

## **Editorial**

### **Special issue: Environmentally Sustainable Transport**

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#### **1. Introduction**

In the mid-1990s, the Environment Directorate of the Organisation for Economic Co-operation and Development (OECD) started an ambitious and exciting project that became known as the Environmentally Sustainable Transport (EST) project. There were growing concerns then about transport's adverse environmental impacts, present and future, and about the contribution of trends in transport activity to the overall unsustainability of human development. In recent decades, conventional approaches to reducing transport's environmental impacts, most of them dependent on improved technology, have helped reduce environmental and health risks in OECD countries, particularly by reducing emissions of air pollutants from motor vehicles. Under currently adopted policies, emissions of all major air pollutants (VOC, NO<sub>x</sub>, CO and PM) from motor vehicle use in the OECD countries are expected to decrease dramatically, by about 70% to 90% between 2000 and 2030 (OECD, 2001).

However, projections for non-OECD world regions are much bleaker. In fact, taken as a whole, roadway emissions of CO, VOC, NO<sub>x</sub> and PM in other world regions are expected to rise over the next thirty years in almost the same proportions as OECD emissions are expected to fall (OECD, 2001). Other environmental and health impacts from greenhouse gases, noise, land-take and resource depletion in the OECD countries will increase too with the growth in transport, as likely advances in transport technology will not be sufficient to counter trends. The transport sector, in particular, is making an increasing contribution to climate change. Under current conditions and without new, stringent, measures geared to

reducing carbon emissions from transport, growth of CO<sub>2</sub> emissions from transport will be substantial in OECD countries, about 25% between 2000 and 2030. European trends are in strong contrast with the EU long-term climate objective of limiting global temperature increase to 2 degrees with respect to pre-industrial levels. This implies a reduction in European CO<sub>2</sub> emissions by 40-60% in 2025 compared to 1990 levels (Elzen et al., 2003). However, the true gravity of the transport CO<sub>2</sub> problem comes to the fore when projections for non-OECD countries are examined, especially considering the fast-growing motorisation rates in Asia. A tripling of CO<sub>2</sub> emissions is forecasted for non-OECD countries between 2000 and 2030, surpassing CO<sub>2</sub> emissions in OECD countries before 2030 (OECD, 2001).

The overall purpose of the OECD EST project was to characterise environmentally sustainable transport and establish guidelines for policies for which implementation could lead to such a transport system. Experts from Europe, North America and Asia were involved in the project. Initially, experts from nine countries worked in six project teams. The six pilot studies were represented by Germany, The Netherlands, Sweden, the Quebec-Windsor Corridor of Canada, the Greater Oslo region of Norway and the Alpine region, comprising parts or all of Austria, France, Italy and Switzerland. Later on, studies were undertaken by UNEP, Austria and the OECD under the Central European Initiative (CEI) for the Central and Eastern European economies in transition and Japan. Initiatives were also taken to start an Asian EST at an International Conference on Environmentally Sustainable Transport held in May 2003 in Nagoya, Japan.

The EST project differs from other studies on sustainable transport in a number of ways. Firstly, a wide range of very stringent environmental criteria was used to address the full range of health and environmental impacts from transport. Clearly, to achieve and maintain EST would involve dramatic overall reductions in atmospheric emissions from transport of a scale not previously contemplated, and dramatic reductions in noise emissions and in how land is used. Six criteria were selected to address local, regional and global concerns, i.e., local noise and urban air quality, regional acidification, eutrophication, tropospheric ozone, global climate change and land use. Internationally agreed goals, guidelines and standards such as the WHO guidelines for human health were used to derive operational EST criteria. For three criteria – the 80% reduction of CO<sub>2</sub> emission and 90% of NO<sub>x</sub> and VOC emissions – both the topics and the criteria were common for all country studies, while for the other three – matter, noise and land use – only the topics were common. Each country team was free to specify the actual criteria. The target year for the scenario studies was set at 2030, which represented a compromise between earlier and later dates. Part of the justification was that current problems – applicable for one or two generations and possibly requiring the same amount of time for a solution – were consistent with forecasting capabilities of existing transport and economic models in OECD countries.

In setting the CO<sub>2</sub> emission reduction goal, the project team took into account that the relative reductions in CO<sub>2</sub> emissions in OECD countries would need to be greater than otherwise necessary to allow opportunities for further economic development by non-OECD countries. Furthermore, it was assumed that the transport sector would need to comply to the same CO<sub>2</sub> emission reduction percentages as other sectors to stabilise CO<sub>2</sub> concentrations at 1990 levels. Clearly, the time frame up to 2030 is very ambitious for some EST criteria to be met. However, the use of stringent environmental criteria fitted in with the aim of the EST project, i.e. to explore what an environmentally sustainable transport system could look like, and to examine feasibility, societal impacts and policy implications.

Furthermore, the EST project was based on a 'backcasting' approach, in contrast to traditional sustainable transport studies that focus on doing what is necessary to achieve a desired future rather than how to avoid an unwanted future. The backcasting approach seemed preferable because of the major departure from current trends that had been envisioned. Explicit attention was also paid to policy strategies and to the time-paths of events necessary to meet the criteria, and the social and economic implications of EST were addressed. The papers contributed to this special issue should help us understand the concept of EST, the importance and effects of its approach, and a variety of applications of the concept through case studies in the countries of Western and Central Europe and Asia that have totally different conditions of transport and the environment.

## **2. Overview of contributions**

### **Environmentally Sustainable Transport: The EST Concept, Goal and Strategy**

Nadia Caïd, Phillippe Crist, Richard Gilbert and Pieter Wiederkehr will present overviews of the Environmentally Sustainable Transport (EST) project. Their paper describes the definition, goals and targets used in the EST project, and gives the overall results of the different country studies, the economic and social implications, and EST policy strategies. The authors conclude that although EST is attainable, it will only occur with a broad-based and concerted commitment. The most important challenges lie in the acceptability of the goals, targets, and strategies and their component instruments. Issues of acceptability are best addressed by carefully phasing the application of instruments across the whole implementation period, up to 2030. The EST project has revealed a substantial gap between the conditions likely to come about as a result of current and future transport trends, on the one hand, and those necessary for achieving environmentally sustainable transport, on the other. The paper also includes policy guidelines for moving towards environmentally sustainable transport that are designed to assist government at all levels in the development and implementation of appropriate strategies towards EST. These guidelines were presented and discussed at an OECD Conference held in Vienna in October 2000 and endorsed by OECD Environment Ministers in May 2001.

### **Urban Transport Sustainability: Asian Trends, Problems and Policy Practices**

Yoshitsugu Hayashi, Kenji Doi, Masaharu Yagishita and Masako Kuwata describe recent trends, problems and policy practices in transport systems within Asia. They also discuss the direction being taken by one form of EST in Asia, which had its origins at an 'international conference' on *Environmentally Sustainable Transport (EST) for the Asian region* held in Nagoya, Japan in March 2003. Here, the term 'EST' was used in a broader sense than the OECD EST concept/approach; emphasis was placed on encouraging Asian countries to take a first step towards EST, i.e. the conceptualisation of Asian EST. The current situation and the transport trends shown in the Asian region were concluded by the authors to present a picture stemming from geographical differences and levels of economic development. Most Asian countries share similar concerns about transport-related problems, in other words, severe congestion, air and noise pollution. Common patterns in these problems can be identified,

i.e., large increases in traffic demand resulting from rapid economic growth, urbanisation, and rapid motorisation, poor control of vehicle emissions and absence of effective inspection and maintenance systems. Lack of adequate and appropriate infrastructure (especially rail transport) and poor coordination of transport and land-use policies also form contributing factors. The Nagoya Statement - which was adopted at the EST Conference in 2003 - sets forth specific future steps toward EST in cooperation with other countries in the region. These include addressing pollution and energy efficiency issues, undertaking research activities, promoting policy dialogues, and exchanging information and human resources, along with early stakeholder involvement, promotion of policy integration and establishment of processes to monitor and report on progress.

**Backcasting as a Tool for Sustainable Transport Policy-Making: the Environmentally Sustainable Transport Study in the Netherlands**

Karst Geurs and Bert van Wee describe the backcasting approach to building scenarios used in the EST project as an alternative to conventional forecasting approaches. The backcasting approach is seen as an innovative tool for policy-making, aimed at generating alternative images of the future, thoroughly analysing the feasibility, consequences and policy implications of these images. The paper describes the results and implications for backcasting in the Netherlands case study. The authors conclude that EST will only be attainable if a substantial increase in development of technology and stringent behavioural adaptations, with changes in economic structures at an international level, are assumed. If EST is to be realised, measures will have to be taken and instruments implemented in the short term. Timely implementation will probably mean a necessary radical change in the current Dutch policy 'life cycle'. Introducing EST will have major impacts on economic performance of the transport sector, especially for the road freight, shipping and aviation sectors in the Netherlands, sectors which are traditionally considered important to the Dutch economy. The economic losses in the transport sector can be partly offset by gains in other sectors and productivity gains due to technology development. As a result, the overall impact on the total Dutch economy will be fairly limited. Moreover, if external costs are used as a measure of non-material welfare, total loss of material welfare in 2030 will be largely, but not fully, compensated by gains in non-material welfare.

### **Environmentally Sustainable Transport in Germany**

Hedwig Verron and Axel Friedrich describe the EST study in Germany – a study that while in progress, played an important role in initiating discussion on environmentally sustainable transport in Germany and influencing the substance of discussion itself. From the case studies they concluded that reducing CO<sub>2</sub> emissions from transportation by 80% by 2030 would be very ambitious, whilst meeting the reduction targets for the other exhaust emissions could be more easily met. EST, with its highly efficient conventional propulsion vehicles and optimised exhaust reduction systems, turns out to be the best available technique for EST. The authors also concluded that EST cannot be achieved without major changes in transport behaviour; in an environmentally sustainable transport system cars and lorries lose their dominant role. Packages of instruments are defined, of which emission limits for CO<sub>2</sub>, exhaust gases and noise, fuel tax and road tolls are the most important. However, no adequate solutions for urban freight transport and aviation could be found. New strategies will have to be developed to slow down the high growth rates in the aviation sector if the EST criteria are to be met.

**Environmentally Sustainable Transport in the CEI countries**

Robert Thaler and Peter Wiederkehr describe the pilot study on environmentally sustainable transport in the Countries in Transition (CEI), an intergovernmental collaborative effort involving 14 Central and Eastern European countries in transition. This study followed the same general strategy of the EST project, although a 50% CO<sub>2</sub> emission target was considered a more appropriate target for the CEI countries that currently benefit from a more environmentally friendly model split. Furthermore, due to a lack of data, institutional capacity and limited resources have meant conducting the CEI project at a higher level of generality than other EST studies. The authors conclude that EST would constitute a net benefit for the environment and for quality of life in general. More important, it follows from the estimated reduction in externalities under EST that some public costs might be significantly lower. The net benefits could be transferred to key areas of the economy, including consumption, savings and investment. Overall, this reduction in externalities could lead to a significant improvement in social well-being. EST will also provide new opportunities for businesses to develop and invest in innovative solutions for passenger and freight transport.

**EST Case Studies and Perspectives in Japan**

Yuichi Moriguchi and Hirokazu Kato describe the results of the EST case study both for the whole of Japan and for the Aichi region in Japan. The authors conclude that the CO<sub>2</sub> and NO<sub>x</sub> reduction targets have severely restrictive conditions. The achievement of targets using only technological or mobility changes is considered totally unfeasible. Even when technological and changes in transport activities are considered, requirements must include strict recommendations for change such as significant widespread use of fuel-cell vehicles and reduction in freight transport demands.

**The Economic Impact of Environmentally Sustainable Transport in Germany**

Burkhard Schade and Werner Rothengatter examined the economic implications of EST in Germany. Two methods were chosen for the assessment of the scenarios: a simplified evaluation method and a complex system dynamics modelling approach, which includes all transport-related sectors of the economy. The economic impacts were examined for two CO<sub>2</sub> emission reduction targets: one, a 50% and the other, an 80% CO<sub>2</sub> emission by 2030 (relative to 1990 levels). The economic assessment shows the departure from the car and road freight-oriented transport policy to be far from leading to an economic collapse. The effects concerning economic indices are rather low, even though the measures proposed in the EST-80% scenario designate distinct changes with respect to today's transport policy. The impacts on some economic indicators, however, are clearly negative. More encouraging results are derived with an extension of the time period for the transition in the EST-50% scenario. Results might be also more positive if other economic sectors make similar efforts to reduce their emissions of CO<sub>2</sub>.

### 3. Conclusions

From the papers in this special issue it can be concluded that an environmentally sustainable transport system is attainable with a broad-based and concerted commitment. Environmentally sustainable transport will result in significant changes in the type of passenger and freight transport provided, but this does not lead to economic collapse. Important challenges lie in the acceptability of the goals, targets, and strategies and their component instruments.

The realisation of the 80% CO<sub>2</sub>-emission reduction target for the transport sector can be concluded to be the most ambitious one. If the CO<sub>2</sub> emission reduction target for the transport sector is assumed to be lower, or the time period for implementing EST longer, the contribution of technological changes to attaining EST is likely to increase, thus decreasing societal impacts and increasing public support. Moreover, recent model studies indicate that global greenhouse gases can - in accordance with the EU climate objective - be effectively reduced by 20%, compared to current levels, by 2040 (i.e. a 50% decrease compared 2040 to baseline projections) through global cap-and-trade emission trading systems and carbon taxation (on average about 100 euro per tonne of CO<sub>2</sub>) (Bollen et al., 2004). These taxation levels do not strongly affect the transport sector, as other sectors may provide CO<sub>2</sub> emission reductions at far lower costs (Van Rompuy et al, 2003).

However, it is difficult to imagine that significant reductions in climate change emissions in the post Kyoto era are attained without efforts to reduce emissions in the transport sector. The EST studies for Germany, the CEI countries and also Sweden show that encouraging environmental, societal and economic impacts can be achieved with an extension of the time period (50% emission reduction by 2030) to allow transition towards EST.

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