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**Working Party on National Environmental Policy  
Working Group on Transport**

**TRANSPORT AND ENVIRONMENT**

**Synthesis of OECD Work on Environment and Transport and Survey of related OECD, IEA and ECMT  
Activities**

**18-19 April 2002**

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Mr. Peter Wiederkehr; Tel: +33 1 45 24 78 92; Fax: +33 1 45 24 78 76; Email:  
peter.wiederkehr@oecd.org, Ms. Nadia Caïd; Tel: +33 1 45 24 81 75; Email: nadia.caid@oecd.org,  
Ms. Masako Kuwata, Tel: +33 1 45 24 81 77; Email: masako.kuwata@oecd.org

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## FOREWORD

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This working document includes two parts:

**Part I: The Background and Synthesis Report**, prepared by the OECD Environment Directorate, presents an overview of key conclusions and findings that can be derived from recent work by the OECD, the IEA and the ECMT on transport and the environment and OECD's sustainable development initiative. It is intended to summarise the current state of our knowledge and help to assess the degree to which understanding of the potential effects of a wide range of possible policy responses could now offer the prospect of a comprehensive, integrated strategy for sustainable transport in OECD countries.

Section 2 of this report describes the current situation of transport and Section 3 describes the outlook of transport trends in OECD countries. Section 4 sets out the related environmental consequences. Section 5 summarises the wide range of individual policy measures (and to the extent possible, their known or anticipated effects) that the OECD has been able to identify so far which appear to have the potential to effectively mitigate the environmental impacts of road transport and eventually lead to sustainable transport. Section 6 describes recent attempts to estimate the overall effects of a comprehensive, integrated strategy for sustainable transport.

**Part II: The Survey of OECD, IEA and ECMT Work** presents an overview of recent, ongoing and planned work carried out by the OECD (DCD, ECH, ENV, STI, TDS), the IEA, and the ECMT on "Transport and Environment". This survey was done to provide information to the corresponding bodies, highlight joint projects and interrelations between these activities and facilitate future co-operative efforts. The current document is an update (as of mid-2002), of a previous survey performed in 1999, and includes more recent developments and provides an outlook for future projects. It was prepared by the National Policies Division of the Environment Directorate with the help and support of other OECD Directorates, the IEA Secretariat and the ECMT Secretariat, and is subject to revision as plans and activities in 2000-2002 develop. The contribution from these organisations is greatly acknowledged.

The OECD, the International Energy Agency, and the European Conference of Ministers of Transport have collaborated extensively and closely, within the frameworks of their respective work programmes, in carrying out the research and analysis on which this document is based. Given their respective mandates, each of these bodies has its own priorities and perspectives on the issues raised at the interface of environment, energy and transport policies. This stocktaking of recent work was undertaken by the OECD Environment Directorate as a contribution to the collective efforts of all three organisations. Its focus, however, is on findings and conclusions of particular relevance to the formulation of *environmental policy*. As such, it does not necessarily represent the views of the IEA, the ECMT or other bodies of the OECD.

For easy access to information on the various projects, references to web pages are provided in the corresponding chapters.



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**PART I**

***BACKGROUND AND SYNTHESIS REPORT ON  
TRANSPORT AND THE ENVIRONMENT***



# 1 INTRODUCTION

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The relationship between transport and the environment in OECD countries has been studied at the OECD, with varying degrees of intensity, for over 30 years. Air pollution, and to a lesser extent, noise, arising from road transport were the chief preoccupations of the OECD's early work. From the late 1980s onwards, however, the overall level and scope of effort directed at work on transport and environment increased sharply, for two reasons. First, concern over the extent and magnitude of the environmental impacts of transport (air pollution, noise, accidents, congestion) had reached a level where not only environment ministers but transport ministers as well were forced to acknowledge the need to integrate transport and environment policies (e.g. the 1989 landmark resolution adopted by European Conference of Ministers of Transport). Second, growing concern about the global problem of climate change, and the significant contribution of transport thereto, led to major new work programmes by the OECD, the International Energy Agency (IEA) and the European Conference of Ministers of Transport (ECMT) in this field.

Thus, in the 1990s, an extensive body of work has been published by these three organisations, providing a broad and strong knowledge base about the development of the transport sector, the environmental implications of that development, and the wide variety of possible policy approaches that could mitigate the environmental impacts of transport in the short and medium term and lead ultimately to the design of sustainable transport policies in OECD countries. Road transport has been identified as having the largest repercussions by far for the environment and has therefore been the focus of most of the OECD's work.

Environmentally Sustainable Transport still constitutes one of the major challenges for OECD. The central question is how sustainable transport can be organised most effectively, minimising costs and environmental and health impacts.

The importance of an international co-operation to lower the costs supported by the various countries, is stressed in several work carried out by OECD, as well as the essential role which governments must play to radically change the behaviour of the population towards sustainable transport. Co-operation between the public sector and the private sector must be enhanced since it is crucial for the development and implementation of sustainable transport.

Another major concern of the OECD's work is the evaluation of the effects of the liberalisation in the freight transport sector both for road and rail transport. The proceedings of the 1996 "Towards Sustainable Transportation Conference", held in Vancouver, as well as those of several other major international conferences sponsored by the OECD, in co-operation with the IEA and the ECMT (Berlin, Stockholm, Düsseldorf, Mexico, Budapest), also provide valuable insights into what might constitute sustainable transport policy.

In 1998, Environment Ministers of OECD Member countries requested the OECD to develop guidelines for moving towards environmentally sustainable transport (EST). In response to this request, the OECD Working Group on Transport of Environment Policy Committee has developed a set of key guidelines which operationalise the 1996 Vancouver Principles towards Sustainable Transportation and the strategic directions. These guidelines, together with the synthesis report and best practices were presented at the Vienna Conference in October 2000. In May 2001, OECD Environment Ministers met in Paris to

discuss and agree solutions to the most challenging environmental problems they face. They endorsed the guidelines and adopted a new OECD Environmental Strategy for the First Decade of the 21st Century to address these challenges.

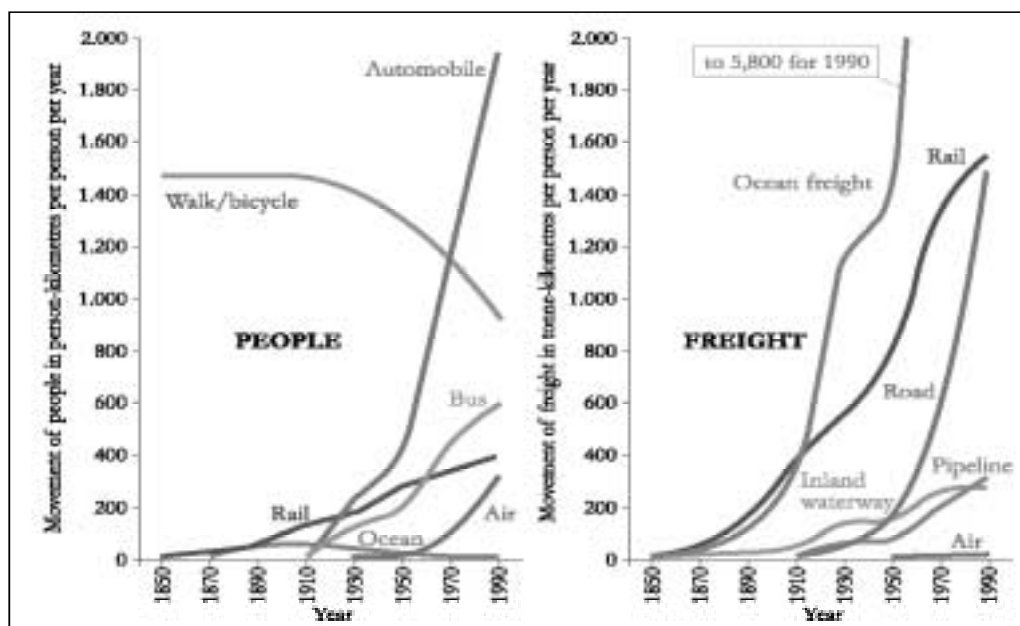
## CURRENT SITUATION OF TRANSPORT IN OECD COUNTRIES

**A**ccess to people, goods and services has been, and remains, vital to economic development, in OECD countries as elsewhere. Transportation - the *movement* of people and goods - has been *one* of the principle means through which governments ensured access. In economic terms, transportation is an important activity in its own right: the production, maintenance and use of transport infrastructure and mobile equipment represent 4-8 per cent of GDP and 2-4 per cent of the labour force. However, some have questioned whether transportation's share of GDP necessarily translates into improved societal welfare, especially given the many uncovered externalities such as air and noise pollution, accidents, land-take, and loss of productivity through congestion.

Historically, there has been a strong correlation between overall GDP growth and the expansion of the transport sector - growth of GDP has been accompanied by a roughly similar growth in transport for both passengers and goods, and by

much faster growth in transport by road. More recently, growth of the transport sector, and of road transport in particular, has exceeded that of GDP in many countries. On the other hand, all regions have witnessed the detriment of rail's share. In absolute terms, road transport by far dominates rail, although passenger rail travel volume remains large in Asia and Europe, as does freight rail in North America. Whether ongoing structural adjustment, improved logistics and the changing nature of economic activity can ultimately reduce the 'transport intensity' of economy of OECD countries remains to be seen.

Road transport accounts for over four fifths of all transport related energy consumption, and is responsible for much of the transport sector's impact on the environment. The defining features of growth in road transport in OECD countries over the past 30 years are the steadiness and rapidity of that growth and the fact that it appears likely to continue, relatively unabated, well into the next century (see Figure 1).



**Figure 1:**  
World-wide  
trends in  
the  
movement  
of people  
and freight

Source: EST,  
Futures,  
Strategies and  
Best Practice:  
Synthesis  
report, OECD  
2000a

average rate of 9% annually since 1960 (see Figure 2).

**2.1 Passenger Traffic**

More vehicles, carrying fewer passengers per vehicle, are making more and longer trips. On average for the OECD countries, and that for the past 20 years, the numbers of passenger cars has increased by around 3% a year, while road passenger kilometres travelled have increased even faster at around 5%. Over the next two decades, in the absence of efforts to reduce demand, some scenarios suggest that both vehicle numbers and vehicle kilometres travelled will grow on average by 2 per cent per annum.

On the other hand, rail transport shows a totally different picture. The share of railways has declined in recent decades in all OECD countries. While total passenger transport by rail has experienced a growth of 10% over the past fifteen years, it accounts for only 6% of passenger travel in OECD countries.

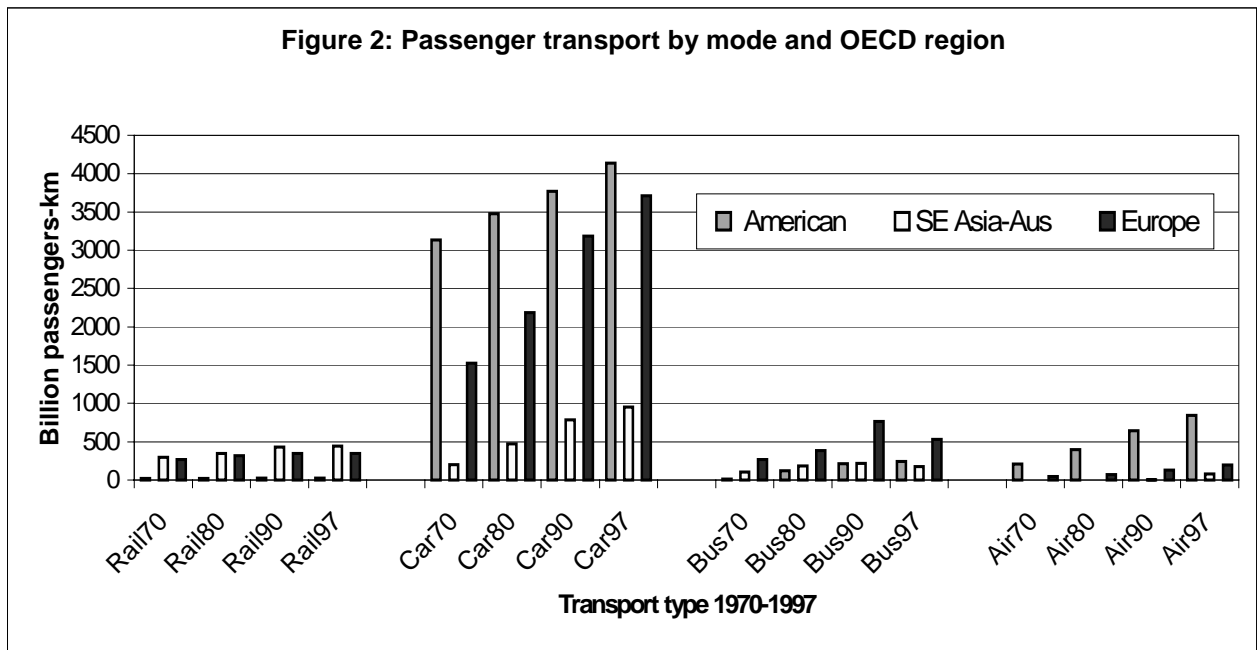
Aviation is the fastest growing mode though the volume of passenger travel by air in 1997 was approximately 10% of total passenger travel in the OECD countries. It has expanded at an

**2.2 Freight Transport**

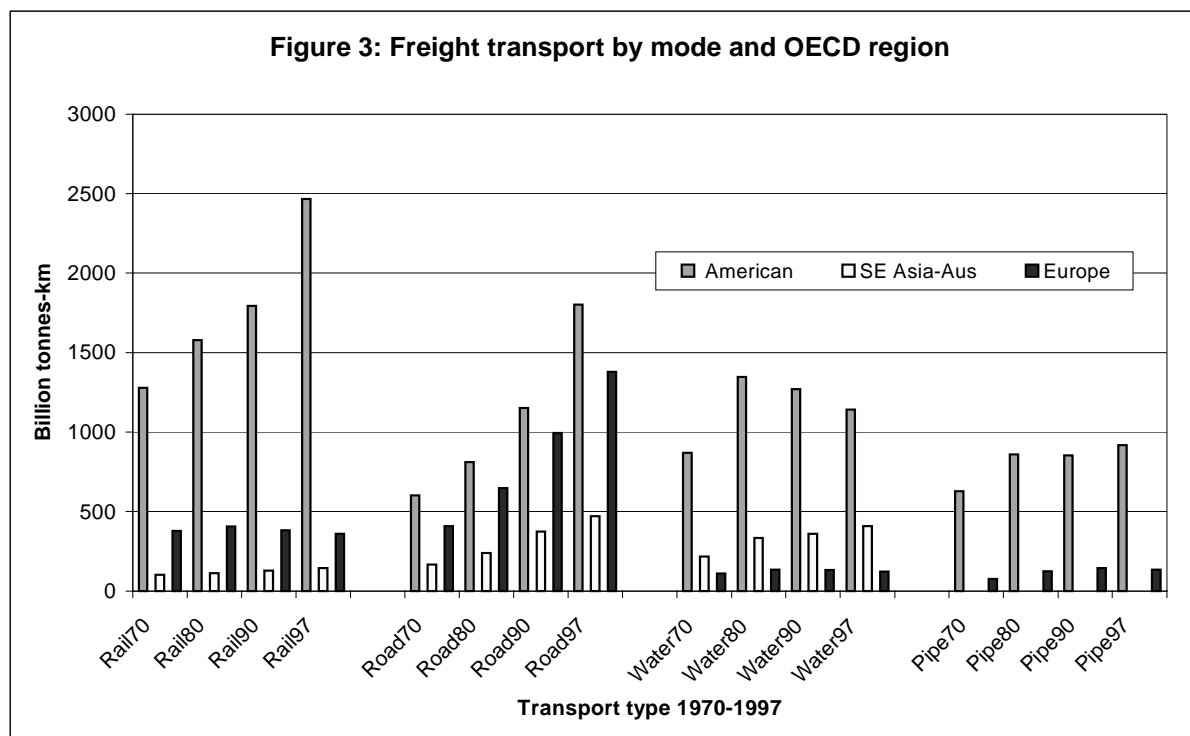
The demand for freight transport is closely linked to economic growth and international trade, to the overall development of the various sectors of the economy, and to land-use planning and infrastructure. Freight transport has been growing faster than passenger transport in the past decades, but total vehicle kilometres travelled for freight transport is still less than for passenger transport.

A particularly striking feature has been the growth of goods transport by road (see Figure 3). Road freight in OECD countries has been growing at an average rate of 4.8 per cent p.a. since 1970- higher than GDP (2.8 per cent p.a.) and even higher than car traffic (3.3 per cent p.a.). In the European countries of OECD, the rate of growth of goods vehicle-km has been similar to that of car-km (about 3.7 per cent p.a.).

Structural changes in the economy and the expansion and improvement of road



Source: OECD, Environmental Data, Compendium 1999



Source: OECD Environmental Data, Compendium 1999

infrastructure have been accompanied by changes in the nature of goods transport: more powerful trucks can carry manufactured goods efficiently, while lighter trucks can ensure expeditious, timely and door-to-door delivery of high value-added goods. Improved reliability and availability of relatively cheap road freight is both a cause and effect in the trend towards 'just-in-time' production and enables manufacturers to reduce warehousing facilities. Shifts in economic activity to suburban areas have led many firms to move to edge-of-town and out-of-town sites where they are no longer connected to existing rail and port terminals.

Rail has traditionally been suited to transporting large and regular loads of freight over long distances. While the market for large and regular loads of freight has declined over the past 50 years, the demand for rail freight traffic has increased in the OECD as a whole. However, rail's share of the total freight market has declined considerably in most countries primarily due to strong competition from road haulage. Rail freight accounts for some 15 per cent of total freight transported in Europe.

Within the sector, however, significant changes have taken place in Europe and combined road-rail transport is increasing rapidly with significant growth rates in recent years. It has maintained its level of transport activity (tonne-km) in Europe.

Air cargo has expanded at an average rate of 11% annually since 1960 and it accounts for well over one-third of the value of the world's manufactured exports.

The share of railways, however, has declined in all OECD countries, except in the US where rail freight has been growing rapidly.

Water-bound transport has also experienced a declining market share, both for inland waterways and seaborne shipping though overall freight transport by these modes has been growing steadily in recent years in many OECD countries. Seaborne freight transport has doubled from 1970 and 1998 (from 2.5 billion tonnes to close to 5 billion tonnes), broadly in line with world economic growth.

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### 2.3 *Factors Underlying the Growth in Road Transport*

Many of the underlying factors responsible for the growth in demand for road transport in recent decades have been explored in the OECD literature, in particular by the ECMT and, from an urban environment perspective, by the OECD Urban Affairs Division. These factors include expanding economies and increasing consumer spending power, increasing urbanisation and sprawl - the geographical spread of cities. As urban populations expand, land at the edges of urban areas becomes developed and new residential and employment subcentres emerge. These new subcentres' dispersal and distance from older urban centres contribute to an increase in car travel that often supplants other modes like walking, cycling and public transport. Car dependency is further reinforced as new lifestyle patterns take hold and people spread their daily activities over a wider and wider geographical area.

OECD work has gone in somewhat less depth into the social, cultural and demographic dimensions of motor vehicle use in OECD societies. It is apparent that improved economic welfare and greater leisure time are shifting car travel away from commuter trips and increasingly towards social, leisure and shopping activities. The ECMT work points to a number of social factors tending to increase demand for car travel: the growing proportion of the elderly in the population (now motorised to a high degree and with a strong propensity to continue driving as long as possible); greater access of women to cars as new drivers; growth in numbers of two-worker households; expectations of young people to drive earlier and more; and declines in household size leading to increases in car ownership.

Moreover, in most OECD countries, the car has come to symbolise both affluence and freedom. Personal mobility is highly valued and the automobile is often *perceived* to be the most

convenient, flexible and comfortable travel mode. The car is seen not only as a highly personal and versatile means of transport, it may also serve as temporary shelter, office space, telephone booth, power tool, plaything and status symbol. Like a home, a car is often a highly valued part of an individual's personal space.

A recent OECD overview of research pertaining to people's travel behaviour has also highlighted other important factors that lead to and/or sustain high levels of car use. These include growing childhood dependence on car travel and its role in forming adult perceptions and behaviour, the emergence and persistence of car-centred travel habits, the impact of media and advertising messages and lack of experience with alternative transport modes.

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### 2.4 *Transport and Fuel Consumption*

Oil is primarily the energy resource used for transport, a non-renewable resource that is being used more quickly than renewable substitutes are being developed and brought into use. In OECD countries, transport accounts for one-third of current final consumption, but has represented almost two-thirds of the growth in consumption since the early 70s. After falling in the early 1980's, world use continues to rise, largely on account of industrialisation in non-OECD countries and transport uses everywhere. In OECD countries, non-transport use of oil is declining but use for transport is increasing at a rate of about two per cent a year, resulting that the transport sector accounts for all oil-demand growth. In non-OECD countries, oil use is increasing overall at three to four times the rate of increase in OECD countries.

Data on transport activity across OECD countries continue to present difficulties of completeness, reliability and comparability. Data collected by the IEA on energy consumption by the transport sector are a valuable additional source of information. IEA statistics indicate that while other sectors of energy use in OECD countries rely on a variety of energy sources (indeed, important shifts away from fossil fuels have been

noted in these sectors), transport remains almost completely dependent on oil. In OECD countries, road transport accounts for over 80% of all transport related energy consumption and road transport is 99 per cent oil dependent. Moreover, transport's share of total final oil consumption continues to grow significantly (e.g. 45% from 1980 to 1997) while other sectors' dependence on oil has decreased, shifting to other sources. The IEA, in its 2000 World Energy Outlook, expected fossil fuels to meet 90% of additional global energy demand from 1997 to 2020. Oil is used increasingly to fuel rapidly growing demands for road and air transport. The outlook projects world energy demand to grow by 57% and CO<sub>2</sub> emissions by 60% between 1997 and 2020 unless new policies are put in place to significantly reduce fuel consumption. The transport sector contributes heavily to both categories especially in OECD countries. World energy demand in the transport sector will climb faster, at 2.4% per year and from 1997 to 2020, it accounts for 26% of the increase in total emissions.

During the 1970s and early 1980s, fuel-efficiency targets were adopted in a few OECD countries, mostly voluntary in nature with the exception of the United States CAFE standards, and fuel efficiency of new vehicles (in test conditions) began to show significant improvement. However, this was only partially reflected in actual on-road fuel economy because of differences between official test results and on-road fuel use. In the mid-1980s, however, improvement in fuel efficiency of the vehicle fleet dropped off sharply in many OECD countries, reflecting low oil prices and increases in vehicle size, engine power and weight. The average fuel consumption of the car fleets in many OECD countries has actually increased since the mid-1980s.

## OUTLOOK OF TRANSPORT TRENDS

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Transport is indispensable to the economic development. However, given current trends, the impact of continued growth in transport services is not sustainable in the long term. The OECD Environment Outlook (OECD 2001*d*) shows that transport demand has been growing rapidly in OECD countries as well as world-wide and continues to be strong. This growth has been almost entirely in the form of road transport and more recently, aviation. Improvements in fuel efficiency and emissions control have been much more than offset by growth in vehicle fleets and thus vehicle use. Without major changes in policies and practices these trends seem set to continue for several decades. The integrated and comprehensive transport policies are needed to address growth in transport as well as to support technological improvements and transport demand management.

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### **3.1 *Developments of Road Transport***

Road transport, both passenger and freight, has experienced tremendous growth over the past decades, having more than doubled in the last 25 years in OECD countries. Road transport is the dominant transportation mode, representing over 90% of passenger travel and 75% of goods transported. Today, over 550 million motor vehicles (75% of which are passenger cars) are registered in OECD countries, and almost 700 million in the world.

The level of motorization, car ownership and total distance travelled are projected to be at

substantially higher levels in 2020. The total stock of motor vehicles in OECD countries is projected to increase by 32%, from around 552 million in 1998 to around 730 million in 2020. Over the same period, the stock of motor vehicles in non-OECD countries is expected to increase by 80%, from around 250 million to close to 600 million vehicles. Globally, the number of motorcycles and heavy trucks will grow by more than 100% between 2000 and 2020.

Total distances travelled are projected to grow by 40% in OECD countries. Within OECD regions, growth rates are expected to be very high in Central & Eastern Europe, but more moderate in the other OECD regions. Growth in vehicle kilometres travelled is expected to be higher at the world level, with a total increase of approximately 86% from 1997 to 2020. The outlook in non-OECD countries is for vehicle kilometres travelled to increase by more than 165% over the period to 2020. This substantial increase will significantly impact urban areas.

Transport activity by heavy truck is projected to become much more important world-wide, with distance travelled by heavy trucks expected to almost double from 1995 to 2020. Total distance travelled by passenger cars is projected to increase by 79%.

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### **3.2 *Developments of Rail Transport***

The share of rail transport, both for passenger and freight transport, has declined in recent

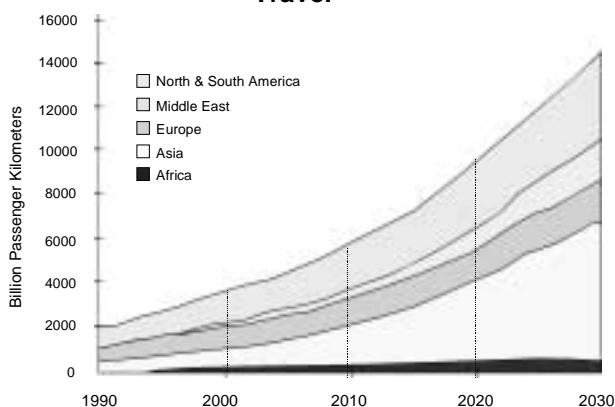
decades in all OECD countries, except in the US where rail freight has been growing rapidly. The current market share of passenger transport by rail accounts for 6% of passenger travel in OECD countries. It is projected that rail freight will increase by 40% in the period to 2020, although it is expected that rail will continue to lose market share in freight transport (Environment Outlook, OECD 2001d).

### 3.3 *Developments of Air Transport*

Passenger travel by air currently less than 3% in the world and nearly 10% in OECD countries. However, aviation is the fastest growing mode for the movement of both passenger and freight. Passenger traffic has expanded at an average rate of 9% annually since 1960, and air cargo by 11%. It is projected that global air passenger kilometres from 1997 to 2020 will increase by 200% (see Figure 4). The highest growth rates are expected from intra-Asia travel, between Europe and Asia, and on trans-Pacific routes.

Environmental impacts from aviation are also of growing concern. Release of exhaust gases at an altitude of about 10-11 kilometres, where commercial aircraft fly, results in a total greenhouse effect that is 2 to 4 times greater than that from CO<sub>2</sub> produced by the burning of the aircraft's fuel. Therefore, based on current trends and present assessment of the altitude effect, aviation's global warming effect is projected to exceed that of trucks or cars in 2030 (OECD, 2000a).

**Figure 4: Global Trends in Passenger Air Travel**



### 3.4 *Developments of Maritime Transport*

Seaborne freight transport has grown steadily for some decades broadly in line with world economic growth, doubling from 1970 to 1998 (from 2.5 billion tonnes to close to 5 billion tonnes). This trend is expected to continue because there are no alternatives to maritime transport for intercontinental freight transport, especially where goods are transported in bulk. Therefore, continued global economic growth can be expected to generate additional international maritime transport and it is projected to increase by approximately 90% from 1990 to 2020, and thus increase its market share.

**TRANSPORT AND THE ENVIRONMENT**

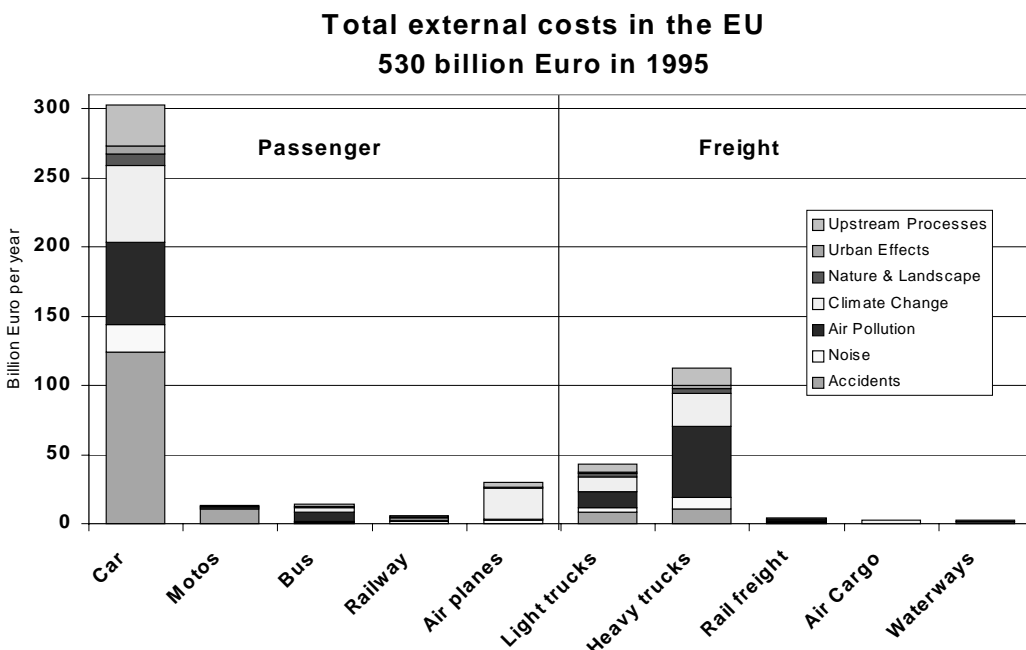
The four main forms of environmental and social externalities arising from transport - are considered to be air pollution (including greenhouse gases and ozone depleting substances), noise, congestion and accidents. Taken together, these environmental and social externalities impose large costs on society, which are estimated to amount to almost 8 per cent of GDP in European OECD countries (excluding congestion costs). For 1995, this represented some 530 billion Euros, primarily from accidents (21%), and air pollution and climate change (48%) (INFRAS/IWW, 2000, see Figure 5). Road transport is responsible for 92% of these costs and two-thirds of the costs are caused by passenger transport, one-third by freight. Urban populations are especially exposed to the negative impacts of motor vehicle traffic.

generally recognised as the source of more air pollution than any other single human activity. In urban areas, where more than 70 per cent of the population of OECD countries live, levels of motor-vehicle-related pollutants frequently exceed internationally agreed air quality guidelines. High levels of air pollution, apart from generally lowering the quality of life in cities, are also directly responsible for a large number of adverse health effects, ranging in seriousness from respiratory problems to carcinogenesis. A great deal of attention has been devoted to health effects of transport-related air pollution, and more research is needed to improve and consolidate knowledge of health and environmental impacts and risks.

Motor vehicle emissions are complex and include hundreds of compounds that are released into the atmosphere as gases, aerosols and particulates. Many of these compounds are transformed in the atmosphere, producing secondary pollutants such as tropospheric ozone (a component of summer smog), acid aerosols and carcinogenic hydrocarbons, that are sometimes more harmful

**4.1 Air Pollution and Global Climate Change**

Motor vehicle use in OECD countries is now



**Figure 5: Externalities from Transport in Europe**

Source: INFRAS/IWW, 2000

than their directly emitted precursors. Major air pollutants emitted by motor vehicles include carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), particulate matter (PM), nitrogen oxides (NO<sub>x</sub>), sulphur dioxide (SO<sub>2</sub>) and volatile organic compounds (VOC). Highly reactive VOC species in vehicle emissions are, along with NO<sub>x</sub> emissions; the major motor vehicle related precursors of tropospheric ozone (O<sub>3</sub>). For a number of these pollutants, motor vehicles are the single largest source of total emissions in OECD countries, e.g. 89 per cent of CO, 52 per cent of NO<sub>x</sub> and 44 per cent of VOCs.

Motor vehicles are also a major source of a number of toxic and carcinogenic air pollutants, including VOC species (e.g. benzene, 1,3-butadiene, formaldehyde, acetaldehyde and polynuclear aromatic hydrocarbons), lead, fine particulate matter, etc. Emissions of these substances are largely related to fuel composition or fuel additives, as well as engine technology, and are often results of incomplete combustion. An important fraction of overall motor-vehicle related VOC emissions is contributed through evaporative losses during fuel distribution, storage, transfer and vehicle refuelling, as well as from losses during vehicle use.

Carbon dioxide (CO<sub>2</sub>), a radiatively active gas in the atmosphere, is of global importance due to its implication on global climate change. The mechanism is that CO<sub>2</sub> acts as a greenhouse gas and thus contributes to an increase in the planet's surface temperature. Carbon dioxide is related to the metabolism of plants and animals, and is regularly recycled through the biosphere, atmosphere, and oceans in a complex system that currently maintains the surface temperature of the Earth at about +15 C. Other radiatively active gases can be produced during combustion of fossil fuels, but the greatest potential impact is believed to arise from the atmospheric accumulation of carbon dioxide. Atmospheric levels of CO<sub>2</sub> have been increasing for more than a century, roughly in line with the increased fossil fuel use associated with industrialisation and with the motorization of transport. The effects of continued climate change could include more variable and extreme weather, raised sea levels, expansion of deserts and widespread destruction

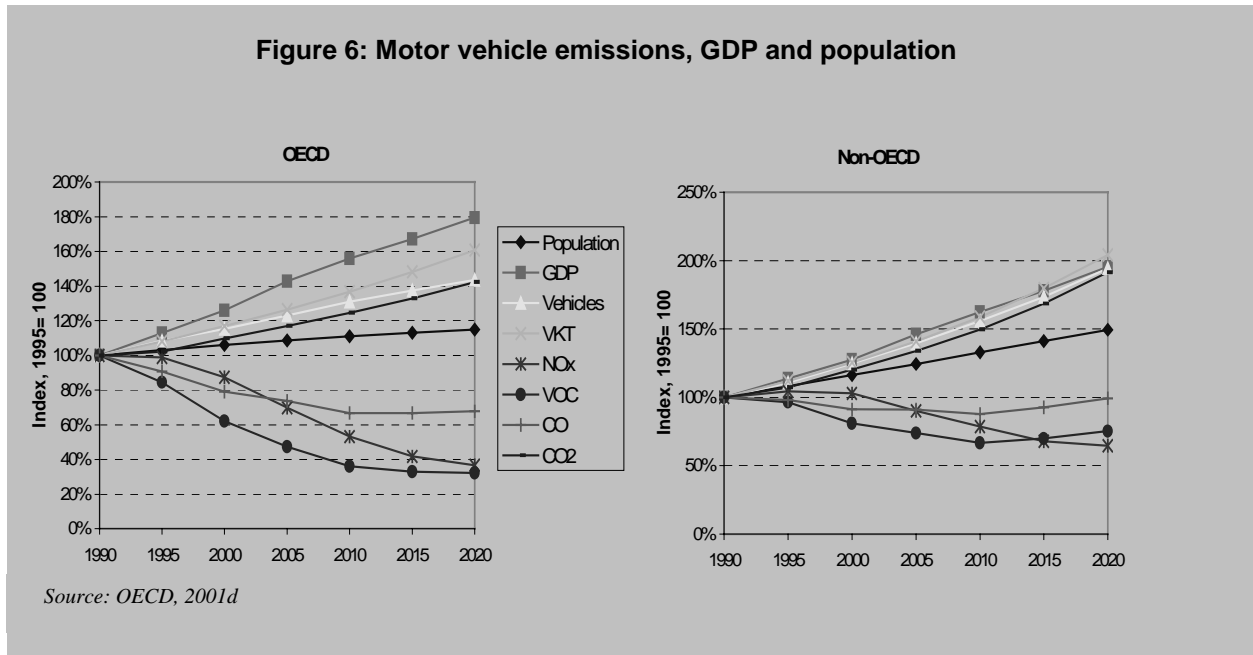
of plants, animals, and ecosystems unable to adapt to changes in temperature and other aspects of climate.

Among the different vehicles classes, automobiles are currently responsible for the greatest amount of polluting emissions, particularly CO, VOC and CO<sub>2</sub>. On the other hand, heavy-duty trucks and buses are responsible for half the world's emissions of motor-related NO<sub>x</sub> in spite of a comparatively small share (around 5 per cent) of the vehicle population. They are also the source of a large share of fine particulate matter emitted by diesel engines. The high output of NO<sub>x</sub> and PM reflects not only the high fuel consumption and large amount of travel logged by heavy duty-vehicles, but is also indicative of comparatively poor emission standards and controls on this vehicle class.

Policies adopted by many OECD countries in the 1970s and 1980s proved effective in reducing emissions of some conventional air pollutants. Emissions of major air pollutants (e.g. VOC, NO<sub>x</sub> and CO) are expected to significantly decrease in the OECD region in a period of continued growth of vehicle stock and transport activity (see Figure 5). However, projections for the growth in motor vehicle traffic suggest that in the absence of new control measures, emissions of CO, hydrocarbons and NO<sub>x</sub> will rise again. And despite progress to date, pollution episodes due to motor vehicle emissions (e.g. smog) continue to occur frequently throughout the OECD area and are a subject of growing public concern. Moreover, smog and the ingredients of acid rain spread from urban areas, causing damage to surrounding regions.

In recent years, concern about the nature and scale of the climate change problem has led to numerous studies on the impact of the transport sector. As mentioned above, although emissions of major air pollutants are expected to decrease CO<sub>2</sub> emission from transport will continue to grow rapidly (see Figure 6). CO<sub>2</sub> emissions from transport are directly proportional to gasoline and diesel fuel consumption. During a period when other sectors of energy consumption have begun to rely to a greater degree on other fuels, oil consumption by transport has been rising

Figure 6: Motor vehicle emissions, GDP and population



Source: OECD, 2001d

continuously. In OECD countries, transport accounts for more than 60 per cent of total oil consumption and about 20 per cent of total fossil fuel use. It is thus a major source of CO<sub>2</sub> and without strong policies that target fuel efficiency improvements, CO<sub>2</sub> emissions from transport will continue to grow. In OECD countries, CO<sub>2</sub> emissions from motor vehicles are projected to increase by approximately 44% from 1995 to 2020 (59% from 1990) and the contribution of the transport sector to total CO<sub>2</sub> emissions is to increase from approximately 20% in 1997 to 30% in 2020. Road transport generates other greenhouse gases, such as the CFCs (which are also ozone depleting) used in automobile air conditioning systems, NO<sub>x</sub>, etc.

The external costs for air pollution caused by road transport in the 17 EU member states and Switzerland and Norway are estimated to amount to 129,900 million Euros and those for climate change to 94,400 million Euros per year (INFRAS/IWW, 2000).

#### 4.2 Noise

Noise is generally perceived by urban residents as the first and foremost as problem associated with road traffic. However, the effects of transport noise are not yet well understood, nor are there fully satisfactory measurements of noise and the nuisance its causes. Traffic is a major source of noise, particularly in urban areas. In addition to being unpleasant, noise contributes to such health problems as stress disturbances, cardio-vascular disease, and hearing loss. People feel more directly affected by noise than by any other form of pollution. Measuring the magnitude of noise pollution is complex. Volume is measured in acoustically weighted decibels [dB (A)]; a level above 65 dB (A) is considered unacceptable and incompatible with certain land uses in OECD countries. However, a number of different parameters must be factored into an indicator of noise: volume, frequency, duration, and variability.

Heavy-duty trucks are a significant source of road noise, and may be more significant than other modes of freight transport. The result of a recent work of the ECMT suggests that for a given quantity of freight transported across a particular spot, the size of the truck does not make a major difference in terms of noise produced. The study

apply different methods for estimating the cost of noise: valuation of damage imposed on health or property values, costs of preventing noise, and contingent valuation of willingness to pay to avoid noise. One general conclusion drawn from this work is that the cost of preventive action and damage are similar, and therefore that it is preferable to make the necessary preventive investment than to bear the damages.

Stricter standards for noise in vehicle and engine design, coupled with traffic calming measures (reduced speed limits, time and space restrictions on noisy vehicles), sound barriers and the development of quieter road surfaces can bring some attenuation of traffic noise pollution, at least by automobiles. However, these improvements are likely to be eroded by overall traffic growth. The problem is particularly severe in Europe and Japan. In European OECD countries, about 30% of the population are exposed to road traffic noise levels above 55 dB (A), and some 13% above 65 dB (A) (EEA, 2000). In Japan, the figure is 30 per cent, while in the United States it is only 7 per cent.

The external costs of road traffic in the EU17 are estimated to amount to approximately 32,100 million Euros, which accounts for 0.47% of their GDP (INFRAS/IWW, 2000).

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#### 4.3 Congestion

Traffic congestion is now a common feature in almost all large urban centres, not just in central and inner areas, but increasingly in the suburbs. Stalled and slow-moving “stop and go” traffic multiplies fuel consumption, pollution and noise. It is difficult to estimate the true costs of congestion because it depends very much on the definition chosen, but on almost any definition, the costs are estimated rather high. The essential problem of congestion is the time lost. The total cost of the time spent travelling in OECD countries is equivalent to roughly 7 per cent of GDP. Using the definition of “additional time spent travelling compared with free-flowing travel”, congestion is estimated to cost the

equivalent of about 2 per cent of GDP. The external costs of road traffic for congestion in the EU17 are estimated by 33.3 billion Euros in 1995, which accounts for 0.5% of their GDP (INFRAS/IWW, 2000). OECD studies have shown that building more roads in major urban areas has generally failed to ease congestion, and induces additional traffic. On the positive side, traffic congestion itself is becoming a significant constraint on urban traffic growth, albeit a costly one for those affected.

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#### 4.4 Accidents

In the transport and environment context, recent OECD work has not focused specifically on accidents although some projects have investigated the links between environment and integrated safety strategies. The ECMT does, however, maintain road accident statistics and has done some work on road safety. Rough estimates of the order of magnitude of the costs of accidents (medical care, lost production) have been made.

Many studies have been undertaken on the valuation of accidents and many governments have adopted official estimates for the cost of traffic accident fatalities. In deriving cost estimates, a crucial choice is whether to include non-material damage such as the intrinsic value of life lost and the suffering that results for friends and relatives. Putting a price on life is a sensitive issue, but such price may be approximated as what society is willing to pay to save lives.

Improved road infrastructure and safety features in vehicles, and increasingly stringent law enforcement have tended to reduce fatalities and injuries in some OECD countries. The ECMT statistics show a slight although irregular decline in accident rates in recent years. Overall growth in road traffic (with a trend to more powerful, faster cars and heavier trucks) tends however to increase the risk of accidents. Excessive speed in built-up areas is considered to be the prime cause of accidents.

The situation of Western Europe's countries is not the same as the Central and Eastern Europe's countries. In Western Europe, the trends of the accidents is not homogeneous and depends upon the indicator used, the only positive element being a small reduction in the number of people killed. Over a longer time period, traffic level have risen sharply but the number of people killed on the roads annually has fallen by more than 41 per cent since 1972 as a result of the measures taken by the public authorities since the mid-1970's. Overall the heavy toll exacted on the roads of Western Europe would still appear to be far too high, both in human terms and in terms of the cost to the economy and society. The external costs of road transport accidents in the EU17 are estimated by 155 billion Euros in 1995 which accounts for 2.3% of their GDP (INFRAS/IWW, 2000).

In the countries of Central and Eastern Europe, the situation on road safety has deteriorated in the late 1990s and seems to confirm a very worrying trend of the transition process. Since 1988, the number of road accident fatalities has actually risen by almost one-third in CEECs. This trend merely reflects the fact that buying a car is increasingly within the reach of consumers and thus the authorities must step up their efforts to improve road safety. This would seem to be particularly important in some countries where road accident prevention policies are still far too rudimentary and where levels of car ownership can be expected to grow strongly over the next few years.

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#### **4.5 *Internalising Health and Environmental Costs***

The transport sector is characterised consistently in the literature as an important example of market failure to internalise the high social and environmental externalities. Transport markets in many OECD countries fail to make users pay the full cost of transport services. While some safety, health and environmental costs may partly be internalised through regulation, transport prices generally do not reflect the full social costs of noise and air pollution, increased risk of accidents

or traffic congestion. They are currently estimated to amount 8% of GDP in European OECD countries (INFRAS/IWW, 2000).

Knowledge of transport sector as social costs sector is gradually improving as more improving and better research is done. The uncertainties that remain have many causes, most of these being related to the difficulty of calculating monetary values in the absence of markets, and to imperfect understanding of the harmful effects of transport in certain fields, such as noise or pollution. Internalisation need not only seek to account for currently uncovered costs but should also attempt to structure prices more efficiently so as to create incentives for adopting less environmentally harmful behaviour (e.g. shifting the balance from fixed to variable costs, eliminating distortion causing subsidies, etc.) Internalising the social costs of transport has been and remains a major theme of work by the ECMT and OECD.

Significant welfare gains could be realised by adjusting regulations, charges and taxes to provide incentives for reducing the external costs of transport. Internalisation aims to provide such incentives by factoring these costs into markets so that the market mechanism can work more efficiently. The objective is to improve the economic efficiency of the market, by adjusting market prices directly or through indirect regulatory instruments. The key to internalisation is the development of incentives that encourage the use of alternative transport forms and alter behaviour in order to reduce external costs. Internalisation in the transport sector should not be viewed in isolation. To achieve efficient improvements in environmental quality the most cost-effective measures to reduce externalities should be sought across sectors.

On the positive side it is fair to say that internalisation increases the efficiency of markets and should prove compatible with efforts to liberalise markets, restructure public finance and contain government spending. The measures to be used for internalisation depend on the externality targeted and the nature of the incentives required controlling it. Bringing incentives as close as possible to the point of decision is the key. For example, a sales tax

could be effective where the choice of a vehicle is to be influenced but is not relevant to influencing driving style and intensity of use. Here a fuel tax is a better instrument - relevant to the external costs of accidents as well as emissions.

The main responses of internalisation policies are likely to be technological change and increases in operational and organisational efficiency. The end-use transport costs (as perceived by freight forwarders, private car users and rail passengers) may increase on average 15-30% in Europe as a result of full internalisation of the main externalities, according to rough estimates (Efficient Transport for Europe, ECMT, 1998). The increased efficiency effect from internalisation should ensure that industry, as a whole remains competitive. Internalisation is expected to have little or no effect on GDP growth and could have a small positive effect on labour markets. There are, however, theoretical problems in evaluating externalities, practical problems for application to local impacts and most importantly, political problems in introducing price rises in a sector that already makes a substantial contribution to tax revenues.

Total external costs from transport (excluding congestion costs) are projected to increase by 42% between 1995 and 2010, which amount to 754 billion Euros. Road transport accounts for 88% of it (INFRAS/IWW, 2000).

By including the external costs in the "overall road traffic costs" the full costs of road traffic would increase considerably. However, internalisation of the external costs from transport is crucial to attain sustainable transport.

## POLICY MEASURES AND THEIR EFFECTS

The published OECD, IEA and ECMT literature considered in this review has identified and analysed a broad range of policy measures which have the potential to mitigate the adverse environmental effects of transport. The reports of a series of major international OECD conferences focused on specific subjects like public transport (Budapest 1994), clean and fuel efficient automobiles (Mexico 1994, Berlin 1991, Rome 1990), urban transport (Düsseldorf 1993), urban electric vehicles (Stockholm 1992) and sustainable transportation (Vancouver, 1996). The conference held in Vienna in October 2000 was the culmination of five years work on the OECD's Environmentally Sustainable Transport project.

Five publications produced in 1995 and 1997 have attempted to present comprehensive and integrated strategies for developing environmentally sustainable transport. "Motor Vehicle Pollution: Reduction Strategies beyond 2010" focused primarily on technological approaches to emissions reductions and fuel efficiency improvements. Urban Travel and Sustainable Development" elaborated a three-tiered strategy emphasising land-use and the use of progressively higher fuel prices as an economic instrument to reduce travel demand. The Report of the OECD Policy Meeting "Sustainable Consumption and Individual Travel Behaviour" held in Paris, identified policies and initiatives to make transport activity more sustainable. The report on "CO<sub>2</sub> Emissions from Transport" presented the different economic instruments and the report on "Which Changes for Transport in the Next Century" analysed the role of governments' for developing sustainable transport. These reports contain the foundations of future strategy orientation with regard to sustainable transport. They address the fundamental question: How to reach sustainable transport?

The complex interrelationships among most of the measures proposed are such that it is difficult to present them within any one simple framework or structure. Also, many of the measures proposed for the future lack a framework for effective implementation. Moreover, many as not address the prospect of continuous transport growth which threatens to outweigh the gains likely to be achieved through technological improvements.

The discussion that follows looks first at the scope that exists for technological solutions to reducing the environmental impact of transport. It then considers measures designed to modify and/or reduce transport demand. Finally, it looks at the potential of institutional reform for improved policy integration, as well as the role of international co-operation.

### 5.1 *Technological Measures for Clean, Fuel-Efficient Motor Vehicles*

Numerous recent OECD studies have pointed to the very considerable potential of technological measures to reduce the environmental impacts of motor vehicles. If the presently available improved technology were introduced today for all new passenger transport, they could contribute to reduction in fuel consumption by around 30% by 2030. There appears to be a wide degree of consensus that the measures described below hold the greatest near-term promise, and as such, merit serious consideration by policy-makers. It should be noted however that in the absence of large scale, real-world experience of these measures, legitimate questions as to their actual cost-effectiveness remain unanswered. The fact that much of this technology exists already, yet has not been taken into wide-scale use, suggests

that there are economic, political and social barriers to its adoption, which require further exploration.

### ***Emission controls***

In most OECD countries, the approach taken to reducing air pollution from motor vehicles has been to incite technological improvements by introducing or tightening motor vehicle emission performance standards. This regulatory approach is a direct and effective way to address vehicular emissions. The related testing, enforcement and administrative mechanisms are already in place, are familiar to regulators, politicians, manufacturers and consumers, and have proven (where rigorously applied) an effective means to encourage development and implementation of better technology to control emissions.

At present, combinations of advanced emission control technologies already exist that could allow cars and other light duty vehicles to meet tailpipe emission standards 50 to 80 per cent tighter than the most stringent values currently in effect in any OECD country. Similarly, available control techniques can reduce current evaporative emissions by 75-90 per cent.

Essential for the success of emission control standards, in particular so they have a continuing impact on the in-use fleet, are improved and vigorously applied inspection and maintenance (I/M) programmes. For maximum effectiveness, I/M systems should include certification/type approval, factory testing of new models, regular inspection and random roadside checks. It is estimated that effective I/M programmes would significantly reduce the pollution burden from the existing vehicle fleet operating under current standards (on the order of 25 per cent for HC and CO and about 10 per cent for NO<sub>x</sub>).

Tighter standards and more effective I/M are especially necessary for heavy-duty vehicles (for which today's emission limits are generally considered inadequate) and for two-wheeled vehicles (which generally have escaped standard-setting altogether). The noise and visible pollution (particulates) produced by these two categories of vehicle are perceived by the

public as two of the most intrusive forms of road traffic pollution.

Attention has been devoted recently to controls for evaporative emissions, which can contribute as much as 30-40 per cent of total motor vehicle emissions of VOCs. Regulating the volatility of fuels sold commercially is one means of reducing these emissions.

Other technologies that appear to offer considerable scope for additional emissions reductions include in-engine emission controls, exhaust gas recirculation, on board electronic controls, and improved exhaust gas treatment systems.

### ***Fuel efficiency improvements***

It is estimated that existing vehicle design and engine technologies are rapidly capable of securing significant improvements in vehicle fuel efficiency (of the order of 20 per cent). If lower performance were accepted (reduced engine power, reductions in weight), improvements of 50-60 per cent or more could be achieved with limited technological development implications. Indeed, in the early 1980s, European manufacturers had already developed full size gasoline-fuelled prototypes for 4-5 passengers which achieved 2-3 l/100 km (80-100 mpg) with top speeds of over 150 km/h.

Reductions of vehicle weight, improved aerodynamics, lower rolling friction for tires, down-sized engines (corresponding to maximum authorised speeds), turbo-charging, lean-burn combustion, engine and catalyst preheating, direct fuel injection and electronic ignition controls have all been demonstrated as capable of increasing fuel efficiency and reducing emissions.

Market forces, responding to low oil prices since the mid 1980s, have not created the incentives to optimise the use of the considerable technological potential - much of it production ready for some time - to improve fuel efficiency. Fuel-efficient models have in general sunk to the bottom of the market, while manufacturer's publicity campaigns have tended to focus on large, high-performance

and fuel-intensive models. Faced with tough international competition in the automobile industry and cyclical variations in the oil market, governments have been reticent, since the middle of the 1980s, to mandate greater fuel efficiency.

Action then appears to be needed by governments to provide incentives through measures such as mandatory fuel economy targets, combined with the development of economic instruments aimed at vehicle manufacturers and consumers, geared to fuel efficiency (fuel taxes, vehicle-related taxes designed to discourage the purchase of fuel-intensive vehicles). As to the relative merits of regulatory approaches (standards, targets) and economic instruments, experience has been varied. There is evidence to suggest that mandatory fuel-efficiency targets were effective in stimulating improvements in fuel efficiency in North America in the late 1970s and early 1980s. High oil prices seem to have been responsible for fuel economy improvements in Europe. There are strong arguments for complementary use of both kinds of approaches in motivating manufacturers (and ultimately consumers) to pursue increased fuel efficiency. Voluntary agreements with industry, associated with targets, could also be an effective approach.

### *Alternative fuels*

Although earlier interest in alternative fuels was inspired largely by energy supply and security considerations, their potential to alleviate environmental problems of fossil-fuel consumption generated considerable further attention in the 1990s. Work has focused on liquefied and compressed natural gas (LNG/CNG) liquefied petroleum gas (LPG), methanol/ethanol, hydrogen and electricity (from batteries or fuel cells). Direct subsidies, tax exemptions and other incentives are already being used by some OECD governments to promote alternative fuels and the associated technology and infrastructure. Regulatory mandate, an approach now being tested by the State of California, seems to have been effective in accelerating electric car research and development by vehicle manufacturers world-wide.

More than 99 per cent of today's energy supply for road transport in OECD-countries comes from crude oil (69 per cent gasoline and 30 per cent diesel), while the most important alternative fuels, LPG (0.9 per cent) and natural gas (0.05 per cent) hold minuscule shares. The low price of oil and limited availability of alternative fuels continues to militate against large-scale switching, which would also entail high initial costs for production facilities, distribution networks, and suitably designed vehicles.

The report "Automobile Fuels for the Future", compares the conventional and alternative fuels: Gasoline and reformulated gasoline from crude oil, diesel oil and reformulated diesel oil from crude oil, Liquefied Petroleum Gas (LPG) from refineries and associated gas, natural gas, methanol from natural gas or cellulosic material, ethanol from starch-rich or sugar-rich crops or from cellulosic material, hydrogen by electrolysis of water, dimethyl ether from natural gas. Its major conclusion is that alternative fuels may be blended with conventional fuels. Using blends enables a gradual increase of production capacity of the new fuel as well as the use of existing vehicle technology and distribution infrastructure. Methanol and ethanol may be blended with gasoline and biodiesel, or with conventional diesel oil, in any mixing ratio.

Alternative fuels thus are unlikely in the short term to contribute significantly to sustainable transport (with the possible exception of electricity-driven city cars). There is little doubt that sooner or later, the transition to alternative transportation fuels will be necessary, for a combination of energy security, oil scarcity and environmental reasons.

### *Overall effectiveness of "technological fixes"*

The OECD literature suggests that wide-scale adoption of best available technology already in use would, of itself, bring significant reductions in fuel consumption and pollution, especially if strong enforcement, inspection and maintenance programmes were implemented in all OECD countries. Further significant gains, as mentioned above, could be attained if technologies that are

already at the prototype/demonstration stage were adopted. Market forces have so far failed to generate widespread use of best available technologies, so that the case appears strong for government intervention to progressively tighten standards and develop economic instruments designed to accelerate the adoption of today's optimal technology.

The effective use in the past of such approaches (mandatory standards, differentiated taxes on fuels, vehicle purchase and road taxes favouring cleaner, more efficient vehicles) suggest that this is one way to go. The fact that the average time for technological improvements (once commercially available) to diffuse through the entire vehicle park is about 10-15 years argues for early adoption of these policies, with a tight calendar for their implementation, and on an internationally co-ordinated basis.

As noted above, many questions remain about the cost-effectiveness of "technological fixes". Not only manufacturers and consumers, but many policy-makers as well, argue that it remains to be proven that increasingly costly measures associated with further "greening" of the automobile will indeed be fully compensated by environmental and social benefits. To the extent that higher costs for transport translate into constraints on suppliers and users of transport goods and services, there is a perception that what might be gained in environmental terms may be lost in other respects, whether through decreased individual mobility or more broadly in terms of economic losses to producers and consumers. The economic, political and social barriers to the rapid and wide-scale introduction of new anti-pollution and fuel-efficient technologies are acknowledged in the OECD's work, but have not themselves been the object of in-depth study. Closer examination of these barriers, and the need for better analytical tools to assess the real cost-effectiveness of anti-polluting technologies provide a rich and indeed essential agenda for further work.

### *Capital Stock Turnover in the Transport Sector*

Ongoing IEA works in co-operation with OECD/ENV addresses the issue of how quickly the automotive, truck and aircraft park is replaced<sup>1</sup>. New energy-producing or energy-using capital equipment consumes considerably less energy than the older equipment it replaces. Capital stock turnover (CST) results in lower energy use and lower CO<sub>2</sub> emissions. While newer capital stock generally involves lower operating costs, the feedback response between these lower costs and output or activity is small. Economic growth leads to growth in capital stock. Capital stock turnover leads to continually lower energy use and emissions per unit of output.

Compared with the life spans of other energy-producing and energy-consuming equipment, the mean life of stock in this sector is relatively short. The technical potential for reducing energy use remains very large, especially for automobiles and light-duty trucks.

The scale of future energy consumption and carbon dioxide emissions from this sector will be determined largely by: the level and nature of future travel demand; future growth and CST in road automobiles, light-duty and heavy-duty trucks and aircraft and their energy efficiency; and the type of fuel used and its carbon dioxide emissions attributes.

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<sup>1</sup> Calculating capital stock turnover for cars, trucks and for aircraft is a complex matter representing the replacement of the park of transport vehicles over some years. The basic element in replacement is the so-called survival rate of vehicles in the park. From this rate the average lifetime of a vehicle in the park can be estimated and from that figure the time it takes to replace the entire park can be estimated. Accurate measures of actual scrappage are very difficult to obtain so that registrations have been used throughout as a surrogate. However, the growth in the numbers of vehicles in the park, for a given year, is only the difference between the new registered vehicles minus the vehicles scrapped from the park.

## 5.2 Policy Instruments for Promoting Clean and Fuel-efficient Automobiles

OECD work has examined various economic and regulatory instruments that could encourage and accelerate the adoption of better, if not best-available, technologies for clean, fuel-efficient vehicles.

### *Economic Instruments*

The economic instruments should be directed towards an equitable internalisation of the high social costs associated with motor vehicle use, and removal of other market distortions impeding consumer and manufacturer interest in fuel efficiency. These measures would likely include some combination of the following:

- Fuel pricing:

Fuel prices reflecting the high social costs linked to fuel use could both restrain growing demand for fuel consumption and stimulate demand for more fuel efficient technologies. Higher fuel prices could also be one means of beginning to internalise some of the environmental and social costs of road traffic.

- Vehicle taxes:

Vehicle taxes based on fuel consumption could speed penetration of more efficient vehicles into the vehicle fleet and would better integrate environmental, socio-economic and technological considerations than a point-of-sale tax based on cylinder capacity or other criteria.

A shift in emphasis from taxation based on ownership to emission-related and use-based vehicle taxes would affect the level of transport use and contribute to environmental improvements and less resource use. In most cases, a 10% reduction in motorised mobility and choice of transportation would result.

- Variable driving costs based on fuel consumption:

Implementing a set of mileage charges, road entry fees, parking fees and other charges scaled in reference to fuel efficiency would have an impact

on driving as well as providing a continuous system of incentives and disincentives related to fuel efficiency.

A recent OECD analysis of “no regrets” fuel taxation options- that is, options that are beneficial for reasons other than their environmental impact - has determined that these measures could contribute substantially to reducing fuel use. Options include shifting the burden of taxation from vehicles to fuel, ensuring that governments recuperate the costs of providing transportation-related infrastructure through fuel taxes and indexing fuel costs to pay for uncovered costs associated with traffic congestion, accidents, air pollution, noise and land-use impacts. Fuel price increases justified on these three grounds are likely to vary according to local, regional and national conditions. For instance, some countries’ may already recover all of the costs associated with infrastructure provision through their fuel taxes while others may not yet do so. Harmonisation of such “no regrets” taxes may therefore not make sense at the international level given the variation in different countries’ existing levels of costs and taxation. However, agreement to implement a minimum level of tax increase and/or the harmonisation of charges at the regional level might make good sense in order to ensure reductions in fuel use and the wider adoption of fuel efficient technologies.

### *Regulatory Instruments*

Regulatory measures applied to manufacturers should focus on maximising industry’s response to the fiscal incentives given the consumer. Ambitious mandatory fuel-efficiency target values should be phased in to ensure that technical potential for increasing fuel efficiency is fully exploited while allowing industry to choose its own means to meet the targets.

- Fuel efficiency and emission standards

These measures, whether mandatory or voluntary, are considered to be effective by many in that they leave industry the flexibility to choose the best system and technology to meet a given standard (for fuel efficiency or pollution control) at least cost. Whether expressed as fuel economy

or CO<sub>2</sub> emission standards, targets might become increasingly stringent over time according to a clear, long-term calendar based on the known potential for improvements, and be supported by economic incentives.

Efforts should continue to reduce sulphur levels in fuels to 30ppm and possibly to 10ppm or less, as proposed by several OECD countries (Environment Outlook, OECD, 2001*d*). It is also necessary to reduce particulate matter pollution and allow for the use of available fuel-efficient technology.

- Speed limits

A convergence of speed limits across OECD countries on what are already widely accepted values (e.g. 50 km/h in built-up areas, 90 km/h on roads and 110-120 km/h on motorways) and effective enforcement could reduce accidents, pollution, fuel consumption and noise levels.

Other areas where regulatory approaches would appear to still have considerable scope are inspection and maintenance programmes, eco-labelling and consumer information, and driver training and education programmes.

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### 5.3 *Influencing Demand for Transport*

Even though “technical fixes” show strong potential to reduce pollution through stronger emission controls and improved fuel efficiency, it is foreseen that unconstrained growth of traffic will ultimately overwhelm these gains. Thus, a second important and complementary strategy goal is to simultaneously influence demand for motor vehicle travel. There is thought to be scope in the longer term for land-use planning to reduce demand for travel and/or shift it to other less harmful modes, and in the shorter term to use a wide variety of measures to control road traffic, promote public transport, etc. Reducing road traffic by these means presents the added advantage of meeting other objectives in addition to pollution reduction, e.g. noise and congestion

reduction, traffic safety and improvement of the quality of life in general.

#### *Land use and transport planning*

Carefully conceived and integrated urban land use and transport planning is considered by many to be a potentially effective approach, in the longer term, to significantly modifying demand for travel, especially in favour of public transport. However, the OECD literature suggests that even today, transport planning and urban development tend in general to go their separate ways.

Transport infrastructure consumes about 25-30% of land in urban areas and just under 10% in rural areas in OECD countries. The road network occupies 93% of the total land area used for transport in the EU.

A key lesson that emerges from OECD work, around which there is wide consensus, is that the provision of additional road infrastructure is rarely a solution, but rather adds to the problem. More roads generate more traffic, have not in general reduced problems of congestion, and incite more people to switch from public transport to car driving.

Land-use planning that concentrates home, jobs and other attractors like shops and recreational facilities, whether in city centres or in new suburbs and new towns, should theoretically reduce overall travel demand in the longer term. However, the evidence shows mixed results, not least of all due to a strong propensity on the part of individuals to accept longer travel times, usually in their cars, in order to retain access to a wider variety of job, housing, shopping and recreational opportunities.

A new approach combines land-use and transport policy. The list of policy instruments to redirect urban travel through land-use planning and transport land-use planning and transport policy at the level of government responsible is:

- Land-use planning and development control policies that increase the accessibility to

jobs, shops and other facilities, without the need to travel by car;

- Policies affecting the pricing of fuel, car purchase and licensing, parking and road use to influence vehicle design, the location of activities, modal choice and the growth of teleworking;
- Measures making use of telematics to integrate signal control, parking and public transport management to raise the efficiency of urban travel systems and promote shifts from car to other modes;
- Policies making employers responsible for commuter planning to reduce peak traffic flows;
- Policies concerning subsidy, privatisation and the use of upgraded information systems and marketing to increase the efficiency and attractiveness of public transport;
- Measures to set up car-free zones, traffic calming and cycle and pedestrian priority to assist pedestrians and cyclists, reduce the risks to these modes, and improve the attractiveness of cities;
- Measures to promote goods trans-shipment depots and city-friendly delivery vans to suit logistics to urban conditions.

No single measure has the power to achieve the objectives of sustainable development. Governments need to introduce packages of policies that are mutually reinforcing. Packages embracing land-use and pricing instruments are particularly appropriate, since they have the capacity to reduce car travel and to improve accessibility for those without cars. But the package will be different for each city regarding its size and state of development.

### ***Public transport***

In the OECD area, travel by public transport has barely changed in volume in recent decades, and has declined sharply as a proportion of all passenger travel. Many OECD countries continue to make significant investments in public transport, seeing the expansion and improvement

of public transport as the preferred means of improving overall transport capacity while reducing reliance on road traffic. The beneficiaries of improved public transport are the users themselves, other travellers, and city-centre activities. By reducing car traffic, they confer benefits on other road users through reduced levels of congestion and pollution. Public transport improvements are often an essential component of any policy to restrain car use. Perhaps the most important aspect of improving public transport, especially rail systems, is that they help to retain employment and other activities in city centres or, in the case of rapidly expanding cities, to allow a higher proportion of new jobs and facilities to be located in the centre.

The evidence shows however that these investments are more likely to be effective and economical in areas of high population density than in relatively low-density areas. However, public transport, when operated at only a portion of its full capacity, can have a greater environmental impact than car use. This suggests that efforts ought to be made (including, perhaps, restrictions on single occupant vehicle travel, pricing mechanisms and/or incentive programmes) to ensure that public transport is not impeded by car traffic and operates at or close to its full capacity.

Outside of city centres, the difficulty for land-use and transport planners lies in reversing decades of urban planning based on - indeed impelled by - motor vehicle transport. Existing suburban infrastructure presupposes heavy reliance on the personal automobile, while the widely dispersed, low-density development typical of suburbs can pose serious obstacles to the economical operation of public transport networks. Also, once travellers have made the switch to the private car, for whatever type of journey, it is extremely difficult to persuade them to switch back to public transport.

The case is often made for using revenues from fuel taxes, road pricing and other economic instruments to support the further development of public transport in urban areas. There appears to be scope in most OECD countries to increase the attractiveness of public transport through:

- more effective communication with passengers;
- extension of network coverage, capacity and frequency;
- enhancement of speed and accessibility, e.g. by designated freeway or street lanes for public trams, buses and multi-occupant vehicles;
- reduced or simplified fare structures;
- improved comfort and security;
- expanded parking at main transit terminals and development of park and ride programmes in suburban areas.

### ***Traffic management in urban areas***

Parking controls are still the most common means of restraining traffic in urban areas of most OECD countries. They seem to be accepted by the public and are reasonably enforceable. Wider use of measures affecting the availability and price of parking include limiting the amount of parking provided with new commercial developments, and shifting the supply of parking from central to suburban districts (to favour park-and-ride). Significantly higher charges for parking, coupled with strict enforcement, can effectively discourage motorists from driving into city centres.

Restricted access, e.g. pedestrian zones and streets reserved for public transport, pedestrians and cyclists, seem to find public acceptance in spite of initial misgivings. Some additional road infrastructure may be warranted in this context if it serves to route traffic around closed areas. Experience in OECD countries with using tolls to regulate access to city centres remains limited, but has been shown to be feasible.

Traffic calming can be achieved by stricter enforcement of existing speed limits, reducing speed limits, re-routing of traffic, and by the use of telematics to adjust traffic flow to current conditions.

Employer-based programmes can reduce demand for low-occupancy commuter travel, e.g., teleworking, initiatives to support multi-occupant travel through parking restrictions or financial incentives, substitution of free public transport passes for free parking, etc.

Freight transport can be better managed by restricting times of movement in city centres to off-peak hours and by transferring goods at points outside city centres from heavy road vehicles to smaller, quieter inner city delivery vehicles.

Education, information and public consultation. These instruments have the potential to influence the choice of transport means, routing and driving behaviour and habits, although there is little evidence in the literature that they have been extensively used with the aim of reducing demand for transport.

### ***Pricing mechanisms and transport demand***

Research and discussion on “getting the prices right” for the transport sector have been at the heart of much of the recent work by OECD, ECMT and IEA. The magnitude of the external social and environmental costs of road transport is recognised to be very high. It is argued that the internalisation of these costs, using a variety of pricing mechanisms, would in itself have a major impact on the demand for transport and hence, on the social and environmental impacts of the sector.

Many studies have examined the feasibility of alternative policy options to internalise the environmental and social costs of transport. Despite this, the policy response has been comparatively slow, and there remains a marked divergence between the policies which are often advocated and their acceptance into transport policy. So, it has been considered that internalisation of external effects from transport was unlikely to be realistic or attainable even though road pricing, i.e., tolls for the use of road infrastructure (express highways, bridges, tunnels) is a familiar concept in many OECD countries. Theoretically, a system of electronic road pricing which covers almost all of the major roads would

be a desirable economic instrument. However, it is prohibitively costly. An urban road pricing, which imposes higher user charges during peak congestion hours in urban areas, could help mitigate specific urban problems such as congestion and high pollution levels. However, it still entails an acceptance problem. A kilometre-based tax for HDVs was applied in some countries but abolished due to the very large number of border crossings.

However, Switzerland introduced the new distance-related heavy vehicle fee (HVF) on the 1<sup>st</sup> January 2001. The level of the fee is set so that the resulting price for a transit on the Basel-Chiasso route does not exceed 200 Euros, which is approximately equivalent to estimated external costs. Two-third of the income from the HVF flows into the financing of the large-scale public transport project (New Alpine Rail Transversal). By strengthening the competitiveness of the railways, it ensures that the capacities of the rail infrastructure are used optimally and in a way that covers costs. The result of this HFV should be drawing great attention from other countries.

In the joint OECD/ECMT report "Urban Transport and Sustainable Development", considerable attention was paid to the thesis that potentially the most efficient measure to reduce road transport demand would be a significant rise in the real price of fuel over the longer term. This measure, it is argued, could both reduce demand for, and improve the efficiency of, motor transport. Substantial and steadily increasing fuel prices could influence life-styles, vehicle design, locational decisions, driver behaviour, choice of travel mode and length of journeys. Car use, fuel consumption and emissions would be reduced. The announcement of long-term real price increase strategies would allow people to adjust their behaviour more easily and with greater certainty to a new relative price situation. Theoretically these are convincing arguments; however, such a policy has not yet been put into practice - primarily due to low public acceptance. In order to gain acceptance, such a policy would need to be designed and implemented in co-ordination with other tax and price policies so that its effects are revenue neutral.

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#### ***5.4 Institutional Arrangements for Improved Policy Integration***

While governments are constrained in various ways and degrees in influencing the behaviour of producers and users of transport goods and services, they do have scope to improve how they themselves deal with transport and environment issues. Integrated policy-making for transport remains hampered to a large extent by fragmentation of policy responsibility both horizontally (across transport, environment, energy, finance and industry ministries/departments) and vertically (across central, regional and local governments).

Recent history showed that government intervention in the transport sector had not always produced optimum results. The sector was heavily subsidised, even though it was still in many ways inefficient. As far as the environment was concerned, targets for stabilising greenhouse gas emissions could not be achieved. Four guidelines were advanced in response to the problem of government intervention:

- Since there had been deficiencies in government intervention as well as market deficiencies, governments should ensure that their policies struck the right balance.
- Intervention in the market should take full account of the specific characteristics of the markets concerned. There were cultural, geographical, historic and social differences which required a cautious approach and meant that the same rule could not necessarily apply in every case.
- Governments should only try to strengthen competition where competition really existed. The United Kingdom's experience with introducing competition in local bus services was not considered a success by bus users.
- Often, governments should confine themselves to setting up a framework for competition, and not interfere in the running of firms. This was

extremely important in the CEECs, which needed to put a legal and institutional framework in place for the transport sector.

In response to the problems of the growing mobility, the government should be systemic, combining as appropriate: varying degrees of additional investment, maximum utilisation of capacity through the use of advanced technologies like automated highways and pricing for increasingly scarce infrastructure space. Government should take account of the difference of the regions: the transport policy could not be organised in the same way in every region because of the different expectations and cultures.

The fact that governments do not act like it should is clearly connected to public resistance to heavy-handed government intervention in transport. No government has so far demonstrated policies related to energy can reduce overall demand for mobility, and all governments find it politically difficult to contemplate such measures. On the contrary, many governments support subsidies for auto ownership. The masses of aspirationally mobile citizens also represent the majority of the democratic vote.

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### ***5.5 International Co-operation for Sustainable Transport***

The role of international co-operation has also received attention in OECD work. In view of the strong international competition on automobile markets, and the pressures of national manufacturers on their governments, effective action needs to be taken at the international level to ensure simultaneous decisions, common goals and constraints, and fair competition. Governments should work together to develop economic and regulatory frameworks that are stable, equitable and internationally co-ordinated. Introducing new fuels and significantly changing transport behaviour require considerable preparation, institutional reorganisation and changes to infrastructure, none of which will be possible if contradictory policies are followed by

different divisions within government. Internationally agreed standards for air quality, motor vehicle emissions and fuel economy and quality would greatly facilitate the necessary adjustment by vehicle and fuel manufacturers. The adoption of compatible testing and measurement procedures would be an important step in this direction.

Similarly, co-ordinated action at the international level may be the only way that fiscal and pricing mechanisms for restraining transport demand, notably fuel or energy taxes could work effectively.

A report of "International Collaboration in Energy Technology: a sampling of success stories" (IEA, 1999) provides a framework for collaboration on energy research and development demonstration and information exchange. The programme in this report brings together experts from different countries; it includes information dissemination and collaboration on fossil fuels, renewable energy, energy end-use and fusion power.

The report shows that collaborative programme has proven highly successful in increasing the efficiency of global energy technology development. Cost sharing reduces the costs for individual countries by 50 per cent to 95 per cent from what they would have been spent if each country to finance the projects alone. The resulting increased rate of technological progress and increased flow of information from activities and networks developed under the programme provide added benefits. The collaboration also contributes directly to the development and deployment of new technologies. In many cases, work programmes are designed and undertaken in close co-operation with industry, helping to bring new technology developments directly to marketplace.

## 6

## ENVIRONMENTAL BENEFITS OF INTEGRATED POLICIES FOR SUSTAINABLE TRANSPORT

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**A**ctual demonstrated effects of many of the policy measures described in Chapter 5 remain largely anecdotal and highly dispersed in the OECD literature (much of which is based on case studies). No OECD country has implemented a comprehensive and effective sustainable transport policy in which the interrelationships, synergies and/or neutralising effects of the wide range of measures described above have been demonstrated. Moreover, it is accepted that given the wide disparity in transport situations and environmental conditions across OECD countries - indeed sometimes within individual countries - the relevance and efficacy of any given sustainable transport measure or combination of measures are likely to vary widely. At the 1996 OECD Conference **Towards Sustainable Transportation** delegates did suggest that some common framework for action was necessary. They suggested a series of *Sustainable Transport Principles* and strategic directions that might serve to guide transport and environmental policy-making.

Conventional approaches to mitigating transport's environmental impacts have used observed and projected transport trends and sought to assess the environmental impact of these developments ex-post. This approach has led to important efficiency gains and has helped to reduce certain environmental and health risks stemming from the transport sector. It has not - and likely will not - however, lead us towards meeting long-term environmental objectives.

A new target-oriented approach is needed that places environment and health at the top of the policy agenda for transport and related sectors, at international, national, and local levels. To this end, the Environment Ministers of OECD Member countries agreed on Shared Goals for Action (OECD Environmental Ministerial

Meeting, April 1998). They requested the OECD to undertake further work on environmentally sustainable transport (EST) including the development of guidelines for moving towards EST. In response to the request, the OECD's Working Group on Transport undertook the EST project which included development of the definition and criteria for EST (see Box 1) with a view to elaborating a set of guidelines. The EST Guidelines was elaborated by operationalising the Principles towards Sustainable Transportation and Strategic Directions endorsed by the OECD conference on Sustainable Transport held in Vancouver in 1996.

The EST Guidelines (see Box 2) are part of OECD's commitments to contribute to the implementation of major international conventions and other commitments, and were endorsed by the OECD Conference on Environmentally Sustainable Transport – EST Futures, Strategies and Best Practices in October 2000 in Vienna. They were presented and endorsed by OECD Environment Ministers at their meeting in Paris on 16<sup>th</sup> May 2001 (OECD, 2000a).

- **Project on Environmentally Sustainable Transport (EST)**

The EST initiative involved some 25 countries across the world in a search for a new approach to help solve today's transport problems. It concluded that there exists a new way towards a sustainable transport future. This involves defining what is meant by environmentally sustainable transport, developing a vision, and then working out how to realise it. It also implies an assessment of the economic and social implications of EST.

Qualitatively, environmentally sustainable transport has been defined as follows:

*Transport does not endanger public health or ecosystems and meets needs for access consistent with (a) use of renewable resources below their rates of regeneration, and (b) use of non-renewable resources below the rates of development of renewable substitutes.*

The key conclusions drawn from the OECD EST project are as follows:

- Environmentally sustainable transport doesn't mean less transport than we have today, but it certainly means different transport. A significant difference is the balance of use of more rather than less environmentally friendly modes. Also, the assessment of economic implications of EST shows that following the EST scenario will lead to considerable lower external costs of transport compared to the business-as-usual trends.
- The structure of transport under EST in the future would also be different than it would be under BAU. The analysis found that less than half of the effort towards achieving EST would come from technological advancements for cars and lorries, fuels and infrastructure; the other half from making transport 'smarter' through mobility management, innovative mobility services and freight logistics.

If EST is to be achieved over the next three decades, transport in 2030 might be characterised by:

- A significant change in the type of passenger transport provided. Many passenger vehicles would be running much more fuel-efficient conventional engines, hybrid-electric engines, or

electric engines (e.g. powered by fuel cells). There would be much greater use of non-motorised means for short distance trips, together with supporting infrastructure.

- Public transport, including new forms of integrated public and individual transport such as "public cars", would increasingly provide integrated mobility services.
- Significantly more efficient longer distance freight movements by road due to increasing load factors, better logistics and increased use of rail-based modes. Hydrogen would be used as a fuel both directly and in fuel cells.
- Almost all rail transport would be electric, with increases in high-speed modes, efficiency and capacity, especially for freight transport.
- More efficient and less polluting inland and coastal shipping vessels would be used; hydrogen may also be used as a fuel.
- Long-distance air travel for business purposes might be significantly decrease with information technology used for communication instead. Multi-modal freight logistics would be used for air cargo, and aircraft would be more fuel-efficient.

The EST Guidelines have been elaborated to assist governments at all levels in the development and implementation of strategies towards EST. Their effective implementation requires strategies that accommodate the particular geographic and socio-economic conditions of countries or regions and involve all parties concerned. In the next stage of work, the OECD Working Group on Transport will focus on developing implementation strategies and best practices for EST in specific OECD regions.

**Box 1: Summary of Criteria for EST**

<p><b>CO<sub>2</sub></b> Climate change is prevented by reducing carbon dioxide emissions so that atmospheric concentrations of CO<sub>2</sub> from transport are stabilised at or below their 1990 levels. Accordingly, total emissions of CO<sub>2</sub> from transport should not exceed 20-50% of such emissions in 1990, depending on specific national conditions.<sup>a</sup></p>	<p><b>NO<sub>x</sub></b> Damage from ambient NO<sub>2</sub> and ozone levels and nitrogen deposition is greatly reduced by meeting WHO Air Quality Guidelines for human health and eco-toxicity. This implies that total emissions of NO<sub>x</sub> from transport should not exceed 10% of such emissions in 1990.<sup>b</sup></p>
<p><b>VOCs</b> Damage from carcinogenic VOCs and ozone is greatly reduced by meeting WHO Air Quality Guidelines for human health and ecosystem protection. Total emissions of transport-related VOCs should not exceed 10% of such emissions in 1990 (less for extremely toxic VOCs).<sup>b</sup></p>	<p><b>Particulates</b> Harmful ambient air levels are avoided by reducing emissions of fine particulates (especially those less than 10 microns in diameter). Depending on local and regional conditions, this may entail a reduction of 55% to 99% of fine particulate (PM<sub>10</sub>) emissions from transport, compared with 1990 levels.<sup>c</sup></p>
<p><b>Noise</b> Noise from transport no longer results in outdoor noise levels that present a health concern or serious nuisance. Depending on local and regional conditions, this may entail a reduction of transport noise to no more than a maximum of 55 dB(A) during the day and 45 dB(A) at night and outdoors.<sup>d</sup></p>	<p><b>Land use/Land take</b> Land-use and infrastructure for the movement, maintenance, and storage of transport vehicles is developed in such a way that local and regional objectives for air, water, and ecosystem protection are met. Compared to 1990 levels, transport activity will likely entail the restoration and expansion of green spaces in built-up areas.<sup>e</sup></p>

<sup>a</sup> The Second Assessment Report of the Intergovernmental Panel on Climate Change (1996) maintains that, in order to stabilise atmospheric CO<sub>2</sub> concentrations at near current levels, world-wide CO<sub>2</sub> emissions would need to be reduced by 50% to 70% with further reductions thereafter (IPCC, *Second Assessment Report*, page xi, Intergovernmental Panel on Climate Change, 1996). However, in order to allow for increases in emissions in developing countries, OECD countries should reduce their emissions by 80% or more so that a global reduction of 50% may be attained (OECD, *Environmental Criteria for Sustainable Transport*, OECD Environment Directorate, Paris, France, 1996). A reduction target of 50% might be more appropriate for certain countries that benefit from a favourable (e.g., a more environmentally friendly) modal split, as was suggested by the EST pilot study for the countries of the Central and Eastern European region.

<sup>b</sup> These criteria are set in line with the WHO guidelines for human health regarding NO<sub>x</sub>, VOCs, and ozone (WHO, 1996) and the UNECE protocols under the Convention on Long-Range Transboundary Air Pollution for ecosystem protection regarding critical loads for nitrogen deposition and critical levels of ozone (UNECE, LRTAP Convention, 1999)

<sup>c</sup> WHO advises that there is no ambient level of fine particulate matter (smaller than PM<sub>10</sub>) and ultrafine particles (smaller than PM<sub>2.5</sub>) below which health effects (including cancer) do not occur. Countries should set targets based on dose-effect considerations. The targets set here are preliminary due to the ongoing research on the health effects from ultrafine particulate matter (WHO, Air Quality Guidelines, World Health Organization Regional Office for Europe, Copenhagen, Denmark, 1998).

<sup>d</sup> This criterion is based on the former WHO recommendation on noise that has been recently updated in the WHO Guidelines for Community Noise (WHO, Guidelines for Community Noise, World Health Organization, Geneva, 1999).

*Box 2: The EST Guidelines*

- Guideline 1.** *Develop a long-term vision of a desirable transport future that is sustainable for environment and health and provides the benefits of mobility and access.*
- Guideline 2.** *Assess long-term transport trends, considering all aspects of transport, their health and environmental impacts, and the economic and social implications of continuing with 'business as usual'.*
- Guideline 3.** *Define health and environmental quality objectives based on health and environmental criteria, standards, and sustainability requirements.*
- Guideline 4.** *Set quantified, sector-specific targets derived from the environmental and health quality objectives, and set target dates and milestones.*
- Guideline 5.** *Identify strategies to achieve EST and combinations of measures to ensure technological enhancement and changes in transport activity.*
- Guideline 6.** *Assess the social and economic implications of the vision, and ensure they are consistent with social and economic sustainability.*
- Guideline 7.** *Construct packages of measures and instruments for reaching the milestones and targets of EST. Highlight 'win-win' strategies incorporating, in particular, technology policy, infrastructure investment, pricing, transport demand and traffic management, improvement of public transport, and encouragement of walking and cycling; capture synergies (e.g., those contributing to improved road safety) and avoid counteracting effects among instruments.*
- Guideline 8.** *Develop an implementation plan that involves the well-phased application of packages of instruments capable of achieving EST taking into account local, regional, and national circumstances. Set a clear timetable and assign responsibilities for implementation. Assess whether proposed policies, plans, and programmes contribute to or counteract EST in transport and associated sectors using tools such as Strategic Environmental Assessment (SEA).*
- Guideline 9.** *Set provisions for monitoring implementation and for public reporting on the EST strategy; use consistent, well-defined sustainable transport indicators to communicate the results; ensure follow-up action to adapt the strategy according to inputs received and new scientific evidence.*
- Guideline 10.** *Build broad support and co-operation for implementing EST; involve concerned parties, ensure their active support and commitment, and enable broad public participation; raise public awareness and provide education programmes. Ensure that all actions are consistent with global responsibility for sustainable development.*

- **Urban Travel and Sustainable Development**

In addition, from 1992-1994, a Joint OECD/ECMT Working Group on **Urban Travel and Sustainable Development** sought to broadly estimate the effects of three tiers or “strands” of measures: “the rapid implementation on an OECD-wide basis of best practices and best available technologies; the gradual introduction of innovative policies; and the introduction of a substantial and steadily increasing fuel tax.

The first strand, called “Best Practice”, would involve widespread use of tried and tested measures in land-use planning, traffic management and the improvement of public transport, associated with wide acceptance of today’s strictest standards and targets relating to environmental quality and road safety.

This could bring about some changes in travel patterns, chiefly in inner city areas, where traffic levels could be stabilised. Noise and congestion would be little affected outside city centres and overall travel by car would continue to grow, if perhaps at a slightly reduced rate. Pollution levels should diminish in response to tighter fuel

economy and emission standards, but even with today's most stringent fuel economy targets, CO<sub>2</sub> emissions would continue to rise.

“Policy innovations”, the second strand, would rely heavily on land-use planning and traffic management measures, some of which are still at the research and development stage. Land-use planning would be used to influence the location of jobs and homes so as to widen travel choices. Congestion pricing and telecommunications would be used to bring demand and supply for road space into balance.

Land-use planning measures would determine which types of settlements should expand, where major developments should locate (e.g. concentrating major attractors such as offices and shops in areas well served by public transport). Land uses would be integrated with public transport routes, roads, cycle and walkways. Strictly enforced speed limits would be applied more extensively on through roads and traffic calming would be extended to most residential and school areas. Traffic management measures would include an integrated package of congestion pricing, reductions in city-centre parking, bus priorities, park-and-ride services and investment in transit infrastructure. Congestion and pollution would be reduced substantially. Noise would continue to be a problem, particularly in the absence of strong action aimed at motor bikes, motorcycles and heavy-duty vehicles. Safety levels would improve and people without cars would be able to travel more easily. Car owners would have more attractive alternatives to travel by public transport, on foot or by bicycle. Dependence on cars would be reduced and traffic growth in urban areas might cease altogether, though overall travel levels and CO<sub>2</sub> emissions would continue to rise.

The third strand, referred to as “Sustainable Development”, adds, to the first two groups of measures, a progressively increasing fuel tax to significantly reduce vehicle travel. Taking into account IPCC targets, the example considered is that of a seven per cent annual rise in real terms in the price of fuel over the next twenty years. This is estimated to reduce the amount of fuel used to

about a third of the forecast level of consumption 20 years from now, i.e. to about half of today's consumption, with a corresponding reduction in CO<sub>2</sub> emissions.

This saving would reflect a reduction in car trip lengths of approximately a third and much slower growth in car ownership and car travel over the next twenty years (perhaps 10 to 15 per cent instead of the forecast 50 per cent). High fuel prices should lead to more economical driving styles, smaller and less powerful vehicles and further improvements in fuel economy (perhaps as much as a third) arising from improved engine design. High fuel costs would provide a strong incentive to improve the efficiency of road freight transport and to shift freight to other modes.

#### • Long-term Environmental Outlook and Strategy – Transport Sector

OECD Environment Ministers met in Paris on 16<sup>th</sup> May 2001 to discuss and agree solutions to the most challenging environmental problems they face. They adopted a new OECD Strategy for the First Decade of the 21<sup>st</sup> Century to address these challenges (OECD, 2001*e*). The EST Guidelines were endorsed by the Ministers as a part of implementation of the Strategy. The Strategy identifies five inter-linked objectives for enhancing cost-effective and operational environmental policies in the context of sustainable development.

- Maintaining the integrity of ecosystems through the efficient management of natural resources.
- De-coupling environmental pressures from economic growth.
- Improving information for decision making measuring progress through indicators.
- The social and environmental interface: Enhancing the quality of life.
- Global environmental interdependence: Improving governance and co-operation.

The Strategy was developed taking into account the analysis contained in the OECD Environmental Outlook, which was a pioneering report that provides economic-based projections of environmental pressures and conditions to 2020. The OECD Working Group on Transport developed a set of projections relating to transport/environment trends and their potential impacts in order to facilitate the implementation of the Strategy. Transport is classified as “Red

Lights” in the Outlook which requires urgent measurements. The transport section of the Strategy calls upon OECD Member countries and the OECD for national action and collective work to overcome challenges and attain environmentally sustainable transport (see Box 3).

**Box 3: OECD Environmental Strategy for the First Decade of the 21<sup>st</sup> Century (Transport)**

*Challenges:*

- A. Significantly reduce the environmental and health effects of transport, particularly regarding air pollution and climate change, by ensuring that efficiency gains from technological developments and demand side management achieve lasting environmental quality improvements.
- B. Avoid exceeding air quality and noise standards, critical levels and loads for acidification, eutrophication and tropospheric ozone, prevent habitat fragmentation and minimise transport-related land use, run-off and waste, and reduce risks associated with maritime transport of hazardous substances.

*National action by OECD countries:*

1. Work towards an effective and full internalisation of environmental costs of transportation through the use of effective instruments such as taxation, charges, reform of environmentally harmful subsidies and other incentive-based approaches.
2. Support the further development and implementation of existing international conventions and other commitments on transport, environment and health.
3. Develop and use cost-effective demand side management tools and land use planning to reduce the need for travel, encourage transport usage that minimises its negative environmental effects, such as risks from maritime transport of hazardous substances, including through a better balance in the modal split.
4. Encourage the uptake of clean technologies for vehicles and fuels through targeted incentives.
5. Better assess the strategic environmental impacts of transport inducing infrastructure investment projects, policies, plans and programmes.
6. Contribute to the long-term environmental sustainability of the transport sector by setting targets to meet environmental quality objectives, in particular WHO air quality and noise guidelines.
7. Develop and implement multi-modal strategies based on the Environmentally Sustainable Transport (EST) guidelines, emphasising policy integration among sectors.

*Measurement of progress:*

Taking into account national conditions:

- Total distances travelled (passenger km and ton km by transport mode).
- Fuel use efficiency by mode of transport.
- Emissions from different modes of transport.
- Frequency of exceeding air quality standards for major transport related air pollutants and hazardous trace pollutants.
- Proportion of population exposed to noise at levels harmful to human health.
- Habitat loss and fragmentation resulting from transport infrastructure.

*Further work in the OECD:*

- Further develop the OECD work on Environmentally Sustainable Transport (EST), including:
  - the development of regional implementation strategies by 2006, and
  - the development of policies to counter the environmental impacts of high growth rates in aviation and road transport by 2006.
- Analyse strategies for the application of economic instruments, including emissions trading, levies and taxes, that promote environmentally sound aviation and maritime transport, taking into account work in other international organisations.
- Analyse policies and actions for integrating environmental objectives in territorial, regional and land use policies and their impacts on transport supply and demand.
- Analyse barriers to market penetration by environmentally friendly technologies and develop approaches on how to overcome this.
- Analyse the scope for policies to mitigate the negative environmental impacts from leisure and tourism travel.



**PART II**

***SURVEY ON OECD, IEA AND ECMT WORK ON TRANSPORT AND ENVIRONMENT***



**T**here is extensive work underway in the OECD and associated institutions (IEA, ECMT) on transport and environment relationships - involving, e.g., IEA's *Offices for Long Term Co-operation and Energy Technology, Research and Development*; ECMT; and OECD's *Environment Directorate, Directorate for Science, Technology and Industry (Road Transport Research Programme), Territorial Development Service (Urban Programme), Development Co-operation Directorate, Trade Directorate*. Collectively, this represents a broad spectrum of sectoral issues and capabilities, enabling the OECD and its sister organisations to mobilise a capacity on transport and environment policy integration that is probably not matched elsewhere in the international community.

### 1.1 *Intra-OECD Activities*

#### *The Environment Directorate (ENV) with The Directorate for Science, Technology and Industry (STI)*

In 1995-96, ENV and STI's *Road Transport Research Programme* co-operated on three topics: **Recycling for Road Improvements, Integrated Safety/Environment Strategies, Transport of Dangerous Goods through Tunnels** (see section 2.1).

#### *The Environment Directorate (ENV) with the Trade Directorate (ECH)*

Case studies (Europe and North America) on trade liberalisation in the transport sector were completed by the OECD *Joint Sessions on Trade and the Environment*. A paper summarising the

environmental effects of freight transport was also prepared

The **Liberalisation and Structural Reform in the Freight Transport Sector in Europe**, published in 1997, analyses the effects of the liberalisation and deregulation policy of the European freight transport on the road sector. It compares the transport market between the EUR12 countries and the EUR+3, as well as other countries like Switzerland, which have not participated in the EU liberalisation. One of the major conclusion of that report is that the way in which EU has been implemented liberalisation policy in freight transport has favoured the environmentally less friendly modes and accelerated the decline of rail and inland waterways. Another very significant problem, raised by this report is the impossibility of harmonising within Europe, the implementation of the policies of liberalisation of the market of transport.

The study on **The Environmental Effects of Freight** was published in 1997. The report describes the situation in the United States and Europe. The modal discussions focus on air pollution, noise, global climate issues, water pollution, accidents, land-use and habitat fragmentation. The review describes the impacts in qualitative terms, and then provides emission factors per unit of freight transported. The report highlights the problems involved in quantifying and comparing some environmental impacts from different modes. An example is the pollution caused by ocean freight which is only indirectly linked to the quantity transported. One of the major conclusions is that there is a problem to compare the intensity of different pollution, i.e., the absence of a basis for comparing, for example, air and water pollution.

In the following of this publication, one study was done in 1997 on **Freight and the**

**Environment: Effects of Trade Liberalisation and Transport Sector Reforms.** The study examines the environmental effects of international transport of goods attributable to trade liberalisation and liberalisation/structural reform in the transport sector itself. The study measures how the trade liberalisation is contributing to increased pressure on the environment from the growth in transport. While recognising the growing importance of the effect of heavy truck transport, the macro-economic projections concludes that environmental effects for trade liberalisation are rather small.

The Joint Session of Trade and Environment Experts published in 1997 **Trade Measures in the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their disposal.** The convention was concluded in Basel, Switzerland, on 22 March 1989 and entered into force on 5 May 1992. The issues raised by the convention represent a very complex mixture of environmental, social, ethical, political, legal and economic factors. In line with the mandate of the Joint Session, particular attention is paid to the trade provisions, how they work, and how they relate to the environmental objectives of the Convention.

<http://www.oecd.org/env/policies/index.htm>  
[http://www.oecd.org/ech/index\\_4.htm](http://www.oecd.org/ech/index_4.htm)

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## 1.2 OECD and IEA

In the framework of OECD and IEA projects on clean and fuel-efficient motor vehicles, a series of international conferences have been organised in the 1990's to foster development and market expansion of more environmentally sound vehicles. In March 1994, the OECD and the IEA (with the co-operation of the government of Mexico) organised the **Conference Towards Clean Transport: Fuel Efficient and Clean Motor Vehicles** in Mexico City. Among the topics discussed were the compatibility of the current demand for mobility and sustainable development, the special problems caused by

current trends of motor vehicle use in urban areas, technological developments, the barriers to development and market penetration of fuel efficient and clean motor vehicles, and opportunities for action. Progress towards more fuel efficient or cleaner motor vehicles and related government and industry policies were examined world-wide. The conference proceedings were published in 1996.

An international conference entitled "**Towards Sustainable Transportation**" was held in Vancouver (24-27 March 1996) organised by OECD, in co-operation with the IEA and other international organisations and hosted by the government of Canada (see also sections 2.6 and 3.2). Over 400 stakeholders in the transport sector (automobile and alternative vehicle manufacturers, fuel producers, government officials, regional and local planners, etc.) from 25 countries, met in order to develop a vision of - and chart a course towards - sustainable transport. In particular, the conference highlighted a series of **Sustainable Transportation Principles** and Strategic Directions meant to help guide public policy-making in reducing the negative environmental and social impacts of transport activity. While international in scope, the conference also allowed for an in-depth focus on the North American transport sector. A follow-up seminar (in 1998) on better integration of transport modes intended to focus on inter-city transport in North America.

A joint BIAAC/OECD/IEA Workshop **Industry View on the Climate Change Challenge with Special Emphasis on the Kyoto Mechanism** was held in March 1999. It offered an opportunity to share views among industry and government representatives from a range of major industry sectors. Recognising that each sector has different options and challenges, the workshop provided an opportunity to review the situation on a sector by sector basis. The meeting brought together industry representatives from energy suppliers, industrial energy consumers, transportation, agriculture and forestry. Issues related to transport generated a heated discussion at the workshop. There seemed to be general agreement that as transport

continues to be a high growth sector something had to be done to reduce CO<sub>2</sub> emissions, but no consensus emerged on how much or in what manner.

### 1.3 OECD and ECMT

A joint OECD/ECMT workshop on the **Social Costs of Road Transport** was held in September 1993 in order to review updated and expanded information on the social costs of road transport, and to examine the obstacles to wider efforts aimed at internalising these costs in transport decision-making. A series of other papers on topics such as equity and acceptability, fiscal harmonisation and options for future action were also discussed. An OECD/ECMT publication, **Internalising the Social Costs of Transport**, was released in 1994.

**Urban Transport and Sustainable Development** (see also section 2.4) was a joint project of *Group on Urban Affairs* (formerly in the *Environment Directorate*, now part of the *Territorial Development Service -TDS*) and the ECMT, focusing on transportation in the urban environment. The project builds on the conclusions and recommendations from previous work on urban transport and evaluates the potential of alternative policy instruments, such as road pricing, land use planning and promotion of public transport. An attempt was made to determine whether a reduction in travel demand in cities is feasible through relocation of activities and people closer to the existing public transport modes. Reports were produced on traffic calming, road pricing and planning measures aimed at reducing urban travel demand. A conference on **"Travel in the City: Making it Sustainable"** was held 7-9 June 1993 in Düsseldorf (Germany), in co-operation with the Land of North-Rhine Westphalia. Case studies of exemplary policies in Member and non-Member countries were presented. The report of the OECD and the ECMT Joint Working Group on the project was published at the beginning of 1995.

As a follow-up to existing joint work on urban transport, the *non-Member countries Branch of ENV, TDS and the ECMT* organised a **Seminar on Transport and Environment in Central and Eastern Cities**, in Bucharest in June 1995 (see also 2.4).

In 2001, the ECMT in association with OECD completed a three-year project on **Implementing Sustainable Urban Travel Policies**. This work, which came as follow up to the earlier project on **Urban Transport Sustainable Development**, examined why implementation of integrated sustainable policies has proven to be so difficult, and how countries and cities can overcome these barriers.

The project included a series of workshops on particular topics, an urban travel survey of 168 cities, and a series of national policy reviews. The final report bringing together the findings on implementation from each of the different parts of the project, along with a document summarising **"Key Messages for Governments"**, were approved by Ministers of Transport at their Council in Lisbon in May 2001 and published in early 2002.

Ministers in Lisbon mandated follow-up work to this project, which will include examining the implications of the project recommendations in specific groups of countries; exploring ways to improve consistency in urban data collection and monitoring; and developing a Guide to Good Practice for National Governments on implementation.

The findings of the work, as well as all the papers presented in the project's five workshops are available on the project web site

<http://oecd.org/cem/UrbTrav/index.htm>.

A joint OECD/ECMT conference on **Strategic Environmental Assessment for Transport** was held 14-15 October 1999. The objective of the conference was to:

1. Share information on effective approaches for assessing the strategic environmental

impacts associated with road and intermodal transport corridor developments.

2. Establish contacts between experts and practitioners in Central and Eastern European countries (CEEC's) and their counterparts in OECD countries in order to promote continued open dialogue and exchange on strategic environmental assessment (SEA).
3. Define priorities for improving strategic aspects of environmental assessment, particularly in CEECs.

The conclusions of the conference can be found on the Directorate on Science Technology and Industry Road Transport Research Program Site of web-site:

<http://www.oecd.org/dsti/sti/transport/road/index.htm>

The OECD EPOC Working Group on Transport and the ECMT ad-hoc group on Transport and the Environment have met regularly in **Joint sessions on transport and the environment** since 2001. The purpose of these meetings is to provide input to projects of particular common interest, including the following projects:

- OECD ENV work on the EST project and the project on long-term projections of global motor vehicle emissions
- OECD DSTI/RTR project on low emission vehicles
- ECMT work on an integrated environment and transport project and policy decision-making.

<http://www.oecd.org/env/transport/>

<http://www.oecd.org/cem/>

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#### 1.4 OECD, IEA and ECMT

Work by the OECD, IEA and ECMT to assess and evaluate sustainable transport strategies included a jointly organised **Conference on Reconciling Environmental, Energy and Transport Issues** (Budapest, 30 May - 1 June 1994). The conference focused on transportation trends and

their environmental and energy implications in Central and Eastern Europe. Following a review of Member country and Central and Eastern European experiences and policies related to reconciling objectives for transport, energy and the environment, potential programmes to reverse the decline in public transport and to move towards sustainable transport of people and goods was discussed.

Proceedings have been published for all three conferences. Co-operative efforts will continue to be pursued given (a) the growing demands for ECMT-IEA-OECD contributions of analysis, data and insights to international programmes and events (e.g., *UN Commission on Sustainable Development*; *UN/ECE Regional Conference*); and (b) OECD/IEA/ECMT engagement of non-Member countries. An informal Contact Group met in December 1995 to facilitate the sharing of information and in-house consultations.

Co-operative efforts between the OECD and the IEA relating to policy instruments to promote environmentally sound transport activities will continue in the future. In the technology area, the IEA took the initiative to organise, together with the OECD, the ECMT and the European Commission (EC), a **Transportation Technology Forum on Energy, Environment and Transportation Systems Perspectives** (Valbonne, 14-16 December 1994) in order to help government administrations and industry examine together, and update, priorities for transportation technology programmes; also to obtain views on areas requiring more attention of the organising international institutions, as well as suggestions on how to improve international collaboration where it already exists. As a follow up to the Valbonne Forum, the *IEA Energy Efficiency, Technology and Research & Development (formerly Energy Technology) Office*, with support from OECD, ECMT and EC, organised an Expert Meeting (Paris, 9-13 October 1995) on **Road Vehicle Technology** in order to induce Government and Industry discussions on the subject. Second and third rounds of discussions were held, respectively, in March and October 1996. The IEA and the OECD have also co-operated in examining the

issue of capital stock turnover rates in the transport sector.

In 1999 a joint OECD/ECMT/IEA Workshop **Improving Fuel Efficiency in Road Freight: The Role of Information Technologies**, was held in Paris. The Workshop analysed the increases of fuel consumption and CO<sub>2</sub> emissions from road freight transport. Its objectives were to examine how fleet managers and drivers can achieve organisational and behavioural improvements to reduce fuel consumption in road freight services. The measure highlighted includes fleet fuel management, fuel-consumption awareness when purchasing a vehicle, maintenance and vehicle/driving monitoring. The Workshop focused particularly on fast-evolving information technologies that play an increasing role in identifying, monitoring and maintaining energy efficient practices in all these areas. The Workshop study both private-sector experience and those of national programmes that seek to exploit a fuel saving potential to reduce carbon dioxide from road freight transport.

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### 1.5 Other Joint Activities

In addition to the specific activities described above, various bodies of the OECD, and the IEA and the ECMT have been pursuing a number of more general co-operative projects related to transport and the environment. These include the following:

- The OECD and the IEA are substantially contributing to the work of the *Intergovernmental Panel on Climate Change*, in particular on greenhouse gas emission inventory methods. Members of the IEA and OECD Secretariat were involved as Contributing Authors and Lead Authors for several chapters of the **IPCC Second Assessment Report**, and include the Convening Lead Author for the chapter on mitigation in the transport sector. The report was approved in December 1995, and provides

an overview of greenhouse gas emissions from the transport sector, scenarios of their future evolution, the social, economic and technical factors that influence that evolution, and the mitigation options for the sector. The report reviews what is known about the effects of the options, identifies their limitations, as well as sources of variation and uncertainty.

- The project on **Environmental Implications of Energy and Transport Subsidies** (see Section 2.6), carried out under the auspices of the OECD *Pollution Prevention and Control Group*, includes a series of country case studies (United States, France, Japan) on the transport sector. This project involves several OECD Directorates as well as the IEA and the ECMT. The case studies examine the environmental and economic consequences of internalising environmental and social costs and the project report was published in 1997 (OECD, 1997). In 1996, the OECD Environment Directorate participated in the meetings of the ECMT *Task Force on Internalising the Social Costs of Transport*.

The OECD is working towards a common framework for examining subsidies with environmental impacts under the leadership of the Agriculture and Trade Directorates and in close co-operation with the Environment Directorate, SGE, STI, the ECMT and other parts of the organisation.

- The OECD contributed to the international efforts towards sustainable development through a study of **Sustainable Development on Policy Approaches for the 21<sup>st</sup> Century**. The Secretary General's Office co-ordinated the preparation of a report on Sustainable Development for publication and presentation to the General Assembly of the United Nations in June of 1997. The ECMT had a lead role in drafting the chapter on transport activity, in collaboration with the Secretary General's Office, the Directorate for Science Technology and Industry and the Environment Directorate. It presents an economic, environmental, social, and development co-operation approach for reaching sustainable

development. It takes an in-depth look at nine sectoral issues including transport.

- Ensuring progress towards sustainable development is a priority of the OECD's work. Transport is a particularly challenging sector to achieve this. In 1998, the OECD Environment Ministers asked the OECD to carry out a three-year project on sustainable development and to report back to them in 2001. A report of "**Sustainable Development: Critical Issues**" (OECD, 2001g) responds to that mandate. It represents the efforts of the various OECD Directorates and of its affiliate organisations, including IEA and ECMT. The initiative has aimed at providing coherence, visibility and policy relevance to work carried out in response to specific sectoral priorities, including transport sector, and at considering – to the extent possible – the full range of implications (economic, environmental and social) of policies in each areas.

The conclusions of the transport chapter in the report outlines the approaches, such as integration of transport and environment policies, economic instruments and emission controls to attain sustainable transport. It is noted that in any case, close relation between stakeholders, including governments at all levels and industry is prerequisites for success. The transport chapter was developed by DSTI's Transport Division in co-operation with the Environment Directorate and the ECMT.

### 2.1 *General Secretariat: Advisory Unit on Multi-disciplinary Issues*

Prompted by the need to deepen the understanding of the role of air transport in the global marketplace and to review the regulatory structure which governs civil aviation, the *Advisory Unit* has completed a study on **The Future of International Air Transport Policy: Responding to Global Change** (1997). The report deals with environmental issues at several levels. It discusses the implications of infrastructure capacity bottlenecks in terms of congestion at and around airports and the attendant consequences of atmospheric and noise pollution for adjacent residential areas. It also considers the risk that unilateral national environmental policies may affect international competitive conditions and discusses the issue of aviation-related CO<sub>2</sub> emissions.

The *Advisory Unit* published an article in 1997 on **Air Transport and the Environment** in the special Earth Summit edition of the OECD Observer. The Unit has also contributed a sub-section on air transport in the 1997 **OECD Report on Sustainable Development** for the General Assembly of the United Nations (see section 1.5).

The *Advisory Unit* manages the **OECD Future Studies Information Base**. This documentation system offers succinct key findings and conclusions of published and unpublished literature selected from the world-wide output of projections and their analysis. It is intended to help decision-makers in all walks of life to better understand the long-term trends, potential trend breaks and new driving forces which will likely shape tomorrow's policy and business environment. The base contains some 7000 references of which more than one fifth relate to

environmental and transport issues. The base is available as a CD-ROM.

The **OECD Round Table on Sustainable Development** was established in 1998 to assist the work of Ministers, inter-governmental organisations, the private sector and civil society in addressing the cross-cutting economic, environmental and social policies that are commonly grouped under the heading of 'sustainable development'. On 17 May 2001, OECD Ministers specifically endorsed the role of the Round Table "as a forum for international dialogue among stakeholders. The Round Table provides an 'off-line' channel for exploring some of the more difficult issues related to sustainable development. Chatham House rules are strictly observed. It is the unusual opportunity for the key players to meet, away from the usual publicity that accompanies set-piece type international negotiations, which makes the Round Table such a unique forum.

<http://www.oecd.org/sge/au/>

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### 2.2 *Directorate for Science, Technology and Industry (STI)*

<http://www.oecd.org/dsti/sti>

The Directorate for Science, Technology and Industry (DSTI) deals with issues relating to science and technology, information and technologies and industry including transport. The Division of Transport was created in 1997 and serves two committees: the Maritime Transport Committee (MTC) and the Steering Committee for the Road Transport and Intermodal Linkages Research Programme (RTR).

The **Maritime Transport Committee (MTC)** has been in existence since 1948, when it was created to provide advice with respect to shipping requirements associated with the Marshall Plan. Since then the MTC has become one of the principal international bodies dealing with maritime issues. Its charter is to undertake economic research and provide policy guidance to OECD members. Its principal efforts in recent years have been towards the liberalisation of maritime transport services. With respect to maritime safety and the environment, the MTC has undertaken a number of projects aimed at establishing an economic basis for action against substandard shipping, as well as providing research and political support to the International Maritime Organisation (IMO) and national maritime administrations.

The mission of the **Road Transport and Intermodal Linkages Programme (RTR)** is to promote transport efficiency, safety and sustainability through a co-operative research programme on road and intermodal transport that recommends the development and implementation of effective transport policies in Member countries. The programme undertakes a number of activities in relation to transport and the environment. Through its work on intermodal transport, the programme is attempting to address the issue of overall efficiency of the transport system, and hence, its impact on the environment. This necessitates a broader approach involving other modes of transport.

<http://www.oecd.org.dsti/transport/rtr>

### **Recent Activities**

The objectives of the RTR Programme are to help Member countries to maximise the return on their investments in road transport. It supports improved technical applications, modern management practices, and an intermodal systems approach to favour sustainable road and transport systems. A Chapter is dedicated to environment/transport interaction. References to the following recent RTR environment related activities are made:

### **2.2.1 Environmental Impact Assessment of Roads**

The study provides a review of traditional environmental assessment methods and procedures currently used in the road and road transport sector and explores the potential of new research developments focusing on strategic approaches for long-term policies, plans and programmes, by emphasising the role of communication and involvement. A series of conceptual recommendations and new evaluation methodologies and instruments to enhance the planning and decision-making process are presented, making this publication both a framework and practical guide to OECD Member countries' transport administrations, highway agencies and environmental authorities. The report was published in 1994 and seminar was held in 1994.

### **2.2.2 Roadside Noise Abatement**

This report assesses the various tools available to mitigate the noise level due to road traffic. It presents the prevailing regulations and limits in different OECD countries and provides criteria for evaluation. The emphasis is on low-noise pavements and noise barriers as well as combinations of both measures. Enhanced layouts – tunnels, cuttings, etc. – vegetation and bio-walls are also reviewed in technical and economic terms. The report was published in 1995 and seminar was held in 1995.

### **2.2.3 Recycling for Road Improvements**

The report, published in 1997, urges road administrations to set priorities for recycling. The first priority is for road officials to find the ways and means to recycle road by-products so that the road construction industry sets an example for other industries and does not contribute to the adverse environmental impacts associated with the disposal of waste materials. The report provides information on several proven recycling techniques (“winners”) that are cost-effective and can help to mitigate environmental impacts of road by-products. In addition, the report suggests a road innovation charter that provides a model partnering agreement between transport agency and the

industry to facilitate for the introduction of by-product innovations and usage.

#### **2.2.4 Integrated Safety/Environment Strategies**

This activity, chaired by Finland and France, resulted in the publication of a report in 1997 that examined how evaluation methods and planning tools can be designed and used to give equal and co-ordinated consideration to the safety and environmental effects of road transport. The report based on case studies from OECD Member countries analyses the integration of these aspects into the design and implementation of transport policies. The *Environment Directorate* and its *Working Group on Transport* participated actively in this study.

- As a follow-up to the report, Finland sponsored an OECD Seminar on **Integrated Strategies for Safety and Environment**, in Helsinki, on 11-13 May 1998. The conclusion of the seminar was that an international consensus emerges on what kind of measures help to improve safety and enhance environmental quality, but each country needs its own strategy and should be responsible for setting it up. It is important to improve implementation of the measures known to be effective. The seminar underlined the fundamental importance of:
  1. Seeking solutions to reduce traffic, while taking into consideration the needs of those who use transport services;
  2. Finding new solutions developing countries, particularly economies in transition where motorization is increasing rapidly.

#### **2.2.5 Outlook 2000**

In the occasion of its 30th Anniversary, the RTR Programme issued in 1997 a report **Outlook 2000**. It presents the key results of international activities carried out by OECD and addresses such crucial questions as intermodality, logistics, infrastructure, safety, environment and intelligent traffic technologies.

An International Conference on “**Intermodal Networks and Logistics**” was held on 3-5 June 1997 in Mexico City. The main topics concerned the development of multimodal transport, strategies for multimodal transport development, innovative financing, integrated advanced logistics and international experiences. Environment was a recurrent theme for each of these topics. Environmental concerns calls for an intermodal transport in most cases.

#### **2.2.6 Performance Indicators for the Road Sector**

A study on “**Performance indicators for the road sector**” was published in 1997. The report examines current practices for measuring the efficiency of road administrations and suggests a well-defined set of goals and objectives which road administrations can use to gauge themselves. Environment is a key issue. It also deals with the purposes and uses of performance indicators and data systems that support the development of measures.

#### **2.2.7 Transport of Dangerous Goods through Road Tunnels**

The report, prepared by a joint OECD/PIARC Working group and published in 2001, provides a comprehensive package covering both regulatory and technical issues concerning the transport of dangerous goods through road tunnels. The report proposes harmonised regulations to facilitate compliance by road transport operators and enforcement, thus improving safety. A quantitative risk assessment (QRA) model has been developed as part of the research which compares the risks of transporting dangerous goods through a tunnel to using an alternative route. A decision support model (DSM) was also developed as part of the research which allows decision-makers to combine the results from the QRA with other relevant data (which are not of a scientific or technical nature but rather of a subjective or political nature). The DSM will help the decision-maker to determine the preferred route for the transport of dangerous goods or upgrades to existing tunnel infrastructure and other measures required to meet safety objectives. Finally, the report details the effectiveness of

measures that can be taken to reduce the risks of incidents in tunnels.

### **2.2.8 Performance Indicators for the Road Sector: Summary of the Field Test**

Following the recommendations of the OECD 1997 report, *Performance Indicators for the Road Sector*, a task force was established to field test a selection of 15 performance indicators used by road administrations throughout the world. The objective of the project was to assess the applicability of the performance indicators to improving the management of road administration. The field test was conducted over the period 1997-99 in 15 Member countries. This report, published in 2001, outlines the approach adopted and summarises the results of the field tests.

The 15 indicators that were field tested included: average road user costs; level of satisfaction regarding travel time and its reliability and quality of road user information; protected road user risk; unprotected road user risk; environmental policy/programmes; processes in place for market research and customer feedback; long-term programmes; allocation of resources to road infrastructure; quality management/audit programmes; forecast values of road costs vs. actual costs; overhead percentage; value of assets; roughness; state of road bridges; satisfaction with road condition.

A key aspect of the project was the comparison of the processes in which the indicators are applied by different road administrations. Qualitative assessment on the role of and function served by road administrations, and whether the execution of their mandates reflects the views of the public and government, suggested a need cultural change in most cases toward a client focused approach. The task force concluded that quantitative comparison between administrations is of limited usefulness unless it is accompanied by a thorough examination of the underlying reasons for any differences.

### **2.2.9 Influencing Road Travel Demand**

This study examines a broad array of measures undertaken to influence travel demand. New research findings and innovative trip-reduction strategies and case studies from OECD Member countries serve to update the 1994 OECD report on this topic, titled: Congestion Control and Demand Management. Included are successful measures designed to impact travel choices and use of transport modes, ameliorate traffic conditions, and maximise efficient use of road infrastructure. This study demonstrates the effectiveness of packaging supply and demand-related interventions and policy initiatives to create greater impact on travel demand. It culminates with recommended strategies to address current and future travel demand in OECD countries. The report will be published in 2002.

#### **2.2.10 Heat on Transport: Strategies to Reduce CO<sub>2</sub> emissions from the Road Transport**

Approximately 28% of total OECD CO<sub>2</sub> emissions come from transport. Within this, road-based transport accounts for approximately 80% of greenhouse gas (GHG) emissions from transport. The RTR Programme established a Working Group to undertake a comprehensive study on CO<sub>2</sub> emissions from road transport, with the aim of providing a useful framework for assessing the strategies of the road transport sector in reducing emissions on a global scale. The Working Group investigated recent trends in CO<sub>2</sub> emissions from road transport, and evaluated measures that have been implemented by OECD Member countries to reduce greenhouse gas emissions from road transport. In addition, the Working Group analysed models that have been developed to predict emission levels and attempted to provide insight on future trends of CO<sub>2</sub> emissions. The report will be published in 2002.

### **2.2.11 Effects of Infrastructure Investments on Regional Development**

The belief that transport infrastructure projects have significant impacts on the development of regional economies has often been used to justify allocating resources to transport infrastructure investment. But the clear meaning of these impacts or how these impacts should be evaluated has yet to be established.

The general approach used by decision-makers in the evaluation of transport investment is cost-benefit analysis (CBA). Traditional CBA, though varying in form from one country to another, is limited in its application since it concentrates on the direct user benefits of transport. The evaluation of projects using traditional CBA appears to be deficient in justifying the socio-economic interest of the public or private sectors, because it does not take adequate account of the likely regional impacts arising from the investment. The report will be published in 2002.

The report concluded that it is extremely difficult to measure the exact relationship between transport infrastructure investment and regional development. Though there are theoretical studies suggesting the presence of significant impacts, they need to be complemented by empirical evidence from existing ex-post evaluation studies. Transport infrastructure investment has the direct effect of improving travel conditions for its users. This will change users' behaviour and have wider impacts on the network. There could be further impacts including accessibility, level and location of employment and increased efficiency that will contribute to regeneration of a region. The externalities generated by the investment in transport infrastructure need to be recognised as well, including social inclusion and environment.

### **2.2.12 Joint OECD/ECMT Workshop on the Impact of e-commerce on transport**

The purpose of the Workshop, held in Paris, June 2001, was to analyse the implications for freight transport of the growth in e-commerce. The workshop gathered representatives from governments, industry (shippers, retailers, etc.),

academics and researchers. The discussion of issues focused on challenges to sustainable development that should be addressed through research projects. A summary of the Conclusions and Recommendations are available at the RTR Website (<http://www.oecd.org/oecd/pages/home/displaygeneral/0,3380,EN-document-25-nodirectorate-no-20-19078-25,FF.html>).

The relevant MTC activities are as follows:

- **Action Against Substandard Shipping.** The Maritime Transport Committee recognises that substandard shipping can cause both environmental and economic damage, and highlighted the financial gains available to those who avoided international regulations related to ship safety in a report published in 1996. This was followed by a discussion paper and report in 1998 on "*Possible Actions to Combat Substandard Shipping by Involving Players other than the Shipowner in the Shipping Market*". This report was discussed at an industry Roundtable in late 1998 from, which emanated an Action Plan, which is currently in the process of implementation. The principal objective of this Action Plan is to bring together all players in the shipping market to marginalise substandard shipowners, and reduce the incidence of substandard shipping which can cause substantial environmental damage when involved in serious incidents.

The Maritime Transport Committee will continue providing support to the International Maritime Organisation (IMO) and national maritime administrations, and its 1999/2000 Programme of Work contains a project to establish cost advantages from the avoidance of environmental regulations. This will complement the earlier work on substandard shipping by focussing specifically on international Conventions, which deal with oil pollution prevention and response.

### ***Current Work***

### **Low Emission Vehicles: Implementation Issues**

This working group started in June 2001. The objective is to develop strategies to facilitate the implementation of low-emission vehicles, taking into account their global performance in terms of safety and the environment. The mandate of the Group include the following tasks:

- Based on the existing literature from the International Energy Agency (IEA), from the car manufacturer associations and from other international organisations, assess the potential of existing and emerging low-emission vehicles and analyse their performance as a whole.
- Development of a global indicator that takes noise effects, emissions, comfort and safety performance into account.
  - Evaluate current testing procedures for environmental and safety performance.
  - Assess the life-cycle implications of alternative fuels (e.g. battery disposal).
- Assess the role of the various stakeholders (governments, car manufacturers) in the promotion and implementation of low-fuel consumption vehicles in specific fleets.
- Identify likely new infrastructure needs, such as fuelling infrastructure for hydrogen-based vehicles, and possible technical barriers to the widespread use of these vehicles.
- Identify the implications for policy, including measures, to encourage the development and uptake of low-fuel consumption vehicles.

### **Urban Freight Logistics**

The working group started in November 2001. The objective is to determine appropriate urban policies for freight transport, focusing on innovative solutions to minimise pollution, noise and congestion caused by freight transport; identify the impacts of new technologies and urban planning on the organisation of city logistics; and establish best practices through a review of innovative approaches in OECD cities. The mandate of the group includes the following tasks:

- Identify innovative solutions to minimise the harmful effects of freight distribution in urban areas.
- Evaluate the barriers and problems with new solutions.
- Evaluate the impacts of these options on distribution efficiency.
- Identify the policy implications.

### **What is driving the growth in transport demand?**

This working group will build upon activities commenced during 2001. The objective is to increase the knowledge on how other sectors influence transport demand and how the transport sector influences the development of other sectors. The following tasks have been assigned to the working group:

- Identify sectors where future developments are most likely to have the greatest influence on the demand for transport services, including evolving business-to-business and business-to-consumer practices.
- Identify non-sector specific developments (e.g. globalisation, e-commerce and industrial reorganisation).
- Collect and compare country studies and surveys for the chosen sectors/areas.
- Evaluate options to continue growth in other sectors, while minimising the impact on transport demand.
- Identify the policy implications.

### **Pricing Symposium, Florida, United States, November 2002**

The objective of the workshop, co-sponsored by the US Federal Highway Administration, is to determine appropriate financing options for investment in transport infrastructure projects and identify best practices for private sector financing of transport infrastructure projects. The following issues will be reviewed at the workshop:

- Assessment of experiences among Member countries with public-private sector partnerships in financing investment in transport infrastructure.
- Evaluation of the merits of hypothecation of funding for transport infrastructure investments, including the use of funds from transport asset pricing initiatives.
- Assessment of Member countries' experience with multi-modal infrastructure funds, and the determination of investment priorities across modes, port and terminals.
- Analysis of options for both the private and public sectors in managing risk associated with investment in transport infrastructure, including risk management in private/public sector partnerships.
- Identification of the policy implications.

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### 2.3 *Development Co-operation Directorate (DCD)*

<http://www.oecd.org/dev/>

Environmental sustainability is one of several objectives of the Millennium Development Goals adopted by the international community. The OECD's development assistance Committee is the principal body through which the Organisation deals with issues related to co-operation with developing countries. The DAC is one the key forums in which the major bilateral donors work together to increase the effectiveness of their common effort to support sustainable development. Through *its Working Party on Development Assistance and Environment* and with the support of the *Development Co-operation Directorate*, the DAC has undertaken a substantial body of work aimed at assisting partner countries strengthens their environmental management capacities.

In recent years, the main thrust of this work has been geared towards enhancing policy coherence, developing and maintaining synergies between donors, monitoring global environmental issues, and contributing to the policy debate in OECD capitals.

Activities in relation to transport and environment have included, in particular, a detailed review of urban environmental issues and their links with poverty reduction and economic growth. The document resulting from this work, "**Shaping the Urban Environment in the 21<sup>st</sup> Century: A Policy Reference Manual**", provides guidance for development co-operation agencies and their partners in addressing urban environmental problems. It also brings together two issues that are often considered separately: how addressing urban environmental problems can contribute to poverty reduction; and ensure that urban based demands for resources and the use of natural sinks for urban wastes are ecologically sustainable. The document emphasises that well managed urban centres can combine high quality, safe and healthy living environments with relatively low levels of resource use and waste generation. It also point out that how good practice in urban environmental management can bring about a significant changes in urban services which can greatly reduce the health burden imposed on urban populations by airborne, food borne and water-related diseases, chemical pollutants and physical hazards - and in so doing bring particular benefits to low income groups in general and to women and children in particular. It also emphasises the need for cross-sectoral approaches to these issues.

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### 2.4 *Territorial Development Service (TDS)*

<http://www.oecd.org/tds/>

#### **Recent activities**

Work of the *Group on Urban Affairs* focused on transportation in the urban environment. Conclusions and recommendations from previous work on urban transport (**Environmental Policies for Cities in the 1990s, Cities and Transport, 1992 Conference on The Use of Economic Instruments in**

**Urban Travel Management**) stated that urban congestion, pollution and noise continue to increase in spite of numerous regulations and policies. Technologies, traffic management and public transport improvements are not sufficient: they are offset by rapid traffic increases, for the cost of urban transport does not include the environmental and congestion components.

A major report on **Urban Transport and Sustainable Development** (see also section 1.3) was published early in 1995. The report concludes an OECD/ECMT joint project and builds upon 18 national overviews and a questionnaire completed by more than 130 cities. Present land-use and transport policies in OECD countries are leading to excessive travel by car in cities and their immediate surroundings, causing growing congestion, air pollution, noise and acid rain. The main conclusion of the study is that car dependency in cities can only be reduced by integrated approaches which combine measures that reinforce each other. The study identifies a policy package composed of three distinct strands, all necessary to reduce car travel. The more progressive ones take cities further towards the goals of less congestion, reduced energy consumption, and better environment through the adoption of a mix of pricing restraints (road pricing and higher taxes on fuel) and land use planning.

In 2001, a three-year project on Implementing Sustainable Urban Travel Policies was completed. The final report bringing together the findings on implementation from each of the different parts of the project, along with a document summarising "**Key Messages for Governments**", were approved by Ministers of Transport at their Council in Lisbon in May 2001 and published in early 2002.

Together with the ECMT and the *Non-Member countries Division of the Environment Directorate*, a joint seminar on **Transport and Environment in Central and Eastern Cities** was organised in June 1995 in Bucharest (Romania). The objective of the seminar was to examine the problems and opportunities for urban transport in Central and Eastern Europe

during the transition to a market economy. The seminar concentrated on three major themes: managing the growth in motor vehicle use through a wide range of instruments (such as planning policies, parking controls and pedestrianisation schemes, traffic calming, and economic instruments); assessing the structures of mechanisms for financing urban public transport systems; and developing approaches for building consensus and priorities for action.

A joint OECD/German **Conference on Sustainable Urban Development** took place in Berlin on 19-21 March 1996. The conference marked the culmination of the OECD project on "**The Ecological City**" and built on the results of the programme on urban development which addressed issues related to economic revitalisation, land use, energy use and transport and environment.

#### *Current work*

An international seminar **The Development of Urban Transport Infrastructure, Reconciling the Economic, Social and Environmental Dimensions**, organised by the Urban Affairs Division of the Territorial Development Service, OECD the Caisse des Dépôts et Consignations (CDC) and the Ministry of Public Works, Transport and Housing (France) was held in Paris in April 1998. This seminar aimed first to take stock of the problems raised by trends in urban travel which public decision-makers encounter in designing and financing urban transport infrastructure projects. Two main issues were discussed: 1) the social acceptability issue and questions related to user tolls; and 2) the public-private financing of urban transport infrastructure projects. The results of this activity were published as *Integrating Transport in the City: Reconciling the Economic Social and Environmental Dimensions* (OECD, 2000).

**Towards a New Role for Spatial Planning** (OECD, 2001*i*) is a publication based on two seminars co-organised by OECD and Japan with contributions by high-level experts covering key themes (sustainability, performance evaluation, globalisation) and national policies (Austria, the Netherlands, Japan, the United States). With

direct strategic relevance for an integrative, multi-sectoral approach that includes transport and the environment, the influence of this work can be followed in **Territorial Outlook 2001** (OECD, 2001*h*), which contains a conceptual framework for territorial development policies and the application of this framework in spatial, social and economic development strategies. **Cities for Citizens: Improving Metropolitan Governance** (OECD, 2001) deals with the governance aspects of generating and implementing coherent strategies for metropolitan areas, where many of the difficult transport and environment issues of the day are concentrated.

A number of territorial reviews (Korea, Hungary, Italy, Canada, and Switzerland at the national level and Bergamo, Melbourne, Helsinki, Vienna and the Oresund region at the regional level) contain information on transport as a factor in the accessibility and performance of regions. This ongoing series of studies is closely related to continuing work on infrastructures in urban regions, many of which are networked transport systems or large-scale facilities (e.g., airports, ports) with considerable environmental impacts. A conference on hard infrastructures is being organised in collaboration with the UK Department for Transport, Local Government and Regions, in London on 2 and 3 May 2002 to share views, undertake policy analysis and evaluate and promote innovative policies with regard to the role of infrastructures into territorial development policies. The Conference will focus on planning, governance, legal and financing issues related to infrastructure development with regard to three main categories of hard infrastructures, Transport, Energy and ICT. There is within TDS also a particular interest in the potential of “green infrastructures” whose design features reduce environmental impacts and enhance the attractiveness of places.

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## 2.5 Trade Directorate (ECH)

<http://www.oecd.org/ech/>

**Case studies (Europe and North America) on trade liberalisation in the transport sector** have recently been completed by the *OECD Joint Sessions on Trade and the Environment* (see also sections 1.1 and 2.6). A paper summarising the environmental effects of freight transport has also been prepared in co-operation with the Environment Directorate. This work suggests that the increased economic scale of global freight transport following trade liberalisation might not be very significant, but the environmental effects could be quite large. For example, “transit” countries may find that trade liberalisation concentrates freight traffic volume on their networks, thereby exacerbating already difficult environmental conditions. On the other hand, positive technological and/or structural changes in the freight sector might result from trade liberalisation. As an example, NAFTA is helping to reorient North American transport toward a more rational economic pattern (e.g. from an east-west axis, to a north-south one). More open borders should allow shippers to use the most efficient routes to reach their markets, leading to fewer emissions and/or reduced energy consumption.

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## 2.6 Environment Directorate (ENV)

<http://www.oecd.org/env>

### *Recent Activities*

Work has been undertaken by various groups addressing pollution, noise, fuel efficiency, social costs, urban transport and the transport of dangerous goods.

### **2.6.1 Pollution prevention and control in the transport sector**

Work on this topic was carried out under the auspices of the former *Air Management Policy Group* and the former *Group on Energy and Environment*. In 1990, the study on **Control Strategies for Photochemical Oxidants** concluded that motor vehicles are the largest single source of emissions of major air pollutants and, therefore, the principal source of

photochemical smog in urban areas and of large-scale formation of photochemical oxidants. The **MOVE** Project continued this work by focusing on further controls for motor vehicle emissions. Because of the substantial attention already given to exhaust emissions from automobiles in the OECD and in other agencies, the project focused instead on complementary issues, producing the following studies: **Control of Emissions From Heavy-Duty Vehicles, Evaporative Emissions from Vehicles and Refuelling Systems, Control of Emissions From Vehicles In Use, Choosing an Alternative Transportation Fuel: Air Pollution and Greenhouse Gas Impacts.**

The conclusions of these studies formed the basis for a final report published in 1995, **Motor Vehicle Pollution: Reduction Strategies beyond 2010**, which modelled and assessed the long-term air quality benefits possible with current policies and more stringent, comprehensive emissions control strategies. It was found that motor vehicles are substantial contributors to serious environmental problems on every geographic scale.

The study stressed that currently-adopted policies addressing motor vehicle emissions in OECD countries were insufficient to meet environmental goals. While initial reductions in emissions realised through current policies would begin to be reversed by growth in the vehicle fleet before 2010, a wide range of demonstrated technical solutions exists to justify the rapid implementation of much tighter regulations on vehicle emissions. In spite of the large potential for further reductions of motor vehicle emissions offered by combinations of emissions abatement, fuel-efficiency and alternative-fuel technologies, however, constraints in traffic growth would probably also be necessary to meet environmental standards for tropospheric ozone and reduce greenhouse gas emissions.

Consecutive study on long-term projections of global motor vehicle emissions (**MOVE II**), which will include technology scenarios, costs and benefits of advanced controls; possible extension to include life-cycle impacts focusing on high growth modes, such as aviation and

freight (see “*Current and planned work*” in this section).

There has been a substantial activity on **Clean Fuel Efficient Vehicles** across the last few years, in close co-operation with IEA, ECMT and EC (see Section 1.4).

<http://www.oecd.org/env/transport/>

### 2.6.2 Economic evaluations in the transport sector

In 1988, the former *Group of Economic Experts* began a project on **Overcoming Impediments to the Integration of Environmental Considerations into Economic Development**. The study on **Market and Intervention Failures in Transport Policies** examined policy failures in six OECD countries, and attempted to find commonalities among these problems. It concluded that more emphasis should be placed on internalising social costs of transportation (inappropriate taxing and pricing practices) and on the enforcement of environmental policies.

The 1994 study, **Social Costs of Land Transport**, considered costs due to air pollution, noise and accidents using a generalised model. The study attempted to quantify only the social costs of land transport, but it also concluded that land transport represents “almost all” the social costs within the transport sector as a whole. This work was updated for contribution to the joint ENV/ECMT project on the social costs of land transport (see Section 1.3).

The *Environment Directorate*, along with the *Fiscal Affairs Directorate (DAF)*, convened a small expert’s workshop in November 1995 on **Subsidies/Tax Incentives and the Environment**. A broad sectoral approach, including the transport sector, was adopted and an “issues” paper (with recommendations from the workshop concerning the scope of the project) was presented at the *Environment Policy Committee* meeting in December 1995.

In 1991, the *Group on Economic and Environmental Policy Integration (GEEPI)* published a set of **Guidelines for the Application of Economic Instruments** in several areas of

environmental policy - including the transport sector. In a 1997 follow-up project, a detailed survey of eco-taxes in OECD countries was done. A significant portion of this survey dealt with environmentally-related taxation in the transport sector.

A project on **Environmental Implications of Energy and Transport Subsidies** investigated environmental and economic benefits from eliminating or reducing government interventions in energy and energy-related markets through case studies and modelling. In particular, three transport case studies have been carried out in France, Japan and the US to explore the effects of internalising the social costs associated with transport activities. These studies identified government expenditure associated with road transport in 1991, estimated the external costs associated with the sector, and compared these expenditures and costs with user fees and taxes related to the use of road transport. Reference scenarios of road traffic in 2010 were developed that examined the effects of internalising the social costs for users by using a variety of policy instruments. The project report was published in 1997.

As part of a follow-up project, the OECD *Ad Hoc Meeting of Experts on Subsidies and Environment* is collaborating with the ECMT in a (1997) study of the ways in which tax/subsidy regimes in at least two European locations may be discriminating against more environmentally-friendly freight transport modes. The project formed part of a broader report to OECD Finance Ministers in May 1998.

In its publication of **Improving the Environment through Reducing Subsidies** in 1998, the Environment Directorate's *Economics Division*, analysed the impact of government regulation on road transport. In most countries taxes related on road have increased, to recover both the costs of infrastructure and road-services and the external effects of road usage. However, governments continue to support the provision and usage of transport systems. One of the major conclusions about policy reform is that transportation demand is relatively inelastic in response to price changes in most OECD Member countries and so make a useful tax base.

Demand for road freight transport is more price-elastic, and is often cross-subsidised by passenger transport as a result.

A joint report (1997) with the Trade Directorate has been prepared for the OECD Finance Ministers on *Globalisation and the Environment* (see also sections 1.1 and 2.5). This report contains a section on the way in which globalisation is affecting Sectoral Economic Activities, including activities in the transport sector. This paper concluded that globalisation is likely to lower transportation prices across most modes, in most countries. Even where transportation prices rise in the short term, the longer-term pressure on prices is likely to be downwards. Reduced prices, combined with the increased incomes that should result from more efficient transport systems, generally are likely to result in new demands for transport services. Increased demand for transport services, in turn, may lead to new environmental stresses in the form of noise, air pollution and congestion. This scale effect has been exacerbated in recent years by structural shifts from rail and shipping to road transport. In particular, much of the expansion in freight traffic that is being induced by globalisation is occurring on the road.

### 2.6.3 Noise abatement policies

In 1987, the OECD *Ad Hoc Advisory Group on Noise Abatement Policies* completed the study **Fighting Noise in the 1990s**, which examined noise abatement policies in selected Member countries. The study concluded that the prospect of reduced noise seemed unlikely, particularly in the light of the increases in the number of vehicles and mobility observed since 1985.

### 2.6.4 Indicators and statistics on transport and environment

**Indicators for the integration of environmental concerns into transport policies** have been developed by the *Working Group on Environmental Information and Outlooks* in consultation with the ECMT and are published regularly as **environment monographs** (1993, 1999), or as part of broader publications such as

**Towards sustainable development: Indicators to measure progress, Rome Conference (2000).**

The indicators are drawn up around three major themes: i) sectoral trends of environmental significance; ii) interactions with the environment; and iii) economic and policy linkages between transport and environment. Data on transport and on related air emissions are compiled regularly from OECD, ECMT and other international sources, and published since 1985 in the biennial OECD **Compendium of Environmental Data**. Co-operation has been established with the EEA and Eurostat.

Transport-environment indicators are regularly used in the OECD's country **Environmental Performance Reviews** that often include a special chapter on sustainable transport and the integration of environmental and transport policies.

### **2.6.5 Chemical risk management**

The *Chemicals Group and Management Committee* has been examining the issues associated with chemical accidents and with the use of leaded gasoline since the early 1990s. In 1993, a risk reduction monograph on lead was published which included, among other things, assessments by Member countries of the impact posed by the use of lead in gasoline and the strategies they have employed to minimise that risk. In February, 1996, OECD Environment Ministers endorsed a **Declaration on Lead** which called on governments to give highest priority to certain risk management actions such as progressively phasing down the use of lead in gasoline except where needed for essential or specialised uses. Later that year, OECD and UNEP jointly hosted a meeting of interested industry (i.e., the automobile, oil and lead industries), international organisations and the ECMT to co-ordinate their activities with respect to lead in gasoline and to develop a list of activities to carry forward. These activities include such things as examining air pollution issues associated with changes in fuels or automobile engine types and the experiences of countries who have applied different policy approaches to reduce the release of lead into the environment due to the use of lead in gasoline. In

1998, the report **Phasing Lead out of Gasoline the Experience with Different Policy Approaches in Different Countries** was published, followed, in 1999 by the publication of **Older Gasoline Fuelled Vehicles in Developing Countries their Importance and the Policy Options for Addressing them**.

In 2000, OECD published a two-volume report that documented actions taken by Member countries to implement the 1996 Ministerial Declaration. In 2001, the Environment Policy Committee reviewed a paper which summarised the actions taken by Member countries (and industry) to implement the Declaration and endorsed a recommendation in the paper that Member countries build on the progress made by continuing their efforts to develop or strengthen national and co-operative efforts considered necessary to reduce risks from exposure to lead.

Most of the past work in OECD's **Chemical Accidents Programme** has been related to fixed installations. In 1996, however, as a result of joint work with the *International Maritime Organisation*, OECD published **Guidance Concerning Chemical Safety in Port Areas**.

Also in 1996, the Government of Norway hosted a workshop on pipelines (**Prevention, Preparedness for, and Response to Releases of Hazardous Substances**) in Oslo, Norway. The main aim was to provide an opportunity for experts to exchange information and experience and to make recommendations concerning best safety practices. The report of the workshop was published in 1997.

At the end of 1996, OECD's *Expert Group on Chemical Accidents* included a new project in its work programme for 1997-1999 entitled **Transport of Dangerous Goods (Rail, Motorway and In-land Waterways)**. The main objective in the first instance was to share information on the transport of dangerous goods especially that related to accident prevention, preparedness and response. However, the Expert Group recognised the need to involve industry and all public authorities with roles and responsibilities related to the transport of dangerous goods. It also recognised the importance of working in close co-operation

with other international organisations which already have a role.

<http://www.oecd.org/env/health/>

### **2.6.6 Waste minimisation and life cycle management**

The *Waste Management Policy Group* held in March 1995 a comprehensive workshop on waste minimisation activities and challenges. Two of the five specific waste streams selected as case studies that were presented were automobile related: **End-of-Life Vehicles** and **Lead-Acid Batteries**. The report of the **Waste Minimisation Workshop** was published in 1996.

### **2.6.7 Individual Travel Behaviour**

*Sustainable Consumption and Production* is a programme led by the Environment Directorate. The programme includes a project on **Individual Travel Behaviour (ITB)** which was organised jointly with the *Pollution Prevention and Control Group*. The ITB project has sought to address the need for a more comprehensive understanding of the processes leading to individuals' travel behaviour - and in particular, to understand how this behaviour emerges from a complex interplay between *individuals, businesses and institutions and governments* - in order to highlight key points for policy intervention. The project has sought to incorporate insights from a number of disciplines (e.g. anthropology, sociology, psychology and geography) that are not regularly drawn upon in transport-related policymaking. These issues were addressed through a series of Expert Workshops on **Values, Welfare and Quality of Life** (18-19 March, 1996, Paris) and on **Culture, Choice and Technology** (hosted by the UK-based Global Environmental Change Programme of the Economic and Social Research Council at the University of Sussex, Brighton, from 17-19 July, 1996). The **OECD Policy Meeting on Sustainable Consumption and Individual Travel Behaviour** (January 9-10, 1997) communicated the findings of the previous workshops to transport and environmental policy-makers.

The ITB project, generally, has highlighted the complex interplay between factors both internal (e.g. psychological makeup, habit, etc.) and external (e.g. existing infrastructure, media messages, etc.) to the individual in setting the context for travel behaviour. Policy that fails to take into account this interplay (e.g. by focusing only on pricing mechanisms and not on the constraints placed on individual choice) seems less likely to succeed. One important finding was that important shifts in travel behaviour are possible without individuals feeling a sense of sacrifice or loss. Using expert judgement and or market mechanisms to define "value" in the transport sector may ultimately be less effective than relying on local and private sector innovation and experimentation in transport problem-solving. Combined with local participatory decision-making processes, these approaches seem better able to capture aggregate notions of "value" and "quality of life", and may ultimately lead to voluntary shifts in travel behaviour. The project identified a number of other strategies to change the travel behaviour of individuals, including: focusing policy action on points where people are breaking with habitual behaviour; providing people - and especially children and adolescents - with first-hand experience of a wide range of travel modes and developing more finely targeted and better crafted messages about behaviour change.

Reports of the two Experts Workshops have been published and the report of the OECD Policy Meeting was published in 1997, along with a **Literature Review on Individual Travel Behaviour**. The findings from the project also contributed to the 1997 report to Ministers on the **Sustainable Consumption and Production Programme**.

The *Pollution Prevention and Control Group* (PPCG) has set up a *Task Force on Transport* of its own to serve as a flexible mechanism to oversee projects and co-ordinate amongst many different activities:

- In response to a 1996 mandate from OECD Environment Ministers to analyse the potential contribution of the concept of eco-efficiency to public policy-making, the PPCG and the *Sustainable Consumption and*

*Production Programme* jointly undertook an investigation of eco-efficiency in the transport sector. A background document, **Eco-efficiency in the Transport Sector**, was produced in 1996. A follow-up Experts Workshop on **Eco-efficiency in Transport** was held on 7-8 July 1997 in Berlin. It had three objectives: i) to explore the use of the concept of eco-efficiency as a public policy tool in the transport sector, ii) to address the role of national and local governments in facilitating transport-related eco-efficiency initiatives, and iii) to explore the usefulness of the concept of eco-efficiency as framework for environmental policy-making.

The workshop underlined the complexity and difficulty to measure eco-efficiency in the transport sector. Many indicators of improvement are qualitative and so open to subjective judgements (access, transport value, unit of service). These judgements are difficult to aggregate because of their lack of homogeneity, and therefore, hard for central governments to use. The findings of the Workshop were incorporated into a report to the 1998 Environment Ministerial meeting OECD.

### **2.6.8 Environmentally Sustainable Transport (EST)**

The project on **Environmentally Sustainable Transport (EST)** was initiated in 1994 to give some precision to the concept through the use of criteria which can be quantified and have environmental significance.

The Vancouver Conference **Towards Sustainable Transportation** in 1996 (see also sections 1.2) provided substantial input to the project as have ongoing **EST Expert Workshops** and *Working Group on Transport Meetings*.

The Vienna Conference, **“EST-Futures, Strategies and Best Practices”** in October 2000 was the culmination of five years of work on the OECD’s Environmentally Sustainable Transport project. More than three hundred-fifty delegates from every continent discussed many aspects of the world’s transport problems. The result was a set of ten guidelines that governments everywhere can use to put transport on a

sustainable path. The Vienna EST Guidelines was presented at the OECD Environment Ministerial Meeting in May 2001 and endorsed by the Ministers.

The overall objectives of the project are to provide an understanding of EST, its implications and requirements, and to develop methods and policy guidelines towards its realisation. The core of the EST approach is to develop long-term scenarios and identify instruments and strategies capable of achieving it. Unlike conventional approaches to transport system development, the EST project is a “backcasting” exercise. One or more desirable futures are defined and policy development is guided by an assessment of what is required to achieve them.

The EST project comprises four phases:

- Phase 1 involved a review of relevant activities of Member countries as well as the development of the definition and criteria for EST.
- Phase 2 focused on the identification of the gap between current and projected trends and the EST criteria through scenario-development for 2030. During this phase participants have constructed a “business-as-usual” (BAU) trend forecast scenario and three scenarios consistent with the EST criteria.
- Phase 3 has been the “backcasting” exercise. It comprises the identification of packages of policy instruments whose implementation would result in achieving the EST scenarios. Phase 3 has also involved the assessment of the social and economic implications of the BAU and EST scenarios.
- Phase 4, which has overlapped Phase 3, has refined the criteria for achieving EST and developed policy guidelines for governments towards environmentally sustainable transport. The guidelines are reported on fully in two documents: one is the “Synthesis report”, prepared for the OECD International Conference held in Vienna, Austria in October 2000 entitled “EST-Futures, Strategies, and Best Practices”. The other is the report on that conference which

will be also available shortly. The guidelines were endorsed by OECD Environment Ministers at their Ministerial meeting in May 2001.

Phase 1 resulted in the publication of **Environmental Criteria for Sustainable Transport** in 1996. Phase 2 concerned the development and construction of the BAU trend and EST scenarios and was carried out during 1997 and 1998. It resulted in the publication of the **Report on Phase II of the EST Project** in 1998, with a revised and amended edition in 1999. It explains the definition, criteria and approach of EST project and developed four categories of scenarios: i) the Business-as-usual Scenarios (BAU), ii) the High-Technology Scenarios (EST1), iii) the Capacity-Constraint Scenarios (EST2), iv) the Optimum-Combination Scenarios (EST3).

The phase 3 has concentrated on the identification of policy instruments and the economic and social aspects and implications for achieving environmentally sustainable transport. Phase 3 has described possible policy pathway for EST and had the following objectives:

- Work out how the EST3 scenarios might be reached, i.e., which instruments might be deployed by governments and how they might be deployed.
- Examine the economic and social implications of deploying the instruments, and assess the appropriateness of the instruments in light of this examination. Assess the economic and social implications of moving towards and attaining EST in comparison with the conditions of the BAU scenario.

The report on Phase 3 is being available shortly with a separate annex volume containing the individual Member country reports on policy instruments for achieving EST.

Follow-up activities to the Vienna conference in October 2000 and the implementation of EST guidelines are being focused on as a next step (see "*Current and planned work*" in this section).

<http://www.oecd.org/env/transport/>

### **2.6.9 EST Goes East in Central European Countries**

A similar study using the backcasting method was developed by a joint Austrian/UNEP/OECD effort on **EST in Central European Initiative (CEI) Countries**. The objectives were to examine transport trends and their environmental impacts over a period of 30 years, to identify the gap between projected trends and environmentally sustainable transport in CEI countries, and to outline possible policies and strategies to advance EST. It analysed possibilities to reduce the environmental effects of transport by modelling three different EST scenarios, based respectively on technological improvements, transport demand management and a combination of both. The study focused on the quantifiable, environmental criteria for sustainable transport, i.e. priority on emissions of carbon dioxide (CO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOC), and particulate matter (PM). Noise and land use issues could only be described qualitatively and further work and investigations will therefore be needed as well as for the impacts of aviation on attaining or not attaining sustainable transport. The study published in 1999 concluded on strategies and measures for achieving environmentally sustainable transport, taking account the specific situation in the countries in transition.

The scenario work for the EST Study in CEI countries has been completed and a full report on the study was published. A separate publication of a brochure summarising the main results of the study as well as presenting the Ministerial Declaration of Environment Ministers of the CEI has also been completed with a view to widely distributing it in the CEI countries, in particular to policy makers. The study stresses the need for policies towards EST to review the transport investment strategies and adjust them accordingly favouring more sustainable transport modes and developments.

<http://www.oecd.org/env/transport/>

The objective of the **Environmental Outlook and Strategy (EOS)** work was to develop an integrated, economy-based outlook of the possible environmental situation for the OECD area in 2020. A report of OECD Environment Outlook (OECD, 2001*d*) developed by the Secretariat includes an analysis of trends, the development of longer term outlooks and alternative policy options for modifying these outlooks. This served as background for developing the Environmental Strategy for Ministers in 2001(OECD, 2001*e*).

A trends report for the transport sector has been prepared, partly based on the EST project and partly on some older work on global emission projections for motor vehicles and air quality. To complete the longer-term outlook for the entire sector, projections for other modes (rail, navigation, and aviation) will be included. Specific modelling on global emissions from motor vehicles has been initiated. Modelling of long-term transport trends and development of alternative scenarios is envisaged during the first quarter of the year 2002 (see **MOVE II project** in “*Current and planned work*”).

The *Working Group on the State of the Environment*, published in 1999 **Indicators for the Integration of Environmental Concerns into Transport Policies**, a product of OECD work programme on environmental indicators. This report analysed the environmental consequences of economic growth including indicators to promote and monitor the integration of environmental concerns into transport policies. More specific objectives are to: i) highlight the interface between transport activities and environmental issues, and identify how different driving forces and policy instrument interact and affect the environmental impacts of transport and ii) highlight the linkages between transport trends and patterns, environmental issues and sustainable development, and thus provides a building block for sustainable development indicators. In that report, particular attention is given to:

- The linkages between transport trends and environmental issues. Aspects other than the environment, such as social and economic aspects, are also addressed.

- Road transport, which is responsible for much of the transport sector’s impact on the environment. Other modes are also covered, but are not the focus.
- The national level and indicators designed to be used in an international context. While in a particular country a greater level of detail or breakdown may be needed, the measurement of indicators at these levels is encouraged and lies within the responsibility of individual countries.

<http://www.oecd.org/env/indicators/>

### ***Current and planned work***

In May 2001, OECD Environment Ministers met in Paris to discuss and agree solutions to the most challenging environmental problems they face. They adopted a new OECD Environmental Strategy for the First Decade of the 21st Century to address these challenges. Transport is classified as one of the sectors which require urgent measures. Also, they endorsed the EST guidelines as a practical tool to guide the development and implementation of national environmentally sustainable transport strategies. Many activities are being undertaken in order to implement the strategy.

As follow-up activities to the Vienna conference in October 2000 and the implementation of the EST guidelines, further development of **Environmentally Sustainable Transport (EST) project** is being undertaken. Many regional workshops have been proposed to address barriers to achieve EST and develop regional EST strategies. A conference focusing on railways was held in Sweden in October 2001, and several workshops/conferences are planned next a couple of years. One of them will address on the role of information, communication, education and awareness to achieve EST and another will focus on leisure and tourism travel. A conference on EST strategies for the East-Asian region is planned in early 2003.

<http://www.oecd.org/env/transport/>

Current work on **Global Motor Vehicle Emissions (MOVE II)** has contributed to the OECD Environmental Outlook to 2020 (OECD 2001*d*), and offers the possibility to include costs and benefits, as well as comparing trends with other modes under different scenarios (trend projections; technology scenario). A comparative assessment of different modes and their long-term environmental impacts and resource implications (including waste generation) of current advanced emission control technologies, hybrid and zero emission vehicles and clean fuels might also be performed to show the various options and solutions.

An analysis of the factors that influence market penetration of new vehicle and fuel technologies and the instruments and policies necessary to foster them will be performed based on the experiences in Member countries. An assessment of economic and other policy instruments that enable accelerated market penetration will also be included in the report.

The study could be expanded to include life-cycle impacts (pollution, CO<sub>2</sub>, material use) with a focus on high growth transport modes, such as aviation and freight (road, maritime). The study on environmental problems of increasing concern such as the high growth modes, like aviation and freight (road, maritime), will be examined in the context of the regional developments as well as global trends. The global assessment, which was conducted in 1995 (see *Recent Activities* in this section) shows that given the projected high growth of air traffic, this sector will become a major source of pollution and greenhouse gas emissions, and consequently, have an increasing impact on the global climate. The study will examine different policy options, notably measures focusing on traffic avoidance, modal shifts and efficiency improvements and assess them in a multi-modal context, in order to highlight the most promising solutions that can significantly reduce these activities' environmental impacts in the long-term. A review of Member country policies to assess the environmental impacts will be carried out to initiate the project.

The part of the project on long-term environmental impacts of aviation would be

carried out in close co-operation with ICAO to ensure that it is complementary to that of ICAO/CAEP and its environmental bodies.

<http://oecd.org/env/transport/>

Historically, there has been a strong correlation between economic growth in terms of GDP and the demand for passenger and freight transport in OECD countries. A new project on **Decoupling Transport Impacts and Economic Growth** will examine the potential for encouraging more sustainable transport patterns and securing regional and global sustainability. The project will be launched in 2002, co-ordinated with STI, TDS, ECMT and other relevant international organisations.

<http://www.oecd.org/env/transport/>

Outreach activities to promote the EST approach in non-Member countries is being conducted continuously. A joint UNEP/OECD project on **EST goes EAST in Central European Countries** will focus on capacity building for the development of EST strategies and their implementation in CEE countries. It will also address the identification of barriers to EST and ways and means to overcome them, including the assessment of transport externalities and possible internalisation policies. The project will assist CEE countries in developing EST pilot projects and case studies on best practices as part of the strategies and communicating them through specific workshops. It will also provide assistance for implementation of national studies and action programmes. A launch workshop on this outreach activity will be held on 13-14 May 2002 in Budapest.

<http://www.oecd.org/env/transport/>

The **Sustainable Consumption Work Programme** combines empirical studies of consumption trends in OECD Member countries with conceptual and policy analysis. Programme elements include: development of a conceptual framework to set out boundaries of analysis and policy to influence household decisions; sector case studies documenting trends, environmental impacts, and policy options in three key areas of

household decision-making; policy case studies to deepen analysis of policy instruments that influence household consumption of final goods and services; and refinement of a body of indicators to assess progress towards more sustainable consumption patterns. The results of Programme are published separately and will be drawn together in a Synthesis Report (for more information: [www.oecd.org/env/consumption/](http://www.oecd.org/env/consumption/)).

The Sustainable consumption Programme comprehends a **Case Study on Household Tourism-Travel: Trends, Environmental Impacts and Policy Responses** ([ENV/EPOC/WPNEP(2001)14/FINAL]). It analyses the trends and drivers of household tourism-travel and their related environmental impact at the local, regional and global scales. It focuses on a number of factors including air and water pollution, biodiversity loss, energy and resource use and greenhouse gas emissions. It shows that tourism-related travel is growing across OECD countries and is expected to grow at 4.3% per year to 2020. Long-haul travel is growing at a faster rate than intra-regional travel. The Case Study discusses technological and policy options for reducing the environmental impacts of different modes of travel-transport. And makes a call to governments to improve their accounting of the environmental impacts of tourism travel when calculating the cost and benefits of activities in the tourism sector.

*<http://www.oecd.org/env/consumption/>*

**T**ransport activities in the OECD are responsible for approximately 60% of oil products consumption; hence, since the IEA's inception in 1974 it has carried out analysis of transport sector energy demand, and played a co-ordinating role for international co-operation on transport energy policy and technology development. Following the United Nations Conference on Environment and Development in Rio de Janeiro, 1992, the IEA's transport-related work has focused increasingly on technology and policy to reduce the environmental impacts of transport energy use.

Work on the transport sector is carried out in all of the offices and several divisions of the IEA, including the *Energy Efficiency, Technology and R&D Office*, the *Energy and Environment Division*, the *Oil Industry and Markets Division*, the *Energy Economic Analysis Division* and *non-Member countries Division*.

Seven of the IEA's Implementing Agreements - international agreements to co-operate on technology development and deployment - have some relevance for transport technology. These include the agreements on **Advanced Motor Fuels, Bioenergy, Hybrid and Electric Vehicles, Hydrogen, High Temperature Materials for Automobile Engines, Advanced Fuel Cells and Energy Conservation in Combustion. Implementing Agreements** have been responsible for a number of publications on these relevant areas.

The Agency has also produced several publications based on in-house research and analysis on transport and environment issues. These cover: energy efficiency in road vehicle fleets; technical, economic and environmental analysis of alternative fuels; econometric analysis of transport energy demand; and the

policies of IEA Member countries relating to transport energy use.

### 3.1 *Activities of the past ten years*

#### a) *Studies*

In 1990, the IEA published **Substitute Fuels for Road Transport**. This book provides an analysis, for a time horizon placed roughly in 2005, of fuels that appear to have some potential to contribute to energy security. As well as examining technical feasibility and cost, the book reviews environmental effects of alternative fuel use. It covers fuels from very heavy oils, natural gas, methanol, ethanol and synthetic diesel and gasoline from natural gas.

In 1991, a study on **Fuel Efficiency of Passenger Cars** was published. This was an update of an earlier publication, which reviewed IEA Member country policy on car fuel economy and also drew together information on the factors affecting energy-use by cars. These factors include energy and vehicle pricing and taxation, exhaust emission standards and public information programmes. The study also provided detailed statistics, based on country submissions, on the energy efficiency and energy use characteristics of national car fleets.

The publication **Cars and Climate Change** was released in early 1993. The report examines the technical, economic and market potential for reducing greenhouse gas emissions from cars through energy efficiency improvements and alternative fuels. It draws on a detailed life-cycle analysis of greenhouse gas emissions from a

range of vehicle types and alternative fuels, and provides a cost analysis for some options under a range of conditions for the near-term

The study **Electric Vehicles: Technology, Performance and Potential** was published in December 1993. The study presented an overview of the current status of electric car and truck developments in IEA Member countries. It examined prospects for technology advanced in areas such as battery and vehicle performance and electric recharging systems. Driven by environmental concerns, governments and car industries have launched new programmes to accelerate technology progress.

A monograph was produced in 1994 on the **Refining and Environmental Implications of Increased Use of Diesel-Engined Passenger Cars**. The paper reviews environmental advantages and disadvantages of gasoline and diesel from an environmental standpoint and investigates the implications for the refining industry of an increase in diesel fuel demand at the expense of gasoline. It reviews the economics from the point of view of the car purchaser and of the national government. The study emerges with no clear-cut preference for either gasoline or diesel fuel from an environmental point of view. Future changes in fuel specifications will not only significantly affect the relative environmental impacts of the two fuels but could also influence the capacity of refineries to respond to changes in fuel demand and price.

The first publication in the *Energy and Environment Policy Analysis Series*, **Biofuels**, was published in late 1994. This report presents a thorough analysis of the costs, energy use and greenhouse gas emissions involved in producing and using ethanol from maize, wheat and sugar beet, "biodiesel" from rapeseed oil and methanol from wood. It compares these options with gasoline and diesel fuel. An evaluation of the greenhouse gas abatement potential and cost of electricity generation from wood is also included for comparison. The study used full-fuel cycle analysis to show that while their cost is high; biofuels can help reduce the use of petroleum products and the emission of

greenhouse gases. Among the options considered, electricity generation from wood can be a cheaper means of reducing CO<sub>2</sub> emissions. The report also helps explain why prior analyses have produced conflicting results.

The 1994 **IEA/OECD Scoping Study: Energy and Environmental Technologies to Respond to Global Climate Change Concerns** addresses the potential contribution of new and improved technologies in reducing emissions of greenhouse gases. This broad-based assessment of technology development status and future needs aims to assist governments and international organisations in their efforts to respond to human-induced global climate change. In particular, this study is intended to identify where international co-operation can enhance the development (and eventual deployment) of longer-term energy and environmental technology options.

Several other publications of the IEA have a substantial transport component. **Energy in Developing Countries**, published in 1994, includes a comparative analysis of transport sector trends in energy demand and energy efficiency in several countries.

The 1995 edition of the **World Energy Outlook** included a chapter on the transport sector, discussing the determinants of demand for transport fuels and the effects of policies to influence transport energy demand. The **World Energy Outlook 1998** is based on a new world energy model, considering energy demand and supply for ten regions over the period to 2020. This publication aims to identify and discuss the main issues and uncertainties affecting world energy demand and supply. It does so in the framework of a "business as usual" projections which assume energy policies existing before the Kyoto conference of December 1997 remain in place and that no new policies are adopted to reduce energy-related greenhouse gases. The transport sector is studied, including road, railway, air, internal navigation, and fuels used for transport of materials by pipeline and other non-specified transport.

In the 1997 publication **Voluntary Actions for Energy-Related CO<sub>2</sub> Abatement in IEA Member countries**, voluntary approaches within the transport sector are surveyed for selected countries. The following project also contains a substantial transport component: **Climate Change Policy Initiatives 1994 update (OECD Countries)** and **Climate Change Policy Initiatives 1995 (volume II, selected non-OECD countries)**.

The 1996 report **Comparing Energy Technologies** aims to provide policy-makers with critical guidance in balancing the environmental benefits and costs of greenhouse gas-reducing technologies. It discusses full life-cycle analysis covering each stage of the energy cycle - production, transformation, distribution and consumption. The report considers the state of the art in methodologies for assessing and comparing energy technologies, plus the strengths and weaknesses of current practice. It presents experts' reports on energy R&D approaches and assessment criteria strategies in Canada, France Italy, Japan, the Netherlands, the United Kingdom, the United States and the European Union.

**IEA International Energy Technology Collaboration: Benefits and Achievements (1996)** assesses the results of the Energy Technology Collaboration Programme. The report describes how the international programme works to promote information sharing among more than 30 countries in Europe, America, Asia, Australia and Africa and, ultimately, accelerates the development and deployment of new technologies to meet energy security, environmental and economic development goals. Operating through Agreements among governments, the programme leads to the publication of hundreds of documents that disseminate information about the latest energy technology developments and their commercial applications. This report details the activities and achievements of all 41 Implementing Agreements, covering energy technology information centres and RD&D projects in fossil fuels, renewable energy, efficient end-use and nuclear fusion technologies.

In 1997, the IEA published the study **Energy Technologies for the 21st Century** that assesses the long-term technical and economic potential of new energy technologies. It discusses how future energy security can be ensured through the successful development and deployment of such new and improved energy technologies as: advanced technologies for clean coal conversion and use, improved natural gas transport, enhanced hydrocarbon production, extensive use of new renewable energy sources, advanced nuclear fission power systems, nuclear fusion feasibility, environmentally sound electricity production and demand-side management, clean car technologies and alternative transport fuels and technologies for more efficient and flexible energy end use. The study identifies R&D options and priorities that governments of IEA Member countries may wish to consider for their energy programmes, and recommends increased industry participation and enhanced international co-operation in new technology development.

The Energy and Environment Division in the **Energy and Environment Policy Analysis Series** in 1997 published a policy paper. The work was the result of the IEA's sectoral work of the Energy Dimension of Climate Change together with an ongoing project on energy policy aspects of sustainable transport.

**Energy and climate change an IEA source-book for Kyoto and Beyond**, published on the eve of the crucial Kyoto Conference on Climate Change of December 1997, was designed to aid policy makers in coming to decisions that will affect the world's economy and its environment for years to come. This report studies the different energy demands, the demand for mobility, electricity generation, electricity consumption, and other stationary end-uses of fossil fuels. It proposed some alternative approaches to reduce the emissions in the transport sector like congestion charges in cities, motorway tolls, vehicle/road taxes differentiated by size of vehicle, creation of expectations of increases in the cost of travel by road and the provision of alternative public transport modes. These policies for transport

would also save energy and reduce CO<sub>2</sub> emissions.

**Transport Energy and Climate Change**, published in 1997, identified the implications of transport, which is at the core of many social and environmental problems. Considering that some impacts of transport continue to rise in absolute terms, the role of government is essential. Governments can play a key role in stimulating and preconditioning the transition to more energy efficient transport technologies and lower carbon fuel cycles.

### b) *Symposia*

The IEA has worked jointly with the OECD and the ECMT to organise a series of conferences and to publish the results. These include the 1990 Expert Panel in Rome on the **Low Consumption/Low emission Automobile**; the 1991 Berlin conference **Toward Clean and Fuel Efficient Automobiles**; the 1992 Stockholm conference on **The Urban Electric Vehicle**; the 1994 conference in Mexico on the **Clean and Fuel Efficient Motor Vehicles and Sustainable Transport**, in Budapest on **Reconciling Environmental, Energy and Transport Issues: The Role of Public Transport** (1994) and the 1996 **Towards Sustainable Transportation** conference in Vancouver (see also sections 1.2 and 2.5).

In 1994, the IEA's *Energy Technology and R&D Office* organised in co-operation with the OECD, the ECMT and the EC a **Transportation Technology Forum on Energy, Environment and Transportation Systems Perspectives**. This Forum, held in Valbonne (France) in December 1994, addressed a variety of transport technology issues, relating to new ideas for the road vehicles beyond 2010, and relating also to freight and urban transport technology. Recommendations were made by the representatives of environment, energy and transport ministries as well as by representatives of industry. A follow-up series of Expert Meetings was organised, 1 October 1995 in Paris, on topics concerning road vehicle technology. The discussion dealt with Hybrid Vehicles, Advanced Engines and Lightweight

Materials. This initiative responded to a strong need and technology co-operation under the aegis of the IEA was seen to promote dialogue between Governments and Industry. The IEA ETO was asked to draft specific language for multilateral co-operation in hybrid road vehicles, advanced engines and lightweight materials, and to explore the possible creation of an IEA "Umbrella Agreement" on Advanced Vehicle Technologies. A new series of expert meeting was held in Paris in March 1996 to continue work on these activities.

<http://www.iea.org/pub.htm>

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### 3.2 *Recent work*

In 1998, IEA published **Benign Energy? The Environmental Implications of Renewable**. The report examines the different aspects of using renewable energy sources. Benefits and damages are studied, including the abatement of pollution from transport. Some renewable energy technologies can reduce urban pollution through the use of alternative fuels (e.g. ethanol) or by providing power for electric vehicles. This report identifies methods for improving their potential impacts. One of the major conclusions is that the use of renewable forms of energy can make a significant contribution to reducing greenhouse and acid gas emissions.

A roundtable on **Technology Policy Responses to Kyoto: the IEA Perspective** took place in Cambridge on 12 November 1998. It considered the Kyoto challenge for the transport sector. A wide range of investment strategies targeted motor vehicles, road infrastructure and automobile industries that allowed an increasingly large number of people to enjoy the benefits of private motor vehicle ownership and use for travel. Along with benefits, increased reliance on motor vehicle transportation brings a variety of associated problems- air pollution, congestion, noise, oil dependence and carbon emissions. The challenge facing industry and government is to keep the benefits whole and limiting the problems.

In 1999, the IEA published **International Collaboration in Energy Technology: a sampling of success stories**. It examines the important role of international collaboration for developing and deploying more efficient and less environmentally damaging energy technologies. The benefits of international collaboration in energy end-use technologies for the transport sector are evaluated. One of the major conclusion is that project cost sharing among countries, can reduce the costs for individual countries by 50 per cent to 95 per cent from what they would have been spent if each country were to finance the projects alone.

The study on **Automotive Fuels for the Future: the Search for Alternatives**, published in 1999, concentrates on the available options for automotive fuel choices, their possibilities and constraints. It compares the fuels on the grounds of local emissions, greenhouse emissions, the ability to reduce oil dependency and cost. It focuses not just on the energy use of fuels or emissions of vehicle engines, but also on technology or the infrastructure that produced the fuel and distributed to vehicles.

The study entitled **Looking at Energy Subsidies: Getting the Prices Right**, published in 1999, focuses on substantial subsidies in non-OECD countries that distort energy markets and contribute to excessive GHG emissions. Looking in-depth at eight major non-OECD economies, the study assesses the impacts of subsidy removal on the economy and the environment. While the detailed impacts are different for each individual country, the results reveal that energy subsidy removal has a large potential to reduce pressures on government budgets, as well as to improve economic and environmental performance in the different sectors, including transportation.

The 1999 IEA study **Transportation and CO<sub>2</sub> emissions: Flexing the Link – A path for the World Bank**, introduces the IEA's decomposition analysis of energy consumption and CO<sub>2</sub> emissions to the World Bank's Global Overlays programme and links it to different policy approaches employed in the different countries under scrutiny. A key message is that

in developing countries, while CO<sub>2</sub> concerns are minimal, many strategies to improve traffic safety, reduce congestion and pollution, reduce oil consumption, etc., will reduce or curtail CO<sub>2</sub> emissions indirectly.

In 2000, The IEA published **Energy Technology and Climate Change: A Call to Action**. This report calls on IEA Member countries to find ways, compatible with their own circumstances, to maximise energy technology's contribution to reducing greenhouse gas emissions. It reviews a large number of technologies that could prove important in reducing energy-related emissions in both the near and long term. It points out how the availability of advanced energy technology can mitigate the cost of emissions reduction, and it outlines how traditional "barriers" to using new technology can be overcome. The report argues that maximising technology's contribution to emissions reduction requires redoubling efforts to develop and deploy advanced energy technologies as well as combining technological advances with measures that discourage the emitting of carbon. It also requires a combination of near-term initiatives and work that will only bear fruit years from today. The report deals directly with the issue of what governments can do in this area and points out where government action is needed.

**Experience Curves for Energy Technology Policy** was also published in 2000. This book discusses issues raised by the "experience effect", such as price-cost cycles, competition for learning opportunities in the market, risk of "technology lockout" and the effects of research, development and deployment policies on technology learning. The fact that market experience improves performance and reduces prices is well known and widely exploited in technology-intensive industries, but sparsely used in analysis for energy technology policy. Knowledge of the "experience effect" can help in the design of efficient programmes for deploying of environment-friendly technologies. The effect must be taken into account when estimating the future costs of achieving targets, including targets for carbon dioxide reduction. Case studies illustrate how experience curves can be used to set policy targets and to design policy

measures that will encourage both investment in and use of environment-friendly energy technologies. Low-cost paths to stabilising CO<sub>2</sub> emissions are explored.

The 2000 report **Road From Kyoto: Current CO<sub>2</sub> and Transport Policies in the IEA** reviews transport-related CO<sub>2</sub> abatement policies in six IEA countries: Denmark, Germany, the Netherlands, Sweden, the United Kingdom and the United States. The report focuses on past, recent and potential future policies and the policy context in each country. It provides a comprehensive description of selected key policy elements. More than 27% of total carbon dioxide emissions in OECD countries is produced by the transport sector, and there are still few signs that transportation energy use is peaking. Without new action, the prospects for reductions in CO<sub>2</sub> emissions from this sector look bleak.

During 2000, IEA also published **Energy Labels and Standards**. Energy efficiency labels and standards for appliances and equipment are playing key roles in many governments' strategies to meet energy and environmental goals. They are already widely used to improve the efficiency of home appliances and office equipment, and are increasingly being implemented for electric motors, home electronics and lighting equipment. At present, labels are used in 37 countries, and standards in 34 countries. The market influence of labels and standards is increasing as countries expand and strengthen their programmes, and initiate new programmes. As labelling and standards programmes proliferate, the potential advantages of international co-operation become increasingly apparent. Increased international co-operation on ratings, labels, targets and regulatory standards could increase effectiveness and reduce costs.

In 2000, IEA also published the **World Energy Outlook 2000**, which presents probable developments through the year 2020. The 2000 WEO offers a new "reference scenario," which takes into account those greenhouse gas policies that have been adopted and are now in place in OECD countries. Alternative cases are also presented. These consider the effects of

additional climate-change policies for transport and electricity generation sectors. Another important section studies the potential effects of schemes for trading emission permits among countries with commitments under the Kyoto Protocol.

In 2001, IEA published **Saving Oil and Reducing CO<sub>2</sub> Emissions in Transport: Options and Strategies**. This book examines the many policy approaches being taken by IEA Member countries to reduce transport-related carbon emissions. These include improving fuel economy in new cars and trucks, as well as reducing fuel consumption by vehicles already on the road. Alternative fuel sources are also covered as are ways to cut the growth in travel, by improving transit systems and using new technologies to reduce congestion. Energy-saving options in freight transport are also explored, such as making trucks and trucking systems more efficient and moving more goods by rail and water-borne transport. More than twenty different approaches are developed, including some which have been neglected by most IEA countries. The study discusses the benefits and costs of each option, as well as the obstacles it faces, and quantifies the effect of each option in reducing oil use and CO<sub>2</sub> emissions. Success stories from IEA countries are presented, as well as some stories of failure.

The report **Things That Go Blip in the Night: Standby Power and How to Limit It** was also published in 2001. Appliances and other electrical equipment increasingly draw power when they are switched off or not performing their primary function. This "standby power" provides remote control capability, network sensing, digital display and other features. Often, standby power is consumed simply because power supplies remain "on" while their appliances are switched "off". The book lays out the problem posed by growing standby power consumption, explores fully the technologies available to reduce it, and outlines how increased collaboration among industry, national governments and international organisations can help. Standby power consumption is about 10 per cent of OECD residential energy use or the equivalent of a 60-watt light bulb operating

continuously in each OECD household. Standby power consumption can be reduced by an average of 75 per cent with cost-effective design changes and technological improvements. Savings as high as 90 per cent can be achieved in many appliances without any reduction in services. Some products have already achieved very low standby power consumption at little or no cost. But standby power consumption is normally not high enough to command consumer attention.

During 2001, the IEA along with the Climate Technology Initiative (CTI) and the UN Environment Programme (UNEP) published **Technology Without Borders: Case Studies of Successful Technology Transfer** in 2001. This work examines cases where "climate-friendly" technologies or environmental best practices were transferred to developing countries and economies in transition. For each case it explores the causes for success and draws the lessons learned. The book is centred on four themes, crucial to effective technology transfer, they are:

- enhancing a country's capacity to adopt new technology;
- engaging the private sector – on the local and global scale;
- improving the effectiveness of international aid; and
- innovating new ways to finance climate-friendly projects.

**Energy Indicators and Sustainable Development** was distributed at the UNFCCC COP-7 meeting in Marrakech, Morocco in November 2001, and is available free on IEA's web site. It presents examples of IEA energy indicator analysis and an overview of the methodology used to develop the indicators. The publication also provides a summary of work that the International Atomic Energy Agency (IAEA) and IEA are undertaking to develop indicators for sustainable development and a plan for further activities in this area. The paper highlights the need for having data and indicators to identify and monitor policy decisions and for keeping track of progress towards environmental and sustainable development goals.

**Sustainable Urban Transport Project: Final Report** will be published during 2002 (possibly under a different title). This book will present the findings of IEA's recent study of bus technologies and transit systems in cities around the world. The primary focus was on bus systems in developing countries, where dilapidated vehicles, old technologies, and rapidly increasing traffic congestion and sprawl are jeopardising the ability of the developing world's premier cities to achieve sustainability. Near term bus and bus system improvements in these cities – before cars become dominant – could be among the most important and most cost-effective approaches to achieving transport sustainability world-wide. The forthcoming book includes IEA's "technology ladder", and guidelines for cities to move from basic to more advanced technologies for buses in a sensible way. It also presents the latest improvements in bus systems, featuring a description of Latin America's excellent "bus rapid transit" systems in cities like Curitiba and Bogota. Finally, it presents case studies from six developing cities that are making strides in improving bus systems, and the kinds of support that would help these cities succeed. A short report that summarises the study's main findings, *Sustainable Transport: New Insights from the IEA's World-wide Transit Study* was distributed at the UNFCCC COP-7 meeting in Marrakech, Morocco in November 2001 and is available free on IEA's web site.

**25 Years After - Energy Use in IEA Countries** will also be published during 2002. This book will provide important findings from IEA's work with indicators of energy efficiency and CO<sub>2</sub> emission. The focus is on explaining changes in energy-use and emissions in end-use sectors over the last 25 years covering a majority of IEA countries. The book will include an outline the IEA energy indicator approach but the bulk of the publication will consist of page-by-page illustrations and short descriptions organised by sector. The development of energy and emissions trends will be explained by investigating changes in energy efficiency and fuel mix as well as changes in sectoral structure and activity variables.

c) *Conferences*

The international workshop on **Technologies to Reduce Greenhouse Gas Emissions: Engineering-Economic Analyses of Conserved Energy and Carbon**, was held on 5-7 May 1999 in Washington DC. The workshop concentrated on engineering-economic analytical methods used for assessing the technical, economic, and achievable potential of technologies in the buildings, industry, transportation, and electric utility sectors.

A workshop **Indicators of Transportation Activity, Energy and CO<sub>2</sub> Emissions** took place in Stockholm on 9-11 May 1999. Its objectives was to examine the reasons why, between 1973 and 1995, most energy-using sectors in IEA countries showed significant reductions in CO<sub>2</sub> emissions per unit of output, whereas transport sector was an exception. One element in common among all countries is that the transport sector appears unable to “yield” to significant reduction or even restraint in CO<sub>2</sub> emissions as economies grow and fuel prices remain stable. Understanding what is happening to the key underlying trends and how these could be changed is a key element in the international discussion over CO<sub>2</sub> emissions. The purpose of the seminar was to provide IEA Member countries authorities with both motivation for improving indicators of transportation activity, energy use and carbon emissions and solid advice as to how and which indicators should developed. International co-operation among private and public authorities will be necessary to restrain CO<sub>2</sub> emissions from transportation. A resolution on Strategic Assessment and Decision Making for Integrated Transport and Environment Policy will be presented to Ministers in 2003 together with a report examining assessment and decision making procedures in a selection of ECMT Member countries.

<http://www.iea.org/pubs/studies/file>

## EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT (ECMT)

<http://www.oecd.org/cem/>

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**T**he ECMT is an inter-governmental organisation established by a protocol signed in Brussels on 17 October 1953.

The Council of the Conference comprises the Ministers of Transport of 39 full Member countries, 5 Associate countries and 3 Observer countries. The work of the Council of Ministers is prepared by a Committee of Deputies. The committee is assisted by working groups, each of which has a specific mandate. The ECMT is a forum for favouring transport policy dialogue at a political level. It is organised around an annual meeting.

**At present, the ECMT's role primarily consists in:**

- Creating an integrated transport system throughout the enlarged Europe that is economically and technically efficient, meets the highest possible safety and environmental standards and takes full account of the social dimension.
- Helping also to build a bridge between the European Union and the rest of the continent at a political level.

In November 1989, the Council of Ministers adopted a wide-ranging resolution on **Transport Policy and the Environment**, which is the basis for the ECMT follow-up work. In brief, while the Resolution (ECMT Resolution No. 66) recognised the major economic and social benefits provided by modern transport systems, it also acknowledged the large and growing environmental problems associated with them and identified three areas for further improvements:

- Control of vehicle emissions and fuel quality, and impacts on global pollution.

- Traffic management in urban areas and for inter-urban traffic.
- Integrating transport infrastructure design and evaluation with environmental impact assessments.

The ECMT Council of Ministers regularly debates transport and environment issues. Recent Council Recommendations and Resolutions cover such areas as reducing CO<sub>2</sub> emissions from vehicles, internalisation of the external costs of transport, ending the use of leaded petrol and incentives to replace dirty vehicles with less polluting ones. Taking practical steps towards sustainable development and balancing the social costs and benefits of transport are constant concerns of the conference.

In 2000 in Prague, Ministers debated the development of transport policies to contribute more effectively to sustainable development. They reached agreement on a common position on Sustainable Transport Policies published under this title.

<http://www.oecd.org/cem/resol/env/env66e.pdf>

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#### 4.1 *Recent and Planned Activities*

The issue of transport's contribution to global warming was examined at several events: at the **Hearing of the ECMT Council of Ministers** with representatives of the automobile and fuel industries in November 1990, at an **International ECMT Seminar on Reducing Transport's Contribution to Global Warming** in Paris in 1992, and *inter alia* at the 1993 meeting of the Council of Ministers of Transport in Noordwijk. **Transport Policy and Global**

**Warning**, based on the conclusions of the seminar, was published in 1993.

A seminar on the **External Costs of Transport** was held (with OECD) in September 1993. A publication “**Internalising the Social Costs of Transport**” followed, and the ECMT Annecy Ministerial Session (May 1994) discussed a paper on this issue. Following these discussions, the Ministers set up a Task Force to further develop the issue. A work programme and terms of reference are being drawn up for this Task Force, whose first formal meeting was held in 1995.

**A Task Force on the Social Costs of Transport** has been established to report to Ministers. It aims to clarify the concepts and terms involved in the policy debate, summarise the methodologies used for estimating externalities and the results of studies undertaken and suggest improvements to the policies adopted to address the social costs of transport.

Policy conclusions from the work, outlining an approach to providing incentives for reducing externalities, were presented to Ministers in April 1997. Ministers reiterated their support for further consideration of the application of the principle of internalising the external costs of transport in the 1997 Helsinki Declaration and at the UN/ECE Conference on Transport and Environment in Vienna. A full report, **Efficient Transport for Europe: Policies for Internalisation of External Costs**, was published in November 1997. Also a resolution on internalising transport externalities was adopted in 1998. Work is underway on subsidies and taxation in transport. One of its outputs is a quantification of distortion in transport markets in order to assess whether the kinds of changes to charges and taxation recommended by the Ministers are likely to be effective.

A major part of the ECMT work focuses on railways, combined transport and inland waterways including switching between modes. A report on **Reducing Noise from Railway Wagons** was prepared for the ministerial session in 1996.

From the dialogue with the *Vehicle Manufacturing Industry* (represented by OICA and ACEA), a joint declaration between government and industry has resulted on **reducing CO<sub>2</sub> emissions from cars**, adopted by Ministers at the ECMT Ministerial Session in 1995 in Vienna. Follow up to the declaration includes monitoring of specific fuel efficiency and CO<sub>2</sub> emissions from new cars.

A report on monitoring was submitted to Ministers in 1997 providing official data for the period 1980 to 1995 and analysing methodological issues for future monitoring activities. The monitoring is updated regularly. Also under the dialogue, a workshop on the influence of driver behaviour and on-board instrumentation on fuel efficiency was organised in Delft in 1996.

Results of pilot projects presented at the workshop suggest a significant potential for fuel savings could be achieved through changes in driving style brought about by training and information programs backed up by feedback from on-board instrumentation.

Under mandate from its 1994 ministerial meeting, the ECMT consulted Member and Associate Member countries in 1996 requesting information on CO<sub>2</sub> emissions from transport and on policies and measures in place or envisaged limiting these emissions. Twenty-nine countries responded and a report summarising and analysing the information provided was submitted to Ministers in 1997. The first part of this publication, the report “**Monitoring of National Policies for the Reduction of CO<sub>2</sub> Emissions from Transport**”, contains the conclusions of this survey. It shows that only a small number of countries have developed focused strategies for CO<sub>2</sub> emissions reductions from the transport sector. *Inter alia* it concludes that transport sector emissions will continue to rise both in relative and absolute terms through 2010 in almost all ECMT countries and that, largely as a consequence, overall greenhouse gas stabilisation targets will not be met by a majority of Member countries. The report was submitted to Council of Parties-3 (on Global Climate Change) in Kyoto (1997).

The second part of this publication, the report entitled "**Monitoring of Fuel Consumption and CO<sub>2</sub> Emissions of New Cars**", examines the requirements of a monitoring system and takes a look at current data sources. It concludes that while data remain imperfect, they are sufficient to record trends in new car fuel consumption to the degree of accuracy required.

The question in the center of the discussions is how can the sustainability of transport be secured. Governments could influence land use planning in order to prevent spatial dispersion. They could also intervene by improving conditions that encouraged environmentally friendly modes or non-motorised forms of travel, and influence individual decisions by making the real costs of mobility clear, particularly the costs in terms of environmental resources.

One of the major conclusions of this report is that the objective of environmental sustainability of transport is not fundamentally incompatible with strengthening markets and competition. Rather than re-regulating the transport sector, each initiative should be carefully selected in the awareness that economic and social sustainability has to be considered as well as environmental sustainability.

*<http://www.oecd.org/cem/pub/contents/CO2en.pdf>*

A round table about **Freight Transport and the City** explains the role that freight transport plays in the economy without forget the problem of the added pollution and congestion caused by freight transport. The Round Table reviewed the various aspects of freight transport by examining experiences in different countries and by discussing some of the more innovator approaches adopted. These Round Table discussions were published in September 1999.

In March 2000 the ECMT organised a ministerial level conference jointly with ACEA and OICA "**Smart CO<sub>2</sub> Reductions**" on non-product measures to reduce CO<sub>2</sub> emissions from cars. This covers areas such as reducing emissions

from vehicles in use through the tax system and other government incentives, influencing driver behaviour, improving vehicle maintenance and improving traffic management and infrastructure. The work is currently being taken forward in cooperation with the original partners and with the IEA. Follow up to the joint ECMT-IEA-OECD workshop on Improving Efficiency in Road Freight will be incorporated in this work.

*<http://www1.oecd.org/cem/topics/env/CO2turin.htm>*

A report **Vehicle Emission Reductions** was published in 2001 summarising recent and anticipated developments in vehicle emission regulations and comparing regulations in the three OECD regions: Europe, North America and Japan. A report on the strategy towards the use of sulphur free fuels in the interest of cutting both air pollutant and CO<sub>2</sub> emissions was presented to Ministers the same year, following close consultation with the European Parliament and European Commission which is legislating in this area. A Resolution on the introduction of sulphur free fuels is in preparation.

A report on **Efficient Transport Taxes and Charges** was published in 2001, incorporating a resolution on Charges and Taxes in Transport. This complements the 1998 Resolution on the Policy Approach, entitled the Internalising the External Costs of Transport and the publication, **Efficient Transport for Europe**. The work on improving the efficiency of transport taxation and internalising the external costs of transport continues. A database of road haulage taxes is currently being extended to cover 16 countries and the difference between existing structures and levels of taxation across the modes and a scenario for efficient taxes and charges is being modelled.

**Strategic Environmental Assessment in the Transport Sector**, published in 1998, underlines the environmental consequences of growing mobility. It develops new techniques that can help improve evaluation and understanding of these effects. Strategic Environmental Assessment (SEA) is emerging as a potentially powerful tool to evaluate in a more structured

and systematic way the environmental impacts of transport policies, programmes and plans. This report seeks to contribute to the development of effective procedures for incorporating adequate environmental assessments in all strategic transport sector decisions. A new report was published in 2000, updating and expanding the original version with recent experience in the field.

A report, **Assessing the Benefits of Transport** was published in 2001. This complements the work on SEA and sets out procedures for improving cost benefit assessments, particularly so that they take proper account of the widespread distortions that exist in transport markets and adequately examine the mechanisms for the delivery of projected benefits, evaluating the outcomes against the goals of government policy. The report reflects recent groundbreaking work for the British Government and more generally promotes more systematic use of good cost benefit assessment. Work is currently underway to examine how the results of evaluations of environmental impacts and of the benefits of transport projects and policies can be better brought to bear in the decision making process. This is seen as the key to advancing the aims of integrating transport and environment policymaking.

At their last Council debate on sustainable development, Ministers highlighted the importance of **modal shift** to sustainable transport strategies. The potential and constraints for shifting freight from roads to rail and other modes has been examined in detail by the working group on railways together with the financial and regulatory implications. A paper on Developing a Sustainable Balance between Substitutable Modes of Freight Transport that recommends a coherent package of measures and discusses appropriate targets has been prepared as the basis for a debate between ministers at their 2002 council meeting.

*<http://www.oecd.org/cem/pub/pub/pubforth.htm#freight>  
<http://www.oecd.org/cem/pub/contents/sea.pdf>*

**SELECTED LIST OF ACTIVITIES RELATED TO TRANSPORT AND THE ENVIRONMENT  
- EXCERPTS FROM PART II -**

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**1. Joint activities of the OECD, IEA and ECMT**

**1.1 Intra OECD**

□ **ENV and STI**

Projects

- Recycling for Road Improvements, 1995-1996
- Integrated Safety/Environment Strategies, 1997
- Transport of Dangerous Goods through Tunnels, 1999

□ **ENV and ECH**

Publications

- Liberalisation and Structural Reform in the Freight Transport sector in Europe, 1997
- The Environmental Effects of Freight, 1997
- Freight and the Environment: Effects of Trade Liberalisation and Transport Sector reforms, 1997
- Trade measures in the Basel Convention on the Control of Transboundary Movements of hazardous Wastes and Their Disposal, 1997

**1.2 OECD and IEA**

Conferences/Workshops

- Towards Clean Transport: Fuel Efficient and Clean Motor Vehicles, March 1994, Mexico City
- Towards Sustainable Transportation, March 1996, Vancouver
- Industry View on the Climate Change Challenge with Special Emphasis on the Kyoto Mechanism, March 1999

**1.3 OECD and ECMT**

Conferences/Workshops/Seminars

- Social Costs of Road Transport, September 1993
- Travel in the City: Making it Sustainable, June 1993

- Transport and Environment in Central and Eastern Cities, June 1995, Bucharest (OECD/ENV, TDS and ECMT)

#### Publications

- Internalising the Social Costs of Transport, 1994
- Implementing Sustainable Urban Travel Policies, 2002
- Key Messages for Governments, 2002

#### Projects

- Urban Transport and Sustainable Development (with TDS)
- Implementing Sustainable Urban Travel Policies(with TDS)

#### Others

- Joint sessions of OECD/ENV and ECMT on transport and the environment since 2001

### **1.4 OECD, IEA and ECMT**

#### Conferences/Workshops

- Reconciling Environmental Energy and Transport Issues, May-June 1994, Budapest
- Transportation Technology Forum on Energy, Environment and Transportation Systems Perspectives, December 1994, Valbonne
- Road Vehicle Technology, October 1995
- Improving Fuel Efficiency in Road Freight: The role of Information Technologies, 1999

#### Publications

- IPCC Second Assessment Report, 1995
- Environmental Implications of Energy and Transport Subsidies, 1997
- Sustainable Development on Policy Approaches for the 21<sup>st</sup> Century, 1997
- Sustainable Development: Critical Issues, 2001

## **2. OECD**

### **2.1 SGE**

#### Publications

- The Future of International Air Transport Policy: Responding to Global Change, 1997
- Air Transport and the Environment (an article of OECD Observer), 1997

#### Others

- OECD Future Studies Information Base (documentation system)
- Roundtable on Sustainable Development (established in 1998)

### **2.2 STI/RTR**

#### Publications/Studies

- Environmental Impact Assessment of Roads, 1994 (publication and seminar)

- Roadside Noise Abatement, 1995
- Recycling for Road Improvements, 1997 <also see 1.1>
- Integrated Safety/Environment Strategies, 1997 <also see 1.1>
- Outlook 2000, 1997
- Performance indicators for the Road Sector, 1997
- Transport of Dangerous Goods through Road Tunnels, 2001
- Influencing Road Travel Demand, 2002 (study)
- Heat on Transport: Strategies to Reduce CO<sub>2</sub> emissions from the Road Transport, 2002
- Effects of Infrastructure Investments on Regional Development, 2002

Conferences/Workshops/Seminars

- Environmental Impact Assessment of Roads, 1994
- Roadside Noise Abatement, 1995
- Integrated Strategies for Safety and Environment, May, 1998
- Intermodal Networks and Logistics, June 1997, Mexico City
- Joint OECD/ECMT Workshop on the Impact of e-commerce on Transport, June 2001, Paris
- Pricing Symposium, November 2002, Florida, USA

Project

- Performance Indicators for the Road Sector: Summary of the Field Test, 1997-99
- Low Emission Vehicles: Implementation Issues (current project)
- Urban Freight Logistics (current project)
- What driving the growth of transport demand?, (current project)

**2.3 DCD**

Publications

- Shaping the Urban Environment in the 21<sup>st</sup> Century: A Policy Reference Manual, 2001

**2.4 TDS**

Conferences/Workshops/Seminars

- Conference on the Use of Economic Instruments in Urban Travel Management, 1992
- Transport and Environment in Central and Eastern Cities, June 1995 in Bucharest
- Conference on Sustainable Urban Development, March 1996, Berlin (The Ecological City Project was highlighted)
- Eco-efficiency in Transport, July 1997, Berlin
- The Development of Urban Transport Infrastructure, Reconciling the Economic, Social and Environmental Dimensions, April 1998

Publications

- Urban Transport and Sustainable Development, 1995
- Towards a New Role for Spatial Planning, 2001
- Cities for Citizens: Improving Metropolitan Governance, 2001

## 2.5 *ECH*

- Case studies on trade liberalisation in the transport sector (by Joint Sessions on Trade and the Environment) <also see 1.1>

## 2.6 *ENV*

### Conferences/Workshops

- Subsidies/Tax Incentives and the Environment, 1995
- Waste Minimisation Workshop, 1996
- Values, Welfare and Quality of Life, Mach 1996, Paris
- Culture, Choice and Technology, July 1996
- Towards Sustainable Transportation in 1996, Vancouver
- EST- Futures, Strategies and Best Practices, October 2000, Vienna

### Publications/Studies

- Fighting Noise in the 1990s, 1987 (study)
- Control Strategies for Photochemical Oxidants, 1990 (study)
- The State of the Environment 1991
- Control of Emission From Heavy-Duty Vehicles (study)
- Evaporative Emissions from Vehicles and Refuelling Systems (study)
- Control of Emissions from Vehicles in Use (study)
- Choosing an Alternative Transportation Fuel: Air Pollution and Greenhouse Gas Impacts (study), 1993
- Indicators for the Integration of Environmental Concerns into Transport Policies, 1993
- Social Costs of Land Transport, 1994 (study)
- Motor Vehicle Pollution: Reduction Strategies beyond 2010, 1995
- Declaration on Lead, 1996
- Eco-Efficiency in the Transport Sector, 1996
- Environmentally Sustainable Transport Project, Phase I report: EST criteria, 1996
- Guidance Concerning Chemical Safety in Port Areas, 1996 (published with IMO)
- Prevention, Preparedness for, and Response to Releases of Hazardous Substances, 1996, 1997
- Compendium of Environmental Data, 1991, 95, 97
- Environmental Implications of Energy and Transport Subsidies, 1997
- Proceedings from Towards Sustainable Transportation, 1997
- OECD Policy Meeting on Sustainable Consumption and Individual Travel Behaviour, January 1997
- Literature Review on Individual Travel Behaviour, 1997
- Sustainable Consumption and Production Programme, 1997
- Market and Intervention Failures in Transport Policies, 1998 (study)
- Improving the Environment through Reducing Subsidies, 1998
- Phasing Lead out of Gasoline the Experience with Different Policy Approaches in Different Countries, 1998

- Environmentally Sustainable Transport Project, Phase II report: Scenarios for Environmentally Sustainable Transport, 1998/1999
- Older Gasoline Fuelled Vehicles in Developing Countries their Importance and the Policy Options for Addressing them, 1999
- Indicators for the Integration of Environmental Concerns into Transport Policies, 1999
- The EST Guidelines, 2000
- OECD Environmental Outlook, 2001
- OECD Environment Strategy for the First Decade of the 21<sup>st</sup> Century, 2001
- Environment Related Taxes in OECD Countries, Issues and Strategies, 2001
- Case Study on Household Tourism-Travel: Trends, Environmental Impacts and Policy Responses, 2001
- Environmentally Sustainable Transport Project, Phase III report: Policy Instruments for Achieving Environmentally Sustainable Transport, 2002 (forthcoming)

#### Projects

- Clean Fuel Efficient Vehicles activities
- MOVE project, 1993
- EST, 1994-2001
- Chemical Accidents Programme
- Overcoming Impediments to the Integration of Environmental Considerations into Economic Development, 1998
- Transport of Dangerous Goods (Rail, Motorway and In-land Waterways), 1997-99
- Individual Travel Behaviour (ITB)
- MOVE II project, 2001-2003
- EST in Central European Initiative (CEI), 2001-
- Decoupling Transport Impacts and Economic Growth, 2002-
- Sustainable Consumption Work Programme

### **3. IEA**

#### Symposia/Workshops

- Expert Panel on the Low Consumption/Low emission Automobile, 1990
- Toward Clean and Fuel Efficient Automobiles, 1992 Stockholm
- Clean and Fuel Efficient Motor Vehicles and Sustainable Transport, 1994, Mexico
- Reconciling Environmental, Energy and Transport, 1994, Budapest
- Transportation Forum on Energy, Environment and Transportation Systems Perspectives, 1994,
- Towards Sustainable Transportation, 1996 Vancouver (with OECD/ENV)
- Round Table on Technology Policy Responses to Kyoto: the IEA Perspective, 1998, Cambridge
- Round Table on Technology Policy Responses to Kyoto: the IEA Perspective, 1998
- Workshop on Technologies to Reduce Greenhouse Gas Emissions: Engineering-Economic Analyses of Conserved Energy and Carbon, May 1999, Washington DC

- Workshop on Indicators of Transportation Activity, Energy and CO<sub>2</sub> Emissions, May 1999, Stockholm
- Technologies to Reduce Greenhouse Gas Emissions: Engineering-Economic Analyses of Conserved Energy and Carbon, may 1999, Washington DC
- Indicators of Transportation Activity, Energy and CO<sub>2</sub> Emissions, may 1999, Stockholm

#### Publications

- Substitute Fuels for Road Transport, 1990
- Fuel Efficiency of Passenger Cars, 1991
- Cars and Climate change, 1993
- Electric Vehicles: Technology, Performance and Potential, 1993
- Refining and Environmental Implications of Increased Use of Diesel-Engined Passenger Cars, 1994
- Energy and Environment Policy Analysis Series, Biofuels, 1994
- IEA/OECD Scoping Study: Energy and Environmental Technologies to respond to Global Climate Change Concerns, 1994
- Energy in Developing Countries, 1994
- World Energy Outlook, 1995
- Climate change Policy Initiatives, 1995
- Comparing Energy Technologies, 1996
- IEA International Energy Technology Collaboration: Benefits and Achievements, 1996
- Voluntary Actions for Energy-Related CO<sub>2</sub> Abatement in IEA member countries, 1997
- Energy Technologies for the 21<sup>st</sup> Century, 1997
- Energy and Environment Policy, 1997
- Energy and climate change an IEA source-book for Kyoto and Beyond, 1997
- Transport Energy and Climate Change, 1997
- World Energy Outlook, 1998
- Benign Energy? The Environmental Implications of Renewable, 1998
- International Collaboration in Energy Technology: a sampling of success stories, 1999
- Automotive Fuels for the Future: the Search for Alternatives, 1999
- Looking at Energy Subsidies: Getting the Prices Right, 1999
- Transportation and CO<sub>2</sub> emissions: Flexing the Link – A path for the World Bank, 1999
- Energy Technology and Climate Change: A Call to Action, 2000
- Experience Curves for Energy Technology Policy, 2000
- Road from Kyoto: Current CO<sub>2</sub> and Transport Policies in the IEA, 2000
- Energy labels and Standards, 2000
- World Energy Outlook 2000, 2000
- Saving Oil and Reducing CO<sub>2</sub> Emissions in Transport: Options and Strategies, 2001
- Things That Go Blip in the Night: Standby Power and How to Limit it, 2001
- Technology Without Borders: Case Studies of Successful Technology Transfer, 2001
- Energy Indicators and Sustainable Development, 2001

- Sustainable Urban Transport Project: Final Report, 2002 (forthcoming)
- 25 years After – Energy Use in IEA Countries, 2002 (forthcoming)

#### **4. ECMT**

##### Publications/Reports/Documents

- Resolution on Transport Policy and the Environment, 1989
- Transport Policy and Global Warming, 1993
- Internalising the Social Costs of Transport, 1994
- Reducing Noise from Railway Wagons, 1996
- Reducing CO<sub>2</sub> Emissions from Cars, adopted by the Ministerial Session, 1995, Vienna
- Efficient Transport for Europe: Policies for Internalisation of External Costs, 1997
- Monitoring of National Policies for the Reduction of CO<sub>2</sub> Emissions from Transport, 1997
- Strategic Environmental Assessment in the Transport Sector, 1998
- Freight Transport and the City, 1999
- Smart CO<sub>2</sub> Reductions, 2000
- Vehicle Emission Reductions, 2001
- Efficient Transport Taxes and Charges, 2001
- Assessing the Benefits of Transport, 2001
- Resolution on Strategic Assessment and Decision Making for Integrated Transport and Environment Policy, 2003 (forthcoming)

##### Workshops/Seminars

- Hearing of the ECMT Council of Ministers with representatives of the automobile and fuel industries, November 1990
- International ECMT Seminar on reducing Transport's Contribution to Global Warming, 1992, Paris
- A Seminar on External Costs of Transport, September 1993 (with OECD)

**SELECTED LIST OF PUBLICATIONS  
RELATED TO TRANSPORT AND THE ENVIRONMENT**

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**2002**

- 25 Years After – Energy use in IEA Countries*, IEA, 2002 (forthcoming)
- Environmentally Sustainable Transport – Policy Instruments for Achieving Environmentally Sustainable Transport: Report on Phase 3 of the EST project*, OECD, 2002a\* (forthcoming)
- Heat on Transport: Strategies to Reduce CO<sub>2</sub> emissions from the Road Transport*, OECD, 2002b (forthcoming)
- Household Tourism-Travel: Trends, Environmental Impacts and Policy responses*, OECD, 2002c
- Implementing Sustainable Urban Travel Policies, Final Report*, ECMT, 2002
- Implementing Sustainable Urban Travel Policies, Key Messages for Governments*, ECMT, 2002
- Influencing road travel demand*, OECD, 2002d (forthcoming)
- Proceedings of the EST Conference: Futures, Strategies and est! Best Practices, Vienna 2000*, OECD, 2002e\* (forthcoming)
- Round Table 116, The Transport of Waste Products, 2002*, ECMT, 2002
- Sustainable Urban Transport Project: Final Report*, IEA, 2002 (forthcoming)

**2001**

- Assessing the Benefits of Transport*, ECMT, 2001
- Efficient Transport Taxes and Charges*, ECMT, 2001
- Energy Indicators and sustainable Development*, IEA, 2001
- Environmentally Related Taxes in OECD Countries, Issues and Strategies*, OECD, 2001a
- Improving Metropolitan Governance*, OECD, 2001b
- OECD Environmental Indicators, Towards Sustainable Development*, OECD, 2001c
- OECD Environmental Outlook*, OECD, 2001d
- OECD Environmental Strategy for the First Decade of the 21<sup>st</sup> Century*, OECD, 2001e
- Performance Indicators for the Road Sector: Summary of the Field Test*, OECD 2001f
- Saving Oil and Reducing CO<sub>2</sub> Emissions in Transport, Options & Strategies*, IEA, 2001

*Shaping the Urban Environment in the 21<sup>st</sup> Century: A Policy Reference Manual*, OECD 2001  
*Sustainable Development, Critical Issues*, OECD, 2001g  
*Technology Without Borders: Case Studies of Successful Technology Transfer*, IEA, 2001  
*Territorial Outlook 2001*, OECD, 2001h  
*Things That Go Blip in the Night: Standby Power and How to Limit it*, IEA, 2001  
*Towards a New Role for Spatial Planning*, OECD, 2001i  
*Transport of dangerous goods through road tunnels*, OECD, 2001j  
*Vehicle Emission Reductions*, ECMT, 2001

## **2000**

*2000 World Energy Outlook*, IEA, 2000  
*Energy Technology and Climate Change: A Call to Action*, IEA, 2000  
*EST, Futures, Strategies and Best Practices: Synthesis Report*, OECD, 2000a\*  
*Experience Curves for Energy Technology Policy*, IEA, 2000  
*Integrating Transport in the City: Reconciling the Economic, Social and Environmental Dimensions*, OECD, 2000b  
*Road From Kyoto: Current CO<sub>2</sub> and Transport Policies in the IEA*, IEA, 2000

## **1999**

*Automotive Fuels for the Future: the Search for Alternatives*, IEA, 1999.  
*Economic and Social Implications of Sustainable Transportation – The Ottawa Workshop*, OECD, 1999\*.  
*Freight Transport and the City*, OECD, 1999.  
*Indicators for the Integration of Environmental Concerns into Transport Policies*, working group on the state of the environment, OECD, 1999\*.  
*Indicators of Transportation Activity, Energy and CO<sub>2</sub> Emissions*, IEA, 1999\*.  
*Industry View on the Climate Change Challenge with Special Emphasis on the Kyoto Mechanisms*, BIAC/OECD/IEA Workshop on Climate Change, 1999\*.  
*International Collaboration in Energy Technology: a sampling of success stories*, IEA, 1999.  
*Looking at Energy Subsidies: Getting the Prices Right*, IEA, 1999.  
*Older Gasoline Fuelled Vehicles in Developing Countries their Importance and the Policy Options for Addressing them*, OECD, 1999  
*Strategic Environmental Assessment for Transport*, proceedings of a joint OECD/ECMT conference, 1999.  
*Technologies to Reduce Greenhouse Gas Emissions: Engineering-Economic Analyses of Conserved Energy and Carbon*, International Workshop of IEA, 1999\*.  
*The Evolving Renewable Energy Market*, IEA, 1999.

*Towards Sustainable Transport in the CEI Countries*, Ministerial Declaration and Joint Pilot Study on Environmentally Sustainable Transport in the CEI Countries in Transition, UNEP/OECD/Austria, 1999\*.

*Transportation and CO<sub>2</sub> emissions: Flexing the Links*, IEA, 1999.

## **1998**

*1998 World Energy Outlook*, IEA, 1998.

*Benign Energy?, The Environmental Implications of Renewables*, IEA, 1998.

*Eco-Efficiency in Transport, report and background paper from a workshop*, 7-8 July 1997 in Berlin, OECD\*.

*Efficient Transport for Europe: Policies for Internalisation of External Costs*, ECMT, 1998

*Improving the Environment through Reducing Subsidies*, OECD, 1998.

*Intermodal Freight Transport*, Report of the Multimodal Freight Advisory Group, OECD, 1998\*.

*Phasing Lead out of Gasoline: the Experience with Different Policy Approaches in Different Countries*, OECD, 1998

*Renewable Energy Policy in IEA Countries volume II: Country Reports*, IEA, 1998.

*Safety of Vulnerable Road Users*, OECD, 1998.

*Scenarios for Environmentally Sustainable Transport*, Report on Phase 2 of the EST project, Synthesis Report (Part I) and Country Case Study (Part II), OECD, (second revised edition) 1998/1999\*.

*Strategic Environmental Assessment in the Transport Sector*, ECMT, 1997.

*Technologies policy responses to Kyoto*, Round Table, 1998\*.

*The Development of Urban Transport Infrastructure, Reconciling the Economic, Social and Environmental Dimensions*, international seminar organised by the OECD, the Caisse des Dépôts et Consignations and the Ministry of Public of Public Works, Transport and Housing, 1998\*.

## **1997**

*CO<sub>2</sub> Emissions in the Transport Sector*, ECMT, 1997.

*Culture Choice and Technology*, Report of the Second OECD Workshop on Individual Travel Behaviour, OECD, 1997\*.

*Efficient Transport for Europe: Policies for Internalisation of External Costs*, ECMT, 1997.

*Energy and Climate Change*, IEA, 1997.

*Energy Technologies for the 21st Century*, IEA, 1997.

*Freight and the Environment: Effects of Trade Liberalisation and Transport Sector Reforms*, OECD, 1997\*.

*Globalisation and Environment: Preliminary Perspectives*, OECD, 1997

*Indicators of Energy Use and Efficiency*, IEA, 1997.

*Integrated Safety/Environment Strategies*, OECD, 1997.

*Intermodal Networks and Logistics*, International Conference in Mexico City, OECD, 1997.

- Liberalisation and Structural Reform in the Freight Transport*, OECD, 1997\*.
- Maritime Transport 1995 (1997 Edition)*, OECD, 1997.
- New Trends in Logistics in Europe*, Economic Research Centre Round Table 104, ECMT, 1997.
- Outlook 2000*, OECD, 1997.
- Performance Indicators for the Road Sector*, OECD, 1997.
- Policies and Measures to Encourage Innovation in Transport Behaviour and Technology*, UN FCCC Polices and Measures for Common Action Working Papers #13, OECD, 1997\*.
- Recycling Strategies for Road Works*, OECD, 1997\*.
- Reforming Energy and Transport Subsidies*, OECD, 1997.
- Road Safety Principles and Models: Review of Descriptive, Predictive, Risk and Accident Consequence Models*, OECD, 1997\*.
- Road Transport Research - Outlook 2000*, OECD, 1997.
- Statistical Trends in Transport 1965-1992*, ECMT, 1997.
- Statistical Trends in Transport 1965-1995, 1996*, ECMT, 1997.
- Sustainable Consumption and Individual Travel Behaviour, Report of the OECD Policy Meeting on Individual Travel Behaviour*, OECD, 1997\*.
- Sustainable Consumption and Production*, OECD, 1997.
- Sustainable Development: OECD Policy Approaches for the 21st Century*, OECD, 1997.
- Sustainable Transport Policies: CO<sub>2</sub> Emissions from Road Vehicles, UN FCCC Polices and Measures for Common Action Working Papers #1*, OECD, 1997\*.
- The Environmental Effects of Freight*, OECD, 1997\*.
- The Future of International Air Transport Policy: Responding to Global Change*, OECD, 1997.
- Towards Sustainable Transport, Proceedings of an International Conference (Vancouver, March 1996)*, OECD, 1997\*.
- Trade Measures in the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, OECD, 1997.
- Transport of Dangerous Goods through Road Tunnels*, OECD, 1997.
- Transport, Energy and Climate Change*, IEA/OECD, 1997.
- Trends in the Transport Sector, 1970-1995*, ECMT, 1997.
- Which Changes for Transport in the Next Century*, 14<sup>th</sup> International Symposium on Theory and Practice in Transport Economics at Innsbruck, OECD, 1997.

## **1996**

- Changing Daily Urban Mobility: Less or Differently?*, Economic Research Center Round Table 102, ECMT, 1996.
- Environmental Criteria for Sustainable Transport, Report on Phase 1 of the Project on Environmental Sustainable Transport*, OECD, 1996\*.
- Environmental Sustainable Transport Project, Phase 1 EST criteria, Compendium of Experts Papers*, OECD, 1996\*.

*Integrated Advanced Logistics for Freight Transport*, OECD, 1996.

*Intergovernmental Panel on Climate Change Second Assessment Report*, IPCC, 1996.

*New Problems, New Solutions: 13th International Symposium on Theory and Practice in Sustainable Transport in Central and Eastern European Cities, Proceedings of the workshop* OECD/ECMT, 1996.

*Towards Clean Transport: Clean and Fuel-Efficient Motor Vehicles, Proceedings of an International Conference, (Mexico-City, March 1994)*, OECD/IEA, 1996\*.

*Transport Economics*, ECMT, 1996.

*Values, Welfare and Quality of Life, Report of the first OECD Workshop on Individual Travel Behaviour*, OECD, 1996\*.

*Voluntary Actions for Energy-Related CO<sub>2</sub> Abatement in IEA Member countries*, IEA, 1996.

## **1995**

*Developing Environmental Capacity: A Framework for Donor Involvement*, OECD, 1995.

*Donor Assistance to Capacity Development in Environment, OECD Development Co-operation Guidelines Series*, OECD, 1995.

*Environmental Impact Assessment of Roads, Road Transport Research Programme*, OECD, 1995.

*Motor Vehicle Pollution: Reduction Strategies beyond 2010*, OECD, 1995.

*Planning for Sustainable Development: Country Experiences*, OECD, 1995.

*Reconciling Transportation, Energy and Environmental Issues: The Role of Public Transport, Proceedings of an International Conference, (Budapest, May 1994)*, OECD/IEA, 1995.

*Roadside Noise Abatement, Road Transport Research Programme: Proceedings of an International Seminar, (Madrid, November 1995), Ministry of Public Works, Transport and Environment, Madrid, 1995.*

*Urban Travel and Sustainable Development*, OECD, 1995.

## **1994**

*Alternative Transportation Technology: Energy Security and Environment Concerns*, IEA, 1994.

*Energy Market Effects of Climate Change Policies*, IEA, 1994.

*Internalising the Social Costs of Transport*, OECD/ECMT, 1994.

*Marine Fuel Oil Sulphur Specification*, IEA, 1994.

*The Environmental Effects of Trade in the Transport Sector*, in *The Environmental Effects of Trade*, OECD, 1994.

## **1993**

*Biofuels and Transport*, IEA, 1993.

*Cars and Climate Change*, IEA, 1993.

*Choosing an Alternative Transportation Fuel: Air Pollution and Greenhouse Gas Impacts*, OECD, 1993.

*Control of Emissions from Heavy-Duty Vehicles*, Environment Monograph No. 55, OECD, 1993\*  
*Control of Emissions from Vehicles in Use*, Environment Monograph No. 54, OECD, 1993\*.  
*Evaporative Emissions from Vehicles and Refuelling Systems*, Environment Monograph No. 56, OECD, 1993\*.

*Road Transport Research Outlook, Road Transport Research Programme*, OECD, 1993.

*Seminar on Transport Policy and Global Warming*, ECMT, 1993.

*Ship Scrapping: Trends, Regions and Implications*, OECD, 1993.

*Strategies for Transporting Dangerous Goods by Road: Safety and Environmental Protection, meeting proceedings (Karlstad, Sweden, 2 - 4 June 1992) Linköping Sweden 1993.*

*Towards Clean and Fuel-Efficient Automobiles, Proceedings of an International Conference, (Berlin, June 1991)*, OECD/IEA/ECMT, 1993.

*Travel in the City: Making it Sustainable, Proceedings of an International Conference (Düsseldorf, 7-9 June 1993)*, OECD/ECMT, 1993.

## **1992**

*Cargo Routes, Truck Roads and Networks, Road Transport Research Programme*, OECD, 1992.

*International Road Research Scheme (IRRD) Thesaurus Update*, LCPC/OECD, 1992.

*Market and Intervention Failures in Transport Policies*, OECD, 1992.

*Road Tunnel Management, Road Transport Research Programme / Swiss Federal Highway Office, S.F.H.O., Berne, 1992.*

*The Urban Electric Vehicle, Proceedings of an International Conference, (Stockholm, Sweden, 25-27 May 1992)*, OECD/IEA, 1992.

*The Use of Economic Instruments in Urban Travel Management, Joint Conference of OECD/ECMT/WWZ, University of Basel (Basel, June 18-19, 1992), WWZ-Report No. 37, 1992, Basel, Switzerland.*

## **1991**

*Fighting Noise in the 1990s*, OECD, 1991.

*Freight Transport and the Environment*, ECMT, 1991.

*Fuel Efficiency of Passenger Cars*, IEA, 1991.

*Greenhouse Gas Emissions: The Energy Dimension*, OECD, 1991.

*Low Consumption/Low Emission Automobile*, OECD, IEA, 1991.

## **1990**

*Control Strategies for Photochemical Oxidants Across Europe*, OECD, 1990.

*Environmental Policies for Cities in the 1990s*, OECD, 1990.

*Substitute Fuels for Road Transport*, IEA, 1990.

*Transport Policy and the Environment*, OECD/ECMT, 1990.

(\*) Document available free of charge: <http://www.oecd.org/env/transport/>