



EUROPEAN PARLIAMENT
Directorate-General for Internal Policies of the Union

STUDY

Policy Department
Structural and Cohesion Policies

ENERGY AND ENVIRONMENTAL ASPECTS OF THE TRANSPORT POLICY

EXECUTIVE SUMMARY

TRANSPORT AND TOURISM



ΕΒΡΟΠΕΪΣΚΙ ΠΑΡΛΑΜΕΝΤ ΠΑΡΛΑΜΕΝΤΟ ΕΥΡΟΠΕΟ ΕΥΡΟΠΣΚΪ ΠΑΡΛΑΜΕΝΤ ΕΥΡΟΠΑ-ΠΑΡΛΑΜΕΝΤΕΤ
ΕΥΡΟΠΆΙΣΧΕΣ ΠΑΡΛΑΜΕΝΤ ΕΥΡΟΟΡΑ ΠΑΡΛΑΜΕΝΤ ΕΥΡΩΠΑΪΚΟ ΚΟΙΝΟΒΟΥΛΙΟ EUROPEAN PARLIAMENT
PARLEMENT EUROPEÉEN PARLAIMINT NA ΗΕΟΡΡΑ ΠΑΡΛΑΜΕΝΤΟ ΕΥΡΟΠΕΟ ΕΙΡΟΡΑΣ ΠΑΡΛΑΜΕΝΤΣ
ΕΥΡΟΡΟΣ ΠΑΡΛΑΜΕΝΤΑΣ ΕΥΡÓΡΑΙ ΠΑΡΛΑΜΕΝΤ ΙΛ-ΠΑΡΛΑΜΕΝΤ ΕΥΡΟΡΕΥ ΕΥΡΟΡΕΕΣ ΠΑΡΛΕΜΕΝΤ
ΠΑΡΛΑΜΕΝΤ ΕΥΡΟΡΕΪΣΚΙ ΠΑΡΛΑΜΕΝΤΟ ΕΥΡΟΡΕΥ ΠΑΡΛΑΜΕΝΤΥΛ ΕΥΡΟΡΕΑΝ
ΕΥΡÓΡΣΚΥ ΠΑΡΛΑΜΕΝΤ ΕΥΡΟΡΣΚΙ ΠΑΡΛΑΜΕΝΤ ΕΥΡΟΟΡΑΝ ΠΑΡΛΑΜΕΝΤΤΙ ΕΥΡΟΡΑΠΑΡΛΑΜΕΝΤΕΤ

Directorate General Internal Policies of the Union

Policy Department Structural and Cohesion Policies

TRANSPORT AND TOURISM

ENERGY AND ENVIRONMENTAL ASPECTS OF THE TRANSPORT POLICY

STUDY

Provisional Version

IP/B/TRAN/FWC/2006-156 Lot7

September 2007

PE 389.598

EN

This note was requested by the European Parliament's Committee on Transport and Tourism.

This paper is published in the following language:

- Original: EN.

Author: TRT TRASPORTI E TERRITORIO (Italy)

Responsible Official: Ms Eva Casalprim-Calvés
Policy Department Structural and Cohesion Policies
European Parliament
Rue Wiertz 60
B-1047 Brussels
E-mail: ipoldepb@europarl.europa.eu

Manuscript completed in September, 2007.


This note is available at Intranet:

<http://www.ipolnet.ep.parl.union.eu/ipolnet/cms/lang/en/pid/456>

Brussels, European Parliament, 2007.

The opinions expressed in this document are the sole responsibility of the author and do not necessarily represent the official position of the European Parliament.

Reproduction and translation for non-commercial purposes are authorized, provided the source is acknowledged and the publisher is given prior notice and sent a copy.





ЕВРОПЕЙСКИ ПАРЛАМЕНТ PARLAMENTO EUROPEO EVROPSKÝ PARLAMENT EUROPA-PARLAMENTET
EUROPÄISCHES PARLAMENT EUROOPA PARLAMENT ΕΥΡΩΠΑΪΚΟ ΚΟΙΝΟΒΟΥΛΙΟ EUROPEAN PARLIAMENT
PARLEMENT EUROPÉEN PARLAIMINT NA HEORPA PARLAMENTO EUROPEO EIROPAS PARLAMENTS
EUROPOS PARLAMENTAS EURÓPAI PARLAMENT IL-PARLAMENT EWROPEW EUROPEES PARLEMENT
PARLAMENT EUROPEJSKI PARLAMENTO EUROPEU PARLAMENTUL EUROPEAN
EURÓPSKY PARLAMENT EVROPSKI PARLAMENT EUROOPAN PARLAMENTTI EUROPAPARLAMENTET

Directorate General Internal Policies of the Union

Policy Department Structural and Cohesion Policies

TRANSPORT AND TOURISM

ENERGY AND ENVIRONMENTAL ASPECTS OF THE TRANSPORT POLICY

STUDY

Provisional Version

Content:

The aim of this study was to identify economic and politically feasible measures able to significantly enhance energy efficiency and to reduce negative impacts of transport activities.

The study was based on an in depth literature review on recent statistics, studies, notes etc. focusing on the analysis of the different impacts as well as the consequences of the emissions caused by different modes of transport and the suggested recommendations on how tackle the related problems. The literature review allowed to identify the most promising and cost efficient short, medium and long term measures with particular attention to the energy and new technology developments.

IP/B/TRAN/FWC/2006-156 Lot7

PE 389.598

EN

EXECUTIVE SUMMARY

The aim of this study was to identify economic and politically feasible measures able to significantly enhance energy efficiency and to reduce negative impacts of transport activities.

The study started with an in depth literature review on recent statistics, studies, notes etc., focusing on the analysis of the impacts of the emissions caused by different transport modes and of the suggested recommendations on how to tackle the related problems. The literature review allowed to identify the most promising and cost efficient measures in the short, medium and long term, with particular attention to technology developments. The study was carried out considering primarily atmospheric emissions (NO_x, SO₂, CO, PM₁₀, PM_{2,5}) and greenhouse gases.

Methodology

The study was divided in two parts, part I dedicated to the analysis of technical databases, policy documents and scientific literature and part II devoted to the presentation of advantages and disadvantages of the identifies measures with the support of an analytical framework.

In order to give evidence to the complexity of the issues at stake, part I of the study is divided in four chapters: the development of passenger and freight transport demand, the quantification of energy consumption and pollutant emissions, the analysis of developments in vehicle technology and fuels and the review of the policy documents, which in turn distinguishes between the scrutiny of the EC policy action already in place and the suggestions from the scientific literature and national experiences. The main sources of information were:

- EUROSTAT and DG TREN “Keep Europe Moving” for the development of freight and passenger demand,
- EUROSTAT, GHG inventories sent by EU countries to UNFCCC, PRIMES, TREMOVE and RAINS/GAINS models, EEA TERM reports and the EMEP emission database for energy consumption,
- Car Manufacturers' Association (ACEA), scientific boards and research institutes (IEA, FAO, EUCAR, EC JRC, JRC-IPTS, EMPA, ACARE for vehicle technology and fuel innovation;
- Most recent EC documents and communications as well as a series of recent studies (ECMT 2007 data-base, London Department for Transport 2004, Wuppertal Institute 2005, Banister 2006, TNO 2006, Joint Expert Group on Transport and Environment 2006, Stern 2006, IPCC 2007 and ERTRAC 2007) for the review of the policy actions in place and the suggestions from the scientific literature.

Part II of the study discusses the policy measures with the objective of identifying the most promising ones from the point of view of cost effectiveness, feasibility and suitability. The three chapters of Part II include the classification of measures into nine policy packages, their analysis from different perspectives (the targeted transport mode, the expected type of effect, the relevance of the impact, the time horizon and the reference area for the implementation, the concerned institutional level, either local, national or European, the stakeholders involved and the cost effectiveness) and eventually the final recommendations.

Policy packages and measures

Policy packages	Measures	Descriptions
Technological improvements (Vehicles and fuels)	Reduction in emissions and fuel consumption	New target CO ₂ emissions: car 120g/km and vans 175 g/km to 2012 - COM (2007) 19
	Reduction in vehicle and engine resistance factors	Measure aimed to change design to reduce weight and consumptions
	Increase efficiency in automotive	Efficiency requirements automobile air conditioning system
	New tyre (energy efficiency)	Labelling scheme for tyre
	Labelling scheme of car fuel	New labelling scheme amended car fuel efficiency directive (1999/94EC)
	R&D	Support projects improve vehicles 40% CO ₂ reduction
	Energy innovation	Alternative fuel, second generation of biofuel able to reduce CO ₂ and air pollution emissions
	Efficiency energy	Improve, accelerate development research
	Ecolabel	Environmental certification
Pricing and taxation	Taxation reform	Link taxes on passenger cars to CO ₂ emission level (tax large cars/SUVs more strongly)
		Fiscal incentive to encourage the cleanest light duty vehicles classes
		Explore possibility of Emission Trading Scheme
	Toll system HDV (freight)	Amended "Eurovignette" Directive (1999/62) based on vehicle air emissions
		In congested corridor and sensible areas (i.e. Alpin region)
	Toll roads in congested corridors	Internalising external costs of transport (such as: congestion and environmental costs)
	Road pricing in urban and metropolitan area	Congestion pricing, value pricing, road tolls and HOV lanes
Parking tariffs/pricing	Charging motorists directly for parking	
Tradable mobility credits	Tradable permit schemes among city users	
Long distance travel (passengers and freight)	Rail Interoperability	Improving the seamless movement of trains across the European rail network, both on High Speed and conventional rail networks
	Legal framework	Increase rail market share providing fair competition (harmonising regulation system across EU)
	Rail efficiency	Increase technical unit efficiency of rail
	Rail service quality (passenger)	Stimulating rail usage by increasing the quality (rolling stock, ICT, ticketing, etc.)
	Intermodal facility for passengers	Develop service integration by mode (train, air, maritime, road) and trip (long/short distance)
	Intermodal facility for freight	Intermodal loading units and freight integrators. Freight facility incentives to offset the capital costs of providing rail freight handling and operating facilities
	Rail efficiency and capacity	Improve rail capacity by using advantage technology in key corridors (metropolitan areas) and rail bottlenecks

Policy packages	Measures	Descriptions
Liveable cities (urban policy)	Improve public transport services: bus and LRT and commuters services	Systems providing high quality PT service and convenient Light Rail Transit on urban corridors
	Regulation incentive effectiveness	Policy changes to encourage transport service competition, innovation and efficiency
	Park&Ride facilities and access to PT	Providing convenient parking at transit and rideshare stations
	Walking and cycle facilities	Strategies for improving bicycle transport and walking conditions
	Transport demand management	Develop car sharing and car pooling services as a substitute for private vehicle ownership and encourage ridesharing
		Commuting and school travel planning that encourage more efficient transport mode (shift from car to public transport and environmental mode)
	Planning	Land use, environmental and transport integration, reduction of urban sprawl, encourage the LEZ (Low Emission Zone)
ICT (Information Communication Technology)	Telematics, informatics available locally	ICT applications to the transport system (real time travel information, travel planning)
	Teleworking/ teleconferencing	Use of telecommunications as a substitute for physical work travel
	Telebanking/teleshopping	Use of telecommunications as a substitute for physical travel
	Research and Development	Application and technology including Galileo programme
Eco-friendly	Ecological driving (speed limits)	Strategies for improving driving behaviour, energy-efficiency and traffic safety among drivers
	De-marketing of car	Campaign to de-market cars to change public attitudes and develop environmental certification (ecolabels)
Logistics	Logistic management (integrated supply chain)	Strategies to improve the efficiency of freight transport and storage
	City logistics (freight distribution centres and regulation)	Strategies to improve the efficiency of freight distribution in urban areas
	Increased load factor	Strategies to optimise the load capacity of freight vehicles
Air and Maritime	Emission trading	Emission charging schemes in which an auction serves as permit distribution mechanism
	Fuel tax escalators	Increasing fuel taxes to achieve TDM objectives
	Ecological tax reform	Fiscal policy to promote ecologically sustainable activities via economic incentives
	Carbon tax	Tax on energy sources which emit carbon dioxide into the atmosphere
	Environmentally differentiated fees and charges at terminals	Differentiate terminal fees and charges according to the level of pollutants emitted/discharged and noise produced mainly by ships, aircrafts and trains

Source: TRT.

The Quantification of the Transport Impacts

About one third of the final energy consumption in the EU-25 is related to transport (excluding maritime transport and pipelines) reaching 352 million tonnes of oil equivalent (Mtoe) in 2004. Road transport is by far the dominating sector consuming nearly 83% of the energy used for transport purposes.

The transport market today is almost entirely dependent upon oil-based fuels and is responsible for about 70% of the final oil demand in the EU-25. The fuel mix is slightly changed in terms of importance of renewable energy sources (RES): looking at 2005 figures, almost 1% of the final energy consumption in transport is shifted from oil-based fuels (97%) to biofuels, with electricity energy having a stable 2%. The share of oil-based sources was 98% in 1990.

Emissions from the transport sector are a significant and growing contribution to EU overall greenhouse gas emissions: in 2005 transport contributed to total GHG emissions (CO₂, CH₄, N₂O) in the EU-27 for a 24,1% (including international aviation and maritime transport and excluding land-use change and forestry activities which can remove greenhouse gases or reduce emissions). What worries more is not its actual share on total GHG emissions but the past and expected trends. Between 1990 and 2005, emissions from transport increased by 26% in the old 15 Member States reaching 880 Mt, and is expected to continue to grow due to the trends in passenger and freight transport demand.

Transport contribution to air pollution is also significant, but thanks to innovations in exhaust gas treatment in road vehicles (induced by the introduction of EU standards), improved fuel quality (especially reduced sulphur concentration), increased electrification of EU railways emissions of harmful substances from land transport have decreased significantly between 1990 and 2004.

The Need of a Consistent Mix of Policy Measures

The problems due to the current levels of transport emissions are serious and, without a coordinated intervention, will in some respects get worse. Only a sophisticated policy mix can respond to such a demanding challenge.

The literature review and the analysis of a number of practical actions strongly support the point of view that *to achieve substantial reductions in transport emission it is necessary to combine mutually supporting policies*, involving a variety of stakeholders.

There seems to be a general agreement that individual policies will not significantly contribute to reduce CO₂ emissions and improve air quality, and that only combined policies or policy mix including soft measures designed to raise awareness can. Policy mix can help mitigating the negative effects of a single measure, and therefore increase acceptability, can help control for rebound effects, i.e. problems of reversing the initial benefit by readjustments of individual behaviours, but the important aspects is that the combination of *push and pull* policies are able to simultaneously improve different dimensions of the transport emissions problems, The synergies of combining different measures are such that the effect of their combination is better than the sum of the effects of individual policies.

Up to now, modal shift induced by increasing the supply of competitive modes (rail, short sea shipping, inland waterways, metros, etc.) have shown to be weak in terms of CO₂ and emissions abatements, particularly for long distance travel. The reasons for this are manifold: investments in new infrastructure take a long time to be completed and therefore results become apparent after years, but the main one is that in general the shift of demand has shown to be much lower

then expected. Indeed, people and goods are reluctant to abandon the road and air mode also when they new or upgraded infrastructure of competing modes are in place, unless they are pushed by demand management integrated policies.

To reduce GHG, energy consumption and air pollution in the European transport sector a coordinated combination of individual policies is necessary. This policy mix covers all modes of transport and includes ambitious fuel-efficiency targets, improved standards for vehicles and fuels, reduction in road and air transport activity through pricing, logistics and behavioural changes. The three pillars of the mix of mutually supporting policies are:

- Technological development (use of new vehicles technologies and alternative fuels),
- Pricing (reform of taxation in the transport sector to full account for environmental impacts, Carbon tax, Eurovignette),
- Accompanying measures to optimise the use of vehicles, infrastructures as well as to promote behavioural changes.

The Relevance to focus on Selected Policy Actions

There is little strategic case for action in all places and therefore the EU policy should focus on those parts of the system that are more critical:

- (i) congested urban and metropolitan area, where the majority of passenger trips take place;
- (ii) key interurban corridors where domestic intra-EU and international trades are concentrated;
- (iii) environmental sensible areas (Alpine region, Baltic Sea, etc.).

The ways to approach the CO₂ emissions and air quality impacts of the transport sector are in many cases overlapping and this implies that there are significant synergies in tackling the two problems in a coordinated way. Air pollution policies should concentrate in urban and metropolitan areas as well as in environmental sensible areas, where the impacts are particularly high. CO₂ and in general GHG emissions are function of total transport demand and therefore urban areas and key interurban corridors are priority areas of intervention.

It might be counter-productive to call for action on all measures; priorities should be given to measures that can produce benefits in the short term, and this include the option to make the best use of the existing transport networks.

- (a) *Increase fuel efficiency for all modes of transport.* There is a general agreement that technology is the most promising and effective tool to reduce transport's pollution and GHG emissions. Nevertheless, technology progress per se is not sufficient, while the severity of the problem requires implementing also policies that produce results in the short term, including incremental improvements of the current technologies, use of electric and hybrid vehicles, train, vessels. The focus should be on increasing fuel efficiency for all modes of transport, especially air and road transport including vehicles in the Eco-design Directive and the planned Energy End-use Efficiency Directive and reducing the emission target for passenger car fleet to 120 g CO₂ per vehicle kilometre by 2012 and to 100 by 2020 and extend such an approach to cover trucks, aircraft, vessel. COM (2007) 19 underlines that in a long-term vision the Commission will support research of *“improvements in vehicle efficiency that will deliver as much a 40% reduction in CO₂ emission passenger cars for the new vehicle fleet in 2020. This would*

correspond to a new car fleet average of 95g CO₂/km". To reach this target, a system of emission credits has been proposed, see also Carbon Allowance Reduction System (CARS) recently proposed in the European Parliament Report (see also point c).

- (b) *Get the prices right so that passengers and freight face the full cost of travel and feel the consequence of their decision.* A general reform of taxation in the transport sector, clearly based on CO₂ emission and other environmental emissions, appears to be a fundamental instrument to maximise abatement of emissions. The policy should be designed in order to provide strong incentives to shift toward better performing vehicles in all transport modes: tax levels linked to energy and emission efficiency of the vehicles (lower for the most energy-efficiency, higher for the less energy efficiency), to congestion pricing on roads and to environmental pricing across modes.
- (c) *Introduce innovative measures based on the "emission trading" approach.* One argument often raised against road pricing is that imposing an additional cost to car users affect unfairly different population groups, e.g. low-income individuals that have no alternatives to using car. Technologies now allow for introducing more sophisticated *push and pull* approaches toward a more sustainable urban mobility based on a mix of "pay as you go" and rationing policies based on the possibility of trading the external costs of transport. A first step in this direction is to couple road pricing with a mechanism based on *tradable mobility credits*. Mobility credits would guarantee to everyone the freedom to move and will be differentiated according to several dimensions like the vehicle type (size, emission class), but also the supply of alternative modes. The same closed market mechanism applied on the car manufacturing side, the Carbon Allowance Reduction System (CARS), might help in obtaining substantial reduction in CO₂ emission levels (see point a): manufactures and importers will be required to pay financial penalties in proportion to any exceedance per car sold of the emissions limits. These penalties may be offset by redeemable credits awarded to newly registered passenger cars of the same manufacturer with emission below the limit value curve.
- (d) *Support modal shift from individual car to public transport, pedestrian and cycling, in urban areas and from road to rail freight transport through pricing policies and soft measures.* As stated before, urban and metropolitan areas suffer of high levels of pollution and at the same time alternatives modes to private transport are already available. A combination of pricing policies (congestion charging) and improvements in the public transport supply can significantly reduce emissions, particularly if public transport service enhancements are achieved through short-term measures, fleet renewal, bus priority, information technologies etc.
- (e) *Induce a more efficient organisation of road freight transport.* For long distance freight transport, truck-km charges have shown to be able to induce a process of rationalisation of distribution systems and logistics organisation, and thus to reduce distances optimise routing, load factors and occupancy rates. There is a general agreement that the freight distribution sector as well as logistics have still margins for optimisation and this might be exploited by taxation and charging policies strongly differentiated in order to encourage a more efficient use of the existing fleets.
- (f) *Promote more responsible behaviour of road users.* Develop eco-drive procedure in the road transport sector (freight and passenger) to reduce emission and consumption. De marketing of cars, support to car sharing and car pooling initiatives, support to green logistics, promoting eco drive ITS are all soft measures that might play a highly positive

role in strengthening the positive impacts of other hard measures and in some cases in mitigating the negative ones.

- (g) *Encourage integrated land use and transport planning.* Spatial planning at urban and regional level might play an important role in the medium long term both in slowing down the increase in distance travelled both for goods and passengers and in increasing the attractiveness of alternative modes by concentrating new developments along rail, or metro or near ports or intermodal nodes.

The actions will, inevitably, have to be adapted for specific countries, regions, urban areas whose needs and problems vary widely. As a consequence, the “weight” of each package or measure in the policy mix has to be carefully chosen in order to better exploit their potential positive impacts.

The Interaction among the Policy Actions

Looking at the synergies between the individual measures, policies might be organised into clusters and implemented according to a coherent fashion. In the *near term*, priority should be given to incremental improvements of the current technologies, use of electric and hybrid vehicles, train, vessels.

In order to be effective, the use of alternative fuels (such as natural gas, bio-fuels, electricity and hydrogen) needs to be supported in the *medium-long term* by:

- Tax incentives;
- Green research program for the second generation of bio-fuels (production of the ethanol from the cellulose);
- Extend emission targets to cover trucks, aircraft, vessel;
- Training campaign (eco-driving) for professional and common drivers;
- De-marketing campaign of the car transport mode: *How clean is your car brand? / How clean is your transport mode?*

Policies for cleaner vehicles and vehicle efficiency will take advantage and see their impacts emphasised if combined with:

- Promotion of congestion charge in cities and selected (congested) corridors;
- Incentives to increase occupancy and load factors to offset the costs of road pricing to user;
- Promotion of a CO₂ emission charge related to type of vehicle and distance travelled.

Changes in travel behaviour are an unavoidable condition for the success of the policy mix, and measures like the one listed below can help going in this direction.

- Demand management (route and parking guidance in urban areas, car sharing, work and school travel plans);
- Traffic management system and optimisation of freight transport logistics;
- Develop eco-drive procedure in the road transport sector (freight and passenger) to reduce emission and consumption.

Policy Recommendations by Transport Mode

As recently suggested by the European Commission (COM (2007) 19 and 22 final), many measures have to be implemented in order to reduce the negative impacts of **road transport** on the environment. The recommended policy process should start from technological measures for improving used and consumed products (vehicles, fuels, innovative materials), then consider process measures (such as transport flows optimisation finalised to reduce the distances covered) and economic leverages (measures of economic regulation or road pricing). The last component of such a process are the soft measures (Transport Demand Management) finalised to maximize the people-moving capability of the transportation system by influencing the time of, or need to, travel and capable of increase the feasibility of more environmental friendly modes of transport (public transport, walking and cycling, speed limits, information technology, etc.). The effectiveness of TDM measures is clearly visible in urban areas with high density of inhabitants, through actions aimed at spatially distributing urban or suburban functions, in terms of activity patterns of people in the physical setting.

Rail transport should reduce its impact on the environment thanks to two main leverages: efficiency in passenger and freight services (e.g. increased load factors and cost effectiveness of the whole transport activity) and integration in the intermodal chain. To maximise benefits, interoperability should be defined and pushed on High Speed Trains and conventional lines (including track access to terminals and main port facilities according to Directive 2004/50 /EC) on the basis of the same rationale, the same regimes and the same technical and administrative requirements.

Public transport in urban areas should be improved with a complete mix of policies, where economic measures concerning the supply are supported by proper TDM policies for managing demand in a sustainable way, with specific attention to those measures capable of reducing car use and increasing telecommuting actions (as for the Green Paper of Urban Transport).

Aviation's ecological footprint has been rising steadily in the past due to the increasing demand for air traffic and despite efficiency increases achieved through technological improvements and operative measures. There is a lack of political action to reduce environmental impacts from aviation at international level, despite the growing trend foreseen for the next decades. Added to further technological advancements, the economic regulatory leverage mixed with a price policy, including emissions trading (as proposed in the Directive EC 2006), is suggested as the best instrument to re-align the sector to a more sustainable growth.

Maritime transport (deep-sea, short-sea and inland shipping) has a wide range of measures able to reduce its polluting effects, such as technological innovations (advanced vessel/hull design concepts, low-sulphur marine bunker fuels, marine engine improvements), economic instruments (environmentally differentiated port fees and charges, fleet renewal incentives) and economic or operational measures for promoting intermodal transport (rail links connecting ports and inland terminals, bonus to shift lorries from road to sea).