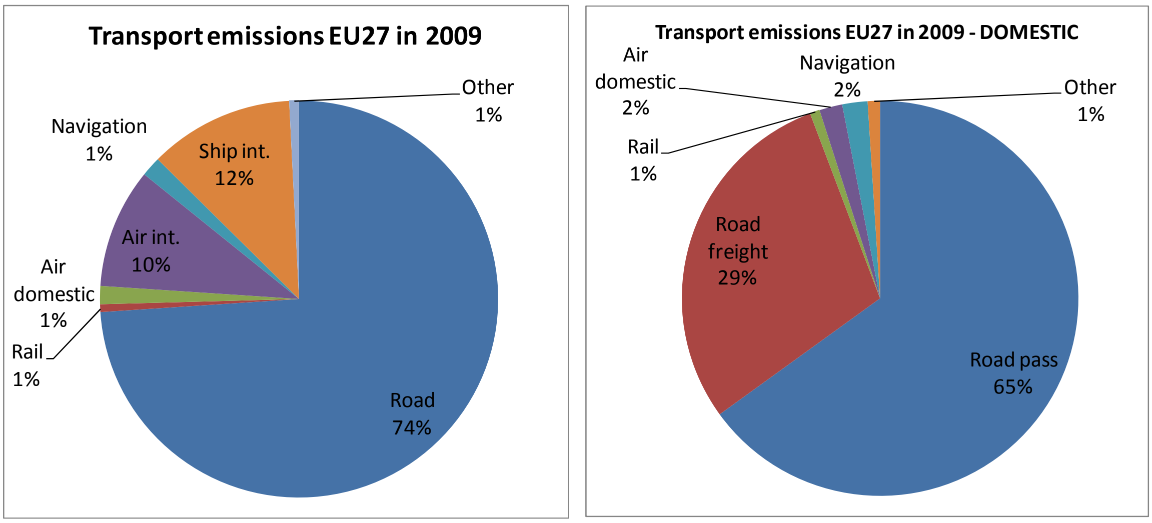
Organisation of Final Conference

The Final Conference was jointly organized by the European Economic and Social Committee (EESC) and the GHG-TransPoRD project. The EESC kindly hosted the conference in their premises. GHG-TransPoRD was co-funded by the European Commission 7th Research Framework Programme (FP7) and coordinated by Fraunhofer-ISI in collaboration with four European partners. As input to the final conference the GHG-TransPoRD project has distributed a note summarizing the project activities, intermediate findings and scenario results to the registered participants. This was accompanied by two invited expert papers by Dan Sperling on the Californian policy approach and by Wang Yi on the Chinese new energy vehicle strategy. The deliverables of GHG-TransPoRD can be downloaded at: http://www.ghg-transpord.eu/ghg-transpord/inhalte/deliverables.php.

Conference summary

Status of the transport sector with respect to climate policy

The transport sector accounts for roughly one fourth of GHG emissions of the EU27. Looking at the left hand side of Figure 1 it can be observed that three modes contribute about 95% of all these emissions: road with three quarter of total emissions, international shipping and international air transport. Taking only domestic transport into consideration, which is for instance the case for the reporting of GHG emissions to the UNFCCC, the structure of emissions becomes even more pronounced: 95% of emissions come from road transport, splitting into one third from road freight and the remaining two thirds from road passenger transport.



Source: GHG-TransPoRD based on EEA TERM 2011.

Figure 1: Emissions of GHG of transport by mode in EU27 – with and without international bunkers (i.e. domestic)

The European transport sector reveals the largest R&D investment compared with all other sectors in Europe. Close to 40 billion € are invested in 2008 by the private sector and about 4 billion € by the public sector. Out of the private R&D investment about one third goes into measures that improve the GHG efficiency of transport. The two major drivers directing the R&D investments were market demand and regulation. In other words, a large share of transport R&D is motivated by government regulation.

The innovation system in the transport sector has a modal focus. The structure of the innovation system with a few large players, high capital intensity for implementing radical innovations and thus high risk favours incremental innovation as opposed to systemic or step change innovation. Public R&D support should thus be directed towards cross-modal and step change innovations. Continuous incremental innovations should be guided by medium- to long-term regulations.

Analysis of GHG reductions in GHG-TransPoRD

GHG-TransPoRD analyzed the GHG reduction measures by mode and for alternative fuels considering both technological measures and policy measures applying a four steps approach:

- Estimating a reference energy and GHG emissions framework against which the GHG reduction potentials of long lists of measures were estimated. Between 20 and 100 measures were analyzed by mode and for biofuels.
- Selecting a short list of more effective measures for further analysis of cost, feasibility and integration into scenario bundles.
- Developing cost curves for the different measures, in particular for technologies, and estimating an initial set of scenario independent abatement costs.
- Bundling the measures into scenarios and estimating the GHG reduction pathways for each scenario. This was undertaken by an iterative approach starting with technology measures under market conditions, implicitly assuming a technology neutral regulation requiring ambitious efficiency improvements and letting the markets decide on technology choices. Subsequently in two steps policies were added: first, ambitious pricing policies (e.g. fuel taxes, carbon charges, feebates, vehicle taxes, parking fees, urban and long distance infrastructure pricing), and second ambitious regulation was integrated into the scenarios.

Based on the findings of the fourth workshop the final set of scenarios for the techno-economic assessment applying in particular the ASTRA-POLES model combination enabling to run fully-fledged scenarios on transport and energy system in Europe until 2050 was designed (for a more detailed description see input note to the GHG-TransPoRD Final Conference):

a) **MAX_E&M**: Maximum efficiency at market conditions.
b) **EV**: Concentrate R&D and feebate scheme to promote electric vehicles.

c) **HFC**: Concentrate R&D and feebate scheme to promote hydrogen fuel cell vehicles.
d) **EV+HF:** Applying the same level of support split to promote both technologies, EV and HVC.
e) **AMB_TP**: Ambitious technology and policy scenario combining MAX_E&M and EV+HFC scenarios, adding urban and long distance policies as well as pricing policies to compensate fuel tax losses and avoid a rebound effect caused by the efficiency technologies.
f) **AMB_REG**: Adding regulation on AMB_TP scenario, in particular to ban sales of fossil fuel cars after 2035 and foster freight modal shift from road to rail and shipping.

As suggested by the stakeholders at the previous workshop of GHG-TransPoRD all policy scenarios share an ambitious structural change of the energy system towards renewable energies, which are supposed to become dominant until the year 2050. In particular the electricity generation in EU27 will be adapted such that in 2050 about 80% of electricity will be generated from renewables. Sensitivity tests have been run for different price paths of fossil fuels and for different energy taxation levels.

Findings of the GHG-TransPoRD scenarios

General findings

The transport sector can be able to reduce its GHG reductions by more than 60% until 2050 compared with 1990, under certain conditions. Today known technologies alone will not be sufficient to achieve such GHG reduction targets of -60% to -80% until 2050. Even putting ambitious pricing measures in place the achievable GHG reductions by technologies and pricing seem not to be sufficient to meet the targets. The final 10% to 15% of reductions would require either additional strong regulation or the emergence of yet unknown technologies, in particular for road and air transport. Strong regulation should comprise a ban of selling fossil fuel cars after 2035 (like with the electric light bulbs) and freight modal-shift from road to rail and shipping.

Timing and role of modes

The Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA) both emphasize the requirement for a peak of GHG emissions during the decade until 2020. This means early reductions of GHG emissions from European transport will be preferential compared with later reductions. In the next two decades only road mode will be able to contribute both significant **and** early GHG reductions. The other modes will mainly rely on operational measures to reduce their GHG emissions during that period due to slow fleet turnover.

Balance of R&D and transport policies

The relevance of achieving GHG reductions by R&D policy and/or by transport policy differs between the modes. R&D support seems in particular relevant for biofuels, due to less advanced development status of second and third generation biofuel technologies, the high number of production pathway options and the political requirements to comply with minimum GHG reductions, to avoid competition with food and indirect land use changes. All such aspects bear a significant risk of failure of any R&D.

Transport policy will be in particular more important than R&D support to foster the GHG reduction potentials of rail transport. These will work through modal-shift from road towards rail, and also shipping where possible, i.e. shifting demand from a more energy intense mode to a less energy intense mode. Providing intermodal interfaces (soft- and hardware) as well as relieving bottlenecks of freight rail would be important measures.

GHG reductions in road, air and shipping mode will be driven by both, R&D policy and transport policy, such that for these modes R&D and transport policy should be designed to be aligned to each other. For some modes R&D would be concentrated on one or only a few technologies. In particular significant GHG reduction of air transport seems to rely strongly on the development and availability of biofuels for use in air transport.

Sensitivity and links to energy system

Transforming the energy system towards a largely renewable based system until 2050 is a pre-requisite to achieve large GHG reductions of transport. Underlying the scenarios of GHG-TransPoRD is a European electricity system generating 80% of electricity from renewables in 2050.

Increasing oil prices support the reduction of GHG emission of transport making a larger number of efficiency and/or non-fossil based technologies cost-competitive. Testing 80% higher oil prices on top of several scenarios revealed up to 5% points higher reductions of GHG emissions. Undertaking the same test with scenarios including as a second element higher transport taxes the supportive effect of higher oil prices would disappear gradually the higher the tax levels have been raised.

Recommendations of GHG-TransPoRD

The following paragraphs summarize key recommendations presented to the final conference. More detailed recommendations will be part of the final report(s) of GHG-TransPoRD project.

Road transport

Car transport bears the largest GHG reduction potentials within the shortest time horizon. The scenarios indicate that CO_2 emission limits for the average new car and applying tank-to-wheel calculation (i.e. one electric car counts as one car with 0 gCO_2/km emissions) should be in the range of 70 to 90 gCO_2/km for 2020 and 50 to 60 gCO_2/km for 2030. Two different pathways could achieve that: (1) implementing all available efficiency technology for internal combustion engines cars (ICE), and (2) combining a cost efficient GHG efficiency strategy for ICEs with alternative fuels strategy (i.e. EV and HFC). The latter are required in the long run and thus the 2^{nd} pathway would be recommended. It requires pricing incentives to promote market introduction of EVs and HFCs i.e. by feebates, strongly differentiated registration or circulation taxes. However, significant GHG reductions can only be expected in the long run when the energy system is renewable.

For truck transport priority should be on implementing efficiency technologies. 40% efficiency improvement until a time horizon 2020-2025 seems feasible at an extra cost of 25%. Biofuels could play a limited role for heavy trucks, while for medium-size trucks CNG/biogas would be relevant options.

The innovation system analysis has proven that road transport is the largest investor of private R&D. Policy-making should thus concentrate on guiding these R&D investments by reliable regulation providing targets and certainty for investments.

Air transport

In the short term GHG reductions of air transport will have to come from operational measures, including the installation of the SESAR system. For air transport biofuels come close to being the silver bullet to significantly reduce GHG emissions until a time horizon of 2050. Additionally the open rotor technology should be developed for use in freighters and medium distance passenger aircraft. Both will require substantial R&D support. The latter could pave the way for new plane design in the form of blended-wing bodies, though these should become technology ready only after 2050 and bear high R&D expenditures and risk.

In parallel to such an R&D strategy it seems reasonable to prepare the grounds for demand management measures, such that if the R&D activities should fail as well as if the ICAO GHG emission targets would not be achieved demand management e.g. via pricing measures could be implemented around 2030. This would imply to work on adapting international agreements such that either energy taxes or emission taxes, ticket taxes and/or value-added taxes become policy options as the case for the other modes.

Ship transport

In the short-term ship GHG emissions can be reduced largely by operational measures, of which the most effective is slow steaming. Long-term setting efficiency standards for new ships, as proposed by the Energy Efficiency Design Index (EEDI), constitutes an important policy. This should be supported by R&D on the one hand focussing on incremental improvements by optimising rudder and propeller as well as by adapting the ship surface and using renewable energies (e.g. wind energy). On the other hand step changes could be achieved by R&D support to develop new design of ship hulls.

Rail transport

Most important for GHG reductions of rail transport is to enable modal-shift by increase of capacity and attractiveness. This holds for freight transport requiring to build dedicated rail freight infrastructure at certain bottlenecks including intermodal terminals and to support collaborative logistics to increase bundled volumes on long distance connections. For passenger rail transport the extension of a high-speed rail network well connected to regional feeder networks is the key, though it seems not always be required to run on top speeds. Continuing electrification is an ongoing activity incrementally improving the GHG efficiency of rail.

Cross-modal transport

Using the optimal vehicle for each transport purpose bears high potentials of GHG reductions. This will effect modal-split and requires innovations both in operations and enabling technology. However, the agents in cross-modal transport have low incentives to innovative and act under strong market pressure such that R&D support is required to foster cross-modal transport. For freight transport this means to develop a consensus roadmap and involve SMEs in such activities. For passenger transport the concept of a seamless multi-modal urban passenger transport system (fifth mode) seems to be most important.

Biofuels

The policy side of developing biofuels is important to establish criteria that guarantee minimum GHG reductions strengthened over time and avoid competition with food as well as indirect land use changes. It seems that developing sustainable biofuels for air transport should be prioritised due to limited number of GHG reduction options of air transport. For specific biofuels the potential mismatch between supply and demand should be taken into account. This holds for bioethanol and biogas, both generating a supply that in the analysed scenarios was larger than demand from the road vehicle fleets.

R&D support should focus on developing biofuels for air transport as well as developing the second generation (i.e. whole crop, non-food crops, residues) and third generation (i.e. algae) of biofuels.

Summary of comments of the panel

The car industry highlighted that they are ready to bring the technologies proposed by GHG-TransPoRD to the market in the next years. Examples include battery electric city cars, efficient internal combustion engines (ICE), plug-in hybrids and hydrogen fuel cell vehicles. Of course, regulatory framework and market demand must suit to the ramp-up plans.

For passenger cars the European objective of achieving 95 g CO_2/km as average of the newly registered car fleet in 2020 was seen as a reasonable target. For trucks efficiency gains of 20% would be feasible in the next decade, i.e. until 2020. This considers the introduction of Euro VI standards, but in some cases builds on improved aerodynamics that requires adaptation of truck shape and length.

Important policy recommendations were to implement GHG/energy performance standards for road vehicles, including standards for trucks. This was seen as the most important single measure. Setting low carbon fuel standards like in California, was also seen as very important and here it was highlighted that a collaboration of California/US, the EU and preferably other global actors will be important to increase effectiveness and acceptance of such a measure. The presentation about the Californian policy model brought-up two further interesting concepts: (1) the application of a cap-and-trade system including road transport (upstream), and (2) the establishment of an independent expert board responsible to develop effective policies for reduction of pollution and GHG emissions of transport (CARB = California Air Resources Board).

GHG reduction targets proposed by GHG-TransPoRD

Building on the scenario calculations and in line with the aforementioned policy recommendations the GHG-TransPoRD project proposed the GHG reduction targets for transport as presented in Table 1. The targets are defined by mode as well as for the total transport sector. The table contains in the upper part reduction targets referring to a GHG emissions base calculated for the year 2010, as the measures implemented and tested in GHG-TransPoRD commence in 2011. The lowest row then presents reduction targets for total EU27 transport in comparison with 1990, which is the base year usually applied in climate policy.

It should be pointed out that Table 1 reports on absolute values of GHG emissions such that targets e.g. for rail transport and road freight transport consider modal-shift from road to rail.

Table 1: GHG reduction targets by mode for EU27 compared to emissions of 2010 and proposed by GHG-TransPoRD

		2020	**2030**	**2050**
Road	Passenger	-20% to -30%	-40% to -55%	-70% to -85%
	Freight	-10% to -20%	-30% to -45%	-40% to -60%
Air		0% to -5%	-10% to -20%	-40% to -55%
Ship		(+15% to 0%)	(+30% to 0%)	(+50% to -20%)
Rail		+10% to -10%	0% to -20%	-10% to -35%
Transport	(excl. ship)	-10% to -20%	-40% to -50%	-70% to -90%
EU27 target against 1990				
Transport	**vs. 1990**	+10% to +5%	-20% to -30%	-60% to -70%

Source: GHG-TransPoRD.