EU Transport GHG: Routes to 2050 II

Development of a better understanding of the scale of co-benefits associated with the transport sector GHG reduction policies

Charlotte Brannigan, AEA

29 June 2011, Diamant Conference Center, Brussels

www.eutransportghg2050.eu

Partners

AEA

CE Delft

Transport and Environmental Policy Research

TNO innovation for life

Overview

- Introduction.
- Overview and approach to the selected co-benefits considered in Task 1.
- Summary and next steps.

Introduction – Task 1

- Previous *EU Transport GHG: Routes to 2050?* study indicated co-benefits of policies to reduce transport sector GHG emissions could be significant.
- Further research required.
- *EU Transport GHG: Routes to 2050?:*
  - Development of calculation functionality in SULTAN tool allowing users to examine the impacts of transport sector GHG policies on emissions of NO_X and particulate matter.
  - Initial work on energy security;
- Recognise a need to quantify the benefits as far as possible.
- Focus on four areas of co-benefits.

Introduction – Task 1

- **Objective:** To develop a better understanding of the co-benefits associated with possible transport sector GHG reduction policies

- **Outputs:**
  - Develop a better understanding of air quality co-benefits;
  - Development of an understanding of the noise co-benefits of specific relevant GHG abatement policies;
  - Understanding of the health co-benefits of specific GHG abatement policies;
  - Estimates of the energy security implications of different abatement options, using new quantitative data for the key assessment criteria;
  - Identification of the relative values of the different co-benefits; and
  - Paper presenting the task findings from all of the above, and will provide the basis of a chapter in the final report.

- **Partners:** AEA (Lead); CE Delft and TNO.

Air quality co-benefits of GHG reduction policies

- Air quality co-benefits widely reported - consider selected elements in more detail.
- Review of developments with respect to air pollutant emissions from transport in the BAU scenario.
  - Consider full penetration of Euro 6 vehicles in European fleet.
  - Possible development of Euro standards beyond Euro 6.
- Review of development of non-exhaust air pollutant emissions for conventional and non-conventional vehicles:
  - Regenerative braking systems –reduced PM.
  - Tyre wear.

Air quality co-benefits of GHG reduction policies

- Review of potential impacts of technical and non-technical GHG reduction options (new propulsion systems, energy carriers, road transport):
  - Indirect emissions from production of electricity and hydrogen;
  - Hybrid vehicles
  - Use of biofuels
  - Measures affecting driving profiles
  - Non-technical policy measures (economic instruments, infrastructure and spatial policy, traffic management and speed, information/awareness measures)

- Bring these elements together to undertake a more in-depth quantitative exploration of the potential overall impacts of a limited number of selected GHG reduction options on overall air pollutant emissions from transport.

Environmental noise co-benefits of GHG reduction policies

- Environmental Noise Directive (2002/49/EC) adopted in 2002 to tackle noise problems across the EU.
- MSs required to produce noise maps for agglomerations and for major transport links, including major roads, railways and airports.
- Noise generation from road/rail influenced by:
  - vehicle type,
  - speed,
  - traffic intensity,
  - road/track type; and
  - road/rail surface conditions.

- Time and route of operation is also a factor that determines exposure levels (e.g. night time freight haulage issues).

Environmental noise co-benefits of GHG reduction policies

- Environmental noise - major impact on health, as described in the 2011 WHO report on health effects [WHO report Burden of disease environmental noise 2011].
- Even those who do not state to be annoyed may still be health affected if highly exposed.
- The number of people affected by road traffic noise are considerably higher than for railway noise.
- Venoliva study – estimates made of numbers of people affected by road traffic noise as a function of proposed new vehicle noise limits:
  - In 2010 around 90% of the EU27 population of 500 million is exposed (L_{DEN}>40 dB(A)) to road traffic noise.119 million are annoyed, 55 million are highly annoyed. 60 million are estimated to be sleep disturbed and 27 million highly sleep disturbed.
  - For railways, numbers of people exposed, annoyed and sleep disturbed are estimated at a factor of around 5% of the figures for road traffic noise, so 23 million exposed, 6 million annoyed, 3 million highly annoyed, 3 million sleep disturbed and 1 million highly sleep disturbed.

Environmental noise co-benefits of GHG reduction policies

- Environmental Noise Directive (Directive 2002/49/EC)
- Road Vehicle Noise Limits (Directive 70/157/EC)
- Tyre Noise limits (Directive 2001/43/EC)
- Outdoor machinery noise limits (Directive 2001/14/EC)
- Railway vehicle noise limits (Directive 2002/735/EC (high speed) and 2006/66/EC (conventional rail including freight wagons)

Environmental noise co-benefits of GHG reduction policies

- Range of abatement options relevant to environmental noise:
  - Regulations and incentives for energy saving and emission reducing vehicle design, including electric, hydrogen and hybrid powertrains, tyres with less rolling resistance, reduced aerodynamic drag;
  - Regulations on enforcement including MOT and spot checks on vehicle condition and emissions;
  - Incentives to reduce use of older vehicles such as scrapping or retrofit programmes;
  - Tax incentives to encourage purchase of environmentally friendly vehicles;
  - Activity reducing policies, such as road closing in city centres and encouraging use of public transport;
  - Restrictions on access times, location or routing for vehicles with lower environmental performance;
  - Campaigns and incentives to encourage energy efficient driving.
- Effects on noise in terms of driving behaviour and management, vehicle design, traffic flow control, infrastructure measures, legislation and incentives.

Health co-benefits of GHG reduction policies

- Health-related co-benefits:
  - Improved **air quality** due to lower levels of pollutant emissions from transport;
  - Reduced **noise** levels due to reduced noise from transport;
  - Reductions in the number and severity of traffic **accidents**;
  - Increases in the amount of **physical exercise** taken by people due to a shift in non-motorised transport modes (walking and cycling); and
  - Indirect effects related to the **life cycle effects** of vehicles, energy carriers or infrastructure.
- Air quality and noise covered in subtasks of Task 1 and life cycle effects covered in Task 2.
- Focussing on health impacts from accidents and physical exercise.
- Analyse:
  - The way GHG policies for transport induces these effects; and
  - Impacts of these effects on human health.

Health co-benefits of GHG reduction policies - Physical exercise

- Physical exercise:
  - Recommended adults achieve a minimum of 30 mins/day moderate intensive exercise, five or more days a week.
  - Health effects of inactivity include mortality, cardiovascular diseases, Type 2 diabetes, cancer, overweight/obesity, and mental health and well-being issues.

- Quantification and monetisation of health effects of physical (in)activity:
  - Review of current studies.
  - Benefits expressed in different ways, including higher life expectancy, impacts on average BMI, disability-adjusted life year (DALY).
  - Economic studies to value the benefits from extra cycling and walking per year or per km.

Health co-benefits of GHG reduction policies - Physical exercise

- Quantification of health effects of physical (in)activity:
  - De Hartog et al (2010) – health benefits of cycling larger than estimated health risks of driving a car.
  - MacDonald et al (2010) - effect of using light rail transit (LRT) on obesity, BMI, and weekly recommended activity levels – positive links identified related to walking to station.
- Monetisation of health effects of physical (in)activity:
  - SQW (2007) study – identified the costs of inactivity and obesity for England.
  - NZ Transport Agency (2008) – monetised the benefits of increased physical activity of non-motorised transport modes.
- Indicative estimates for the total potential benefits for the EU can be calculated based on figures from these studies for various scenarios.

Health co-benefits of GHG reduction policies - Accidents

- Accident drivers:
  - Speed (accident risk / accident severity).
  - Traffic volumes.
  - Vehicle characteristics.
  - Infrastructure.
  - Other drivers.

Health co-benefits of GHG reduction policies - Accidents

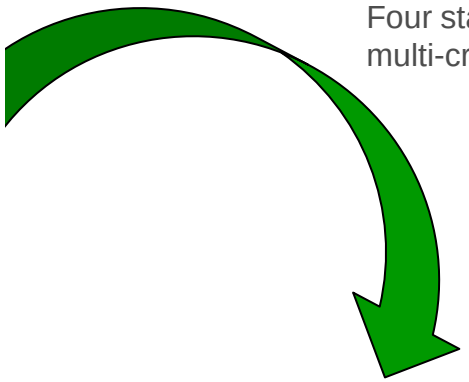
- Speed limits:
  - Probably result in lower accident risks and less severe accidents.
- Road charging:
  - Contribute to improvement in traffic safety – ex-ante studies on road pricing in the Netherlands (although London/Stockholm studies did not produce statistically significant results).
- Vehicle standards:
  - Standards leading to reduction in mass of vehicles will probably result in lower severity of accidents – decrease in mass difference which is an important driver of accident severity.
  - Hybrid/electric car introduction on a mass scale in the fleet may result in higher accident rates, as these vehicles may not be audibly detectable by pedestrians and cyclists.
- Policy instruments stimulating modal shift to slow modes and public transport:
  - Shift from car to bicycle – increase in fatalities/injuries.
  - Shift from car to public transport – slight improvement in traffic safety.

Energy security co-benefits of GHG reduction policies

- Report 1: “Energy Security and the Transport Sector”
  - Overview of energy security issues as they relate to the transport sector;
  - Extent to which the supply of energy for the transport sector is secure (qualitative – current/future situation);
  - Review of existing approaches to quantifying energy security benefits associated with GHG abatement options;
  - Development of a new framework approach for quantifying the energy security benefits/impacts of transport sector GHG abatement options.
- Full quantification not possible – semi-quantitative analysis undertaken using a qualitative scoring system allowing GHG options to be ranked.
- This task concerned with:
  - Improving the quantitative datasets for a range of parameters; and
  - Investigating the impacts of energy security of using different methods to produce alternative transport fuels.

Energy security co-benefits of GHG reduction policies

Abatement option	Linkage to oil price (OCF)	Proportion of current vehicle fleet able to use the fuel	Fuel Cost (€/MJ)	Suscept-ibility to disruptions (extreme events and inadequate market structures)	Surplus supply capacity	Resource concent-ration of energy source
Gasoline/ diesel	1.3	HIGH	MED	MED	MED	MED
LPG	1.2	LOW	MED	MED	MED	MED
NG	0.8	LOW	MED	HIGH	MED	HIGH
Biofuel blends and fungible types	0. 5	HIGH	HIGH	MED	LOW	LOW
Pure non-fungible biofuel[1]	0.5	LOW	HIGH	MED	LOW	LOW
Hydrogen[2]	0.8	LOW	MED	HIGH	MED	
Electricity	0.5	LOW	LOW	HIGH	HIGH	
Energy demand reduction	1.3	HIGH	MED	LOW	HIGH	



Four stages in the multi-criteria analysis

Transport Policy Option	Total MCA score (maximum 600)	MCA score as a percentage	Rank
Energy demand reduction	450	75%	1
Electricity	400	67%	2
Biofuel blends and fungible types	350	58%	3
Gasoline/diesel	300	50%	4
Pure non-fungible biofuel[1]	250	42%	5
LPG	213	35%	6
Natural gas	163	27%	7
Hydrogen (produced from natural gas)	163	27%	7

Energy security co-benefits of GHG reduction policies

- Initial work undertaken identifying the relevant datasets. Currently in the process of identifying quantitative data (as far as possible) on the following:
  - Linkage between price of new energy source and oil price (oil cost factors / OCF).
  - Proportion of fleet able to use new energy source.
  - Cost of new energy source compared to oil.
  - Susceptibility of new energy source to supply disruptions.
  - Resource concentration for the supply of the new energy source.
- Incorporate quantitative data into a MCA framework to undertake a comprehensive assessment of energy security implications of different GHG abatement options.

Task 1 – Next Steps

- Update and finalise report chapters on co-benefits (August 2011).
- Start to develop final chapter: “Indications of the relative values of the different co-benefits”.
  - Not possible to monitise all of the benefits identified to compare resulting values within this study.
  - Would need to access information on geographical noise impacts and population densities in vicinities of relevant noise impacts – only historical information exists, and future projections would involve a lot of research.
  - No readily available methods to monetise energy security impacts.
- Therefore, develop semi-quantitative method for comparing relative values of co-benefits.
- Take into account evidence on the scale and importance of each co-benefit to the wider community of EU.
- Draw upon previous research on monetised benefits and impacts to develop relative ranking for different co-benefits.
- Take onboard updated SULTAN and scenarios (e.g. NOx, PM and Energy security, once they have been integrated).

This project is funded by the European Commission's Directorate-General Climate Action

EU Transport GHG: Routes to 2050 II

Development of a better understanding of the scale of co-benefits associated with the transport sector GHG reduction policies

Charlotte Brannigan, AEA

29 June 2011, Diamant Conference Center, Brussels

Partners

AEA

CE Delft

Transport and Environmental Policy Research

TNO innovation for life