EUROPEAN PARLIAMENT

DIRECTORATE GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

TRANSPORT AND TOURISM

# ECONOMIC ASPECTS OF SUSTAINABLE MOBILITY

## STUDY


### Abstract

This study highlights the economic aspects of sustainable mobility by analysing ten bundles of eco-innovations, i.e. instruments which positively enhance the environmental dimension of transport/mobility making the latter more sustainable. They comprise instruments of different types (e.g. regulatory, organisational) and across different modes and are described and analysed within an analytical framework which presents their economic as well as transport, environmental and market failure impact. Findings of the literature review are complemented by an online survey among practitioners, policy makers and experts.



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## AUTHORS

Wolfgang SCHADE
Werner ROTHENGATTER

## RESPONSIBLE ADMINISTRATOR

Kathrin Maria RUDOLF
Policy Department B: Structural and Cohesion Policies
European Parliament
B-1047 Brussels
E-mail: poldep-cohesion@europarl.europa.eu

## EDITORIAL ASSISTANCE

Nora REVESZ

## LINGUISTIC VERSIONS

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## ABOUT THE EDITOR

To contact the Policy Department or to subscribe to its monthly newsletter please write to: poldep-cohesion@europarl.europa.eu

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## DISCLAIMER

# EXECUTIVE SUMMARY

## Aim

The main aim of this study is to describe, analyse and - where possible - provide a quantitative overview of the economic effects of a series of eco-innovations relevant with a view to sustainable mobility. Based on a sound methodological approach, empirical evidence and the results of existing studies, a list of ten such eco-innovations was proposed to the European Parliament. This list comprises an inter-modal variety of eco-innovations and covers both freight and passenger transport. Based on the findings of the study, recommendations and advice for policy makers are provided.

## Background

The European Union (EU) is currently adjusting its policy framework. The Lisbon Agenda from the year 2000 has been superseded by the so-called Europe 2020 Strategy of 2010. This strategy follows a more balanced approach with the three dimensions of sustainability (economic, ecologic, social) featuring among the top three priorities:

- Smart growth (economic, ecologic)
- Sustainable growth (ecologic, economic)
- Inclusive growth (social).

Transport policy in the EU during the next decade will be shaped by the new Transport White Paper *Roadmap to a Single European Transport Area – Towards a Competitive and Resource-efficient Transport System,* which was published by the European Commission in March 2011. The White Paper describes a vision of the future sustainable transport system and important elements thereof, and includes a long list of 131 initiatives that should be implemented in the next decade(s).

The most important target of the Transport White Paper is to decrease the greenhouse gas emissions (GHG) of transport by at least 60% until 2050 compared to 1990, while maintaining a competitive and resource-efficient transport system. By meeting this target, the transport sector would support the European objective of reducing the GHG emissions of the whole economy by 80 to 95% until 2050 compared to 1990.

When the White Paper was published, the EU was still facing the ongoing impacts of the economic and financial crisis of 2008/2009. This makes it even more important to consider the economic effects of policies to promote sustainable mobility, since ideally such policies would also support the recovery from the economic crisis, even though, in the first instance, the crisis seems to be a consequence of structural failures in the economic and financial systems and not in the mobility/logistics sectors.

Looking at the economic effects it has to be considered that economic analyses in the transport sector usually focuses on two approaches: (1) If new transport infrastructure or general policies like road charging are to be assessed, a cost-benefit analysis (CBA) is performed, which applies a transport network model and usually generates the highest impacts from a user perspective, i.e. time savings or cost changes due to charges or taxes paid by the transport users (individual user and industry). (2) In recent years an alternative approach has gained importance due to the growing need to assess the impacts of new transport technologies, deployed e.g. to reduce GHG emissions. This approach

focuses on the total cost of ownership (TCO) of owning and using a vehicle and usually estimates the balance between increased investment costs and decreased energy costs from a user perspective (e.g. due to more efficient technologies deployed to save energy). However, the user perspective may neglect significant indirect effects that are relevant for actors and levels other than the transport users, e.g. the macro-economy, the distribution of impacts across social groups or across regions, global competitiveness.

When considering the economic aspects of eco-innovations in this study, therefore, it turned out that one focus of analysis is to challenge the basic assumption that the user perspective is the right and comprehensive basis for policy making concerning sustainable mobility. A second focus is to analyse whether an eco-innovation can help to relieve market failures and which of these failures can be addressed by a specific eco-innovation.

## Methodology

The study builds on the concept of eco-innovations to select potential measures to promote sustainable mobility for analysis. Such eco-innovations should alleviate the environmental impacts of transport, but this is not necessarily their main purpose. Building on this understanding of eco-innovations, the following methodological steps were carried out as reflected in the different chapters:

- First, in chapter 1 the policy background is briefly described and in chapter 2 important terminology (e.g. sustainable mobility, eco-innovations) was clarified and a general overview of the causes of market failures that could be addressed by eco-innovations provided.
- Second, based on a compilation of transport analyses and transport policy studies, various eco-innovations are assessed and the ten most important eco-innovations are analysed in detail in chapter 3. This involved:
  - The elaboration of a common analytical framework comprising a description of the eco-innovations and of the impacts on transport, the environment, the addressed market failure, the economy and, if applicable, also the specific effects of a particular eco-innovation.
  - The assessment of the ten eco-innovations along the lines of the analytical framework.
- Third, an online survey was conducted to confirm or reject the selection of the most important eco-innovations. The survey involved scientists as well as stakeholders of the transport sector, including transport users and policy makers. Highlights of the online survey are included in chapter 3, while complete results can be found in Annex III.

## Analysis and findings

Table 1 lists the ten major eco-innovations analysed by the study numbered consecutively from M1 to M10. They include a mix of general, urban and long distance measures as well as all modes, including the non-motorised modes. Both passenger and freight transport are addressed and a variety of instruments has to be applied to implement the eco-innovations.

These eco-innovations can either be implemented directly by an appropriate instrument, or indirectly by establishing framework conditions that foster the market uptake of a specific eco-innovation. In most cases a multiple instrument strategy will have to be applied consisting of instruments like taxes and charges, certificate systems, regulation and standardisation, information, labelling, marketing, fostering new technology, planning and infrastructure financing.

**Table 1: 10 major eco-innovations to promote sustainable mobility**

| No. | Area | Focus | Mode | Measure promoting sustainable mobility | Instruments |
|---|---|---|---|---|---|
| M1 | P + F | General | Road | **$CO_2$ efficiency standards for road vehicles** (i.e. cars, light trucks, heavy trucks) & accompanying package | Standards, tax&charge, information |
| M2 | P + F | General | All, road | **Internalisation of external cost** by (road) user charges – re-engineering of transport taxation | Tax&charge, certificates |
| M3 | P + F | General | All | **Carbon-neutral fuels**: e-mobility for road vehicles (i.e. includes hybrids, pure battery electric vehicles, hydrogen fuel cell vehicles), biofuels/biomass/biogas in particular for air | Technology, regulation |
| M4 | P + F | General | Road, rail | Promoting **driver training, logistics training & education** and adjusted **operation control systems** | Information |
| M5 | P | Urban | Road, PT, NMT | New multi-modal, barrier-free **urban mobility concepts creating the "fifth mode"**, intermodal and interoperable e-ticketing | Standards, technology, marketing, planning |
| M6 | P | Urban | NMT | **Visionary planning of walking and cycling** in visionary cities - pilot projects for **carbon-free urban mobility** | Planning, information |
| M7 | P | Long distance | Rail | **High-speed rail backbone network** including connection to regional networks | Planning and financing, tax&charge |
| M8 | F | Long distance | All | **Cooperative logistics** – optimisation of logistics in company networks | Information, technology |
| M9 | F | General | Road, rail, ship | **Freight intermodality** of ship-rail-road, barrier-free, web-based multimodal promotion, integrated **trimodal transport chains** and elimination of bottlenecks | Planning, information, technology |
| M10 | F | Long distance | Ship | **Clean maritime shipping** - operational and technical measures | Regulation, technology |

*P = passenger transport, F = freight transport, PT = public transport, NMT = non-motorised transport*

**Source:** own compilation

The impacts on transport of eco-innovations can include avoided transport, shifted transport and improved transport. Avoided transport means either avoiding travelling completely, or reducing the distance of a trip by choosing a different destination. Shifted transport means choosing a more environmentally-friendly transport mode, and improved transport refers to measures improving transport efficiency, e.g. by increasing the load factor of a vehicle. In certain cases e.g. when cost impacts on TCO balance out, an eco-innovation may not have any transport impact at all.

The environmental impacts of eco-innovations in transport fall under at least one of the seven following categories: climate impact of GHG emissions, air pollution, noise, energy and material resources demand (upstream and downstream impacts), accidents, impacts on nature and the landscape as well as urban separation. Usually, an eco-innovation will address more than one of these environmental impacts at the same time.

The economic impacts of sustainable mobility can be analysed and measured from six different perspectives: user (individual user and industry), sectoral, macro-economy, societal, distributional, authority and government. Assessment methods differ for the different perspectives, as do their results.

Stakeholders from the transport industry and consumer organisations tend to focus on user costs when discussing transport policies. The usual argument is that cost reductions are positive economically as they reduce production costs and increase competitiveness, or reduce transport expenditures leaving room for other forms of consumption. Looking at the other side of the coin and applying the same simple economics, the cost reductions will increase the demand for transport, which in turn will increase the negative environmental impacts of transport, and possibly, depending on the area, also may lead to greater infrastructure scarcity and thus congestion. Considering sustainability when making policy choices means deviating from a one-dimensional assessment objective (e.g. the traditional focus on reducing user costs) and taking further dimensions into account.

A similar caveat holds for the welfare perspective which builds on conventional transport cost-benefit-analysis (CBA) and largely generates benefits from travel time savings. This approach also needs to consider the impacts on economic growth, distribution and government budgets as further economic aspects of sustainable mobility. This position has also been supported very recently by the International Transport Forum (ITF), which emphasised that "*the appraisal techniques of transport investments need an overhaul, with more of an emphasis on growth and employment than in the usual techniques of cost-benefit analysis and multi-criteria analysis*" (ITF 2011b, p. 8).

A few figures should illustrate the economic impacts of sustainable mobility from different perspectives. Taking the user perspective and estimates of $CO_2$ abatement costs for three different measures reveals a broad range of outcomes: setting $CO_2$ emission standards for new cars to 130 $gCO_2$/km in 2012 results in an abatement benefit of 100 €/$tCO_2$ for German car owners between 2008 and 2020. In contrast, the abatement cost for biofuels in 2020 would be in the range of 132 to 322 €/$tCO_2$ saved. For maritime shipping, it is estimated that 28% of $CO_2$ emissions here can be saved by slow steaming at an abatement cost of 0 €/$tCO_2$. It must be emphasised that the exact figures are strongly influenced by several parameters like oil price assumptions, the chosen discount rate or the effects of technology learning.

Findings related to the welfare perspective can be reported for the impacts of investments in walking and cycling measures, for which cost-benefit ratios between about 3 and 14 and, in outstanding cases, even up to 30 are estimated if the full impacts (e.g. improved health) are included. Taking the macro-economic perspective and looking again at setting $CO_2$ emission standards for cars in Germany, we find that GDP could be increased by EUR 30 billion in 2020 while consumers would spend EUR 79 billion less on fossil fuels over 12 years. A significant share of this saving, however, would be reduced fuel taxes, potentially leading to drastic consequences from the government's revenue perspective.

## Recommendations

Our analysis of eco-innovations reveals that a multiple instrument strategy is required to foster sustainable mobility and to reap positive economic impacts. The three most important eco-innovations, according to both our own analysis and the online survey respondents are setting $CO_2$ efficiency standards for road vehicles, internalising external costs and introducing carbon-neutral fuels to the transport sector. In the latter case, e-mobility is proposed for the road transport sector, while biofuels seem particularly relevant for air transport. These three eco-innovations share the common characteristic that they can be directly implemented by policy decisions, i.e. setting standards, defining tax levels or quotas for biofuel use, in particular for air transport, and the latter accompanied by dedicated R&D programmes.

This policy bundle creates synergies between the individual policies and will reduce the local and global environmental impacts of European transport. It will drive forward technology progress in vehicles, engines and fuel technologies and will increase energy security, both of which in turn should improve the competitive position of Europe.

A more radical, but also important, policy bundle consists of developing new urban mobility concepts – the “fifth mode” and the promotion of walking and cycling in visionary cities. Both focus on urban areas and address behavioural change. These eco-innovations also require the development of new technologies, for instance, small electrified urban vehicles, or unified and standardised integrated systems for information, reservation, usage and billing of the fifth mode. Here, the EU will have an important role to play concerning the standardisation of the integrated system, so that it can be used throughout Europe instead of ending up with a fragmented technical solution that differs from region to region.

The list of major eco-innovations also contains a different type of eco-innovation whose implementation strongly depends on adapting processes within industry. Examples include eco-driving and operation control systems, cooperative logistics and trimodal freight inter-modality. Direct policy implementation does not seem feasible for this type of eco-innovation. Instead, policy-makers would be required to establish framework conditions enabling new forms of cooperation so that shippers and the transport industry could work together to overcome barriers and increase cooperation as opposed to competition and monopolisation.

The economic aspects of sustainable mobility can be assessed from six different perspectives: user, sectoral, macro-economy, societal, distributional, authority and government. Assessment results may differ depending on the perspective taken. Assessments based on the user perspective usually dominate the discussions and decision-making. One reason is a dearth of studies in the transport field taking the macro-economic and distributional perspectives in order to capture the complete picture of economic impacts. Examples of such studies can be found in the climate policy field, which underpin the concept of a Green New Deal. Similar studies on indirect effects and systemic impacts of innovations should be done in the transport policy field.

In summary, the economic aspects of sustainable mobility are undoubtedly relevant for making policy choices. Assessing the indirect and long-term effects of transport eco-innovations properly should reveal that, in most cases, long-term benefits outweigh potential short-term losses. Thus the role of policy-making is to get the incentives right in order to overcome the short-term losses, if these exist, in order to reap the longer term benefits.