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TRANSPORT AND ENVIRONMENT

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

This document is the final update of the survey that was presented to the Working Group on Transport at its meeting of 9-10 November 1999.

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FOREWORD

This working document includes two parts:

Part I: The Background and Synthesis Report, prepared by the OECD Secretariat's Environment Directorate, presents an overview of key conclusions and findings that can be derived from recent work by the OECD, IEA and ECMT on road transport and the environment. 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 paper describes the recent and projected evolution of road transport in OECD countries. Section 3 sets out the related environmental consequences. Section 4 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 5 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-1999), of a previous survey performed in 1997, and includes more recent developments and provides an outlook for future projects. It was prepared by the Pollution Prevention and Control 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 1999-2000 develop. The contributions from these organsiations 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, reference to web pages are provided in the corresponding chapters.

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PART I

BACKGROUND AND SYNTHESIS REPORT ON ROAD TRANSPORT AND THE ENVIRONMENT

1
INTRODUCTION

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 polices 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 transport, i.e., the manner of thinking and organising transport better. 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.

A third 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 IEA and ECMT (Berlin, Stockholm, Düsseldorf, Mexico, Budapest), also provide valuable insights into what might constitute sustainable transport policy.

2
DEVELOPMENT OF ROAD TRANSPORT IN OECD COUNTRIES

Access 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. Whether ongoing structural adjustment, improved logistics and the changing nature of economic activity can ultimately reduce the 'transport intensity' of OECD economy 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.

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. Put another way, travel by car doubled between 1970 and 1990 and, on present trends, could double again within the next 30 to 40 years.

2.2 Freight Transport

A particularly striking feature has been the growth of goods transport by road. 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 veh-km has been similar to that of car-km (about 3.7 per cent p.a.). Road haulage in the European Union is expected to increase by 42 per cent between 1990 and 2010, from 805 to

1 139 billion tonne-km, with rail freight increasing by only 33 per cent during the same period.

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

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. 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 object. 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.

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. 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 in an overall increase in oil use of just less than one per cent a year. 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. Road transport is 99 per cent oil dependent. Moreover, transport's share of total final oil consumption continues to grow significantly (e.g. from 43 per cent to 60 per cent between 1973 and 1988) while other sectors' dependence on oil has decreased, shifting to other sources. The IEA, in its 1998 World Energy Outlook, expected fossil fuels to meet 95% of additional global energy demand from 1995 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 65% and CO_2 emissions by 70% between 1995 and 2020 unless new policies are put in place to significantly reduce fuel consumption. Transport sector will increase 1.5 per cent per annum through the year 2010, representing virtually all of the incremental demand for oil in OECD countries.

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.

3
ROAD TRANSPORT AND THE ENVIRONMENT

The four main forms of negative environmental and social externalities arising from road 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, at a minimum, to the equivalent of approximately 5 per cent of GDP in OECD countries. Urban populations are especially exposed to the negative impacts of motor vehicle traffic.

3.1 Air Pollution and Global Climate Change

Motor vehicle use in OECD countries is now 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 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 than their directly-emitted precursors. Major air pollutants emitted by motor vehicles include carbon dioxide (CO_2), carbon monoxide (CO), particulate matter (PM), nitrogen oxides (NO_x), sulphur dioxide (SO_2) and volatile organic compounds (VOC). Highly reactive VOC species in vehicle emissions are, along with NO_x emissions, the major motor-vehicle related precursors of tropospheric ozone (O_3). 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_x and 44 percent 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_2), a radiatively active gas in the atmosphere, is of global importance due to its implication on global climate change. The mechanism is that CO_2 acts as a greenhouse gas and thus contribute 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 appears set to maintain 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_2 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_2. On the other hand, heavy-duty trucks and buses are responsible for half the world's emissions of motor-related NO_x 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_x 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 standards and emission 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. For example, mean values of CO have been decreasing in most urban areas in OECD countries due to improvement in emission controls. After a period of steady increase during the 1980s, average concentrations of NO_x have levelled off in many OECD countries. However, projections for the growth in motor vehicle traffic suggest that in the absence of new control measures, emissions of CO, hydrocarbons and NO_x 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. CO_2 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 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_2. Road transport generates other greenhouse gases, such as the CFCs (which are also ozone depleting) used in automobile air conditioning systems, NO_x, etc.

3.2 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 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 draw 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. Roughly half of urban residents in European countries are adversely affected by noise and 17 per cent of Europeans are exposed to noise levels greater than 65 dB(A). In Japan, the figure is 30 per cent, while in the United States it is only 7 per cent.

3.3 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. OECD studies have shown that building more roads in major urban centres has generally failed to ease congestion, and serves only to generate 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.

3.4 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. 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. According to the experts, the external cost of road accidents alone may well amount to as much as 2.5 per cent of GDP.

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.

3.5 Internalising Social 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. ECMT has recently estimated these to be the equivalent of 5,6 % of GDP in ECMT countries (although this figure underestimates certain substantial costs, such as climate change, and ignores others, such as separation effects on ecosystems and human communities and damage to landscapes).

Knowledge of transport sector 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 can determine the point where social welfare is maximised. 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 we can 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 primary effects of internalisation policies are expected to be significant welfare gains. The main responses 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. 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.

A new approach for assessing the social costs of transport has been developed in the study “Health Costs due to Road Traffic-related Air pollution” a project of Austria, France and Switzerland, prepared for the WHO Ministerial Conference on Environment and Health in 1999. It uses the willingness-to-pay method to determine the monetary valuation of the air pollution related health effects. The health costs are estimated based on the willingness-to-pay for a decrease in mortality and morbidity related risk. Thereby, the material costs (loss of production/consumption and treatment costs) as well as the intangible costs (pain, suffering, fear of disease and death, grief, etc.) are considered.

Based on this approach, in 1996 the health costs from air pollution in Austria, France and Switzerland have been determined. The total air pollution related health costs of all three countries amount to some 49 700 million EUR, of which some 26 700 million EUR are attributable to road traffic-related air pollution; i.e. about 1.8% of the GDP in France, 1.7% in Austria and 1.1% in Switzerland.

Compared to other road traffic-related negative impacts (noise, accidents, damage to buildings), the health costs are considerable. In the overall road traffic costs, health damage from air pollution represent about 35%, accidents 27%, noise 24% and material damage for buildings 13%.

By including damage to health in the “overall road traffic costs” the uncovered costs of road traffic increase considerably. The sum of the external costs (excluding infrastructure costs) is increased by 60% from EUR 62.6 milliards to nearly EUR 96.5 milliards. This approach is a considerable step forward towards “true cost apportionment in transportation”.

4
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).

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 policy actions and initiatives to make transport activity more sustainable. The report on "CO_2 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 the future orientations of the strategy of 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. 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.

4.1 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. 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 their uptake, 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 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_x).

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 stems 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, dimenthyl 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 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 widescale 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 widescale 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[1]. 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_2 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

[1] 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.

efficiency; and the type of fuel used and its carbon dioxide emissions attributes.

4.2 Policy Instruments for Promoting Clean and Fuel-efficient Automobiles

OECD work has examined various economic and regulatory instruments that could encourage and accelerate the uptake 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.

- 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 owns 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_2 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.

- 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 and fuel consumption.

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.

4.3 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.

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 was developed for combining 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. For example, road-pricing to help optimise urban traffic flows has been given serious consideration by several OECD countries, but none has moved beyond the exploratory stage.

Strict internalisation of all of the external costs and benefits associated with transport is unlikely to prove either realistic or attainable. More important in practice may be the quasi-internalisation of these external effects by

the more widespread adoption of appropriate economic and command-and-control instruments.

Road pricing, i.e., tolls for the use of road infrastructure (express highways, bridges, tunnels) are a familiar feature in many OECD countries. While effective and reliable technical systems for charging for the use of roads have been demonstrated, OECD countries have yet to use this mechanism in any systematic way as a deliberate tool to manage traffic demand and/or internalise environmental costs.

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.

4.4 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 was 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 aspirationnally mobile citizens also represent the majority of the democratic vote.

4.5 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.

One report provides a framework for collaboration on energy research and development demonstration and information exchange. The programme brings together experts from different countries; it includes information dissemination and collaboration on fossil fuels, renewable energy, energy end-use and fusion power.

This 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 market place.

5
ENVIRONMENTAL BENEFITS OF INTEGRATED POLICIES FOR SUSTAINABLE TRANSPORT

Actual demonstrated effects of many of the policy measures described in Chapter 4 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* that might serve to guide transport and environmental policy-making (see box).

The Vancouver Conference provided several additional outputs of potential use to the OECD and to the Government of Canada. Discussions about transportation are usually caught up in details of vehicles, fuels, infrastructure, and traffic management. This conference provided a rare opportunity to focus on visions, principles, and directions. The Vancouver Conference may well influence work on transportation for several years ahead.

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 policy approach is needed which places environmental criteria up front along with other policy goals.

Recognising this need, the OECD initiated the project on **Environmentally Sustainable Transport (EST)** in 1994 to give some precision to the concept through the use of criteria which can be quantified and have environmental significance. The EST has sought to give more meaning to the term "sustainable transport" by seeking to develop and test a qualitative and quantitative vision of sustainability in the transport sector. Qualitatively, environmentally sustainable transport is:

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

Six criteria have been developed during the first phase of the EST project as being the minimum number required to address the wide range of health and environmental impacts from transport. These criteria have been selected so that local, regional and global concerns are addressed, notably noise, air quality, acidification and eutrophication, tropospheric ozone, climate

change and land use. Using international goals, guidelines and standards for these impacts a number of indicators have been derived which concern emissions of carbon dioxide, nitrogen oxides and volatile organic compounds, carcinogenic particulate matter, noise and land use.

CO_2
Climate change is prevented by reducing carbon-dioxide emissions from transport such that atmospheric concentrations of CO_2 are stabilised at or below their 1990 levels. Accordingly, total emissions of CO_2 should not exceed 20% of total CO_2 emissions in 1990.

NO_x
Damage from ambient NO_2 and ozone levels and nitrogen deposition is greatly reduced meeting WHO Air Quality Guidelines for human health and eco-toxicity. Total emissions of NO_x from transport should not exceed 10% of total transport-related NO_x emissions in 1990.

VOCs
Damage from carcinogenic VOCs and ozone is greatly reduced meeting WHO Air Quality Guidelines for human health and ecotoxicity. Total emissions of transport-related VOCs should not exceed 10% (or less for extremely toxic VOCs) of total transport-related VOC emissions in 1990.

Particulates
Harmful ambient air levels are avoided by reduced emissions of fine particulates (especially those less than 10 microns in size). Depending on local and regional conditions, this may entail a reduction of 55% to 99% of fine particulate (PM_{10}) emissions from transport.

Noise
Noise caused by transport no longer results in outdoor noise levels which 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 55-70 decibels during the day and 45 decibels at night and indoors.

Land-Use/Land Take
Infrastructure for the movement, maintenance, and storage of all transport vehicles is developed in such a way that local and regional objectives for air, water and eco-system protection are met. Compared to 1990 levels, this is likely to entail a smaller proportion of urban land devoted to transport infrastructure.

Vancouver Principles for Sustainable Transport

*Following the 1996 Vancouver Conference **Towards Sustainable Transport**, these principles were revised and accepted by the OECD Pollution Prevention and Control Group's Task Force on Transport. They have since been incorporated into the CEI Environment Ministers' Declaration "Towards Sustainable Transport in the CEI Countries" adopted on June 25 1997 in New York, and the UNECE ministerial declaration on Transport and Environment, Vienna, 1987.*

➲ ACCESS

People are entitled to reasonable access to other people, places, goods and services

➲ EQUITY

In meeting the basic transport-related needs of people, including women, the poor, the rural, the disabled and children, nations, states and the transport community must strive to ensure social, interregional and intergenerational equity. Developed economies must work in partnership with developing economies in fostering practices of sustainable transport.

➲ INDIVIDUAL AND COMMUNITY RESPONSIBILITY

All individuals and communities have a responsibility to act as stewards of the natural environment, undertaking to make sustainable choices with regard to personal movement and consumption.

➲ HEALTH AND SAFETY

Transport systems should be designed and operated in a way that protects the health (physical, mental and social well-being) and safety of all people, and enhances the quality of life in communities.

➲ EDUCATION AND PUBLIC PARTICIPATION

People and communities need to be fully engaged in the decision-making processes about sustainable transport, and empowered to participate.

➲ INTEGRATED PLANNING

Transport decision-makers have a responsibility to pursue more integrated approaches to planning. They must involve partners from relevant sectors such as environmental, health, energy, financial, urban design, etc.

➲ LAND AND RESOURCE USE

Transport systems must make efficient use of land and other natural resources while preserving vital habitats and maintaining biodiversity.

➲ POLLUTION PREVENTION

Transport needs must be met without generating emissions that threaten public health, global climate, biological diversity or the integrity of essential ecological processes.

➲ ECONOMIC WELL-BEING

Taxation and economic policies should work for, and not against, sustainable transport. Market mechanisms must account for the full social, economic and environmental costs, both present and future, in order to ensure users pay an equitable share of costs.

The EST project has developed a series of "business as usual" trend scenarios for the year 2030 in the French-Swiss-Austrian Alpine region, Germany, the Netherlands, Sweden, the Quebec-Windsor corridor, and the Oslo Metropolitan area. These have been contrasted with "Environmentally Sustainable Transport" scenarios in which all six EST criteria have been met. The project is currently undertaking a "back-casting" exercise where participants work back from the EST scenario in order to determine what type of measures will be needed in order to achieve environmentally sustainable transport in their region and or country.

The discussion on the first phase of the EST project concluded that the achievement of sustainability will require that each major sector of human activity become sustainable, consistent with the outcome of the United Nations Conference on Environment and development (UNCED) held in Rio de Janeiro in 1992. Transportation, as a major part of human activity, should accordingly become sustainable.

Phase 2 of EST project is a collaborative effort of the eight participating countries (Germany, the Netherlands, Sweden, Canada, Norway, Austria, France, Switzerland) to explore and develop methodology with respect to identification and attainment of environmentally sustainable transport a similar approach has been used for the Central and Eastern European countries in transition. The work of Phase 2 involved quantification of the criteria for the purposes of the EST project only. The first part of the work was to establish four scenarios for 2030. The four scenarios were as follows:

- ***The Business-as-usual scenario*** **(BAU)** characterised the transport system for each of the areas under study and its activity for that area in 2030, as projected from demographic and economic trends and other considerations. It assumed present and planned technology and legislation supplemented by changes considered likely to occur.

- ***The high-technology scenario***, assumed that the amount of passenger and freight transport was to be the same as determined for the BAU scenario for the particular area of study. The EST criteria were to be achieved entirely through technological change.

- ***The mobility management scenario***, assumed that the level of technology was to be the same as for the respective BAU scenarios. The EST criteria were to be achieved entirely through managing and reducing the demand for passenger and freight transport.

- ***The optimum-combination scenario***, assumed that the EST criteria were to be achieved through a combination of technological change and demand management.

Work of the EST project is far from complete but we can already make out some very important conclusions. Transportation could at least in theory (i.e., ignoring costs and social impacts), become environmentally sustainable, through application of advanced technology (the high-technology scenarios); or through efficient mobility management, including reducing in transport activity with respect to the movement of both people and freight (mobility management scenarios); or through combinations of the two approaches. Also we can observe that the last scenario has been constructed emphasising mobility management (including higher efficiency modal shifts and activity reduction), while technological options for improvements in energy efficiency and emissions control have been maintained.

Previous to the EST project, 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_2 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_2 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_2 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 percent instead of the forecast 50 percent). 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.

PART II

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

1
JOINT ACTIVITIES OF THE OECD, IEA AND ECMT

There 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*; the 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 have recently been completed by the OECD *Joint Sessions on Trade and the Environment*. A paper summarising the environmental effects of freight transport has also been 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

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 may focus on inter-city transport in North America.

A joint BIAC/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 reviews thus 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_2 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 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 ECMT* organised a **Seminar on Transport and Environment in Central and Eastern Cities**, in Bucharest in June 1995 (see also 2.4).

As the follow-up to the work on **Urban Transport Sustainable Development,** ECMT and OECD have together launched a three part project based on a sequence of workshops, a survey of cities and a series of in-depth national policy reviews to examine why implementation of integrated, sustainable policies has proven to be so difficult, and how countries and cities can overcome these barriers. Work on this project began in late 1997 when an international steering group has been established agreed on the work for the three-year period.

In September 1998 a joint OECD/ECMT workshop on **Land-use Planning for Sustainable Urban Transport: Implementing Change,** was held in Linz Austria. The objectives were to discuss issues relating to more integrated environmental, land use and transport policies. This event combined a two-day local conference entitled "Car-Free Linz?" with a two days joint ECMT/OECD workshop on land-use planning and transport policy. This workshop was the first in the series of workshops and meetings to be held in the context of the joint ECMT/OECD project on Urban Travel and Sustainable Development. It emerged a consensus that the principal obstacles to integrated policy implementation are political rather than technical in nature. Another general point of agreement was the need for more sophisticated and co-ordinated communication

about policy outcomes so that decision-makers and the public at large are better prepared to make fully informed choices.

The workshop of **Urban Travel and Sustainable Development** held in Athens the 3-4 June 1999, assessed how strategies to improve public transport are being implemented in the context of efforts to render urban areas more sustainable. It concluded guidelines for governments, public transport authorities and operators on how to improve opportunities for implementation of these strategies.

On the same topic the workshop **Managing Car Use for Sustainable Urban Travel,** will be held in Dublin the 1-2 December 1999 and will aim to further understanding about how to implement policies to manage a safe, cost effective, environmentally healthy and socially responsible transport system for the city.

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

A joint OECD/ECMT conference on **Strategic Environmental Assessment** for transport was held the 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/transpor/road/index.htm

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 3 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. A second and third round of discussions were held, respectfully, 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_2 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 involving 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 this fuel saving potential to reduce carbon dioxide from road freight.

The OECD contributed to the international efforts towards sustainable development through a study on **Sustainable Development on Policy approaches for the 21st century**. It was developed by an OECD Task Force on Sustainable Development and published in 1997. It presents an economic, environmental, social and development co-operation issues approach for reaching sustainable development. It takes an in-depth look at nine sectoral issues including transport.

Sustainable transport is one of the five priority areas for the future work of the organisation that has been endorsed by the OECD Ministerial Council meeting in 1998 (http://www.oecd.org/).

In the second phase of the horizontal project, a chapter on transport will present the strategy for the work on sustainable transport to be undertaken in 1998-2001. This work is intended to lead to a major analytical report and policy document to the Ministerial Council meeting in 2001. Sectoral issues including sustainable transport development will be addressed in the interim reports during the year 2000. The chapter will be developed by DSTI's Transport Division in co-operation with the Environment Directorate and the ECMT.

1.5 Other Joint Activities

In addition to the specific activities described above, various bodies of the OECD, and the IEA and 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 2.5), 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 ECMT. The case studies examine the environmental and economic consequences of internalising environmental and social costs. In 1996, the OECD Environment Directorate participated in the meetings of the ECMT *Task Force on Internalising the Social Costs of Transport*.

- 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. 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*.

2
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

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 recently 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 for congestion at and around airports, and the attendant consequences of atmospheric and noise pollution for adjacent residents. It also considers the risk that unilateral national environmental policies may affect international competitive conditions and discusses the issue of aviation-related CO_2 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 futures 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.

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

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 in respect of 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. In respect of 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/transpor/rtr

Activities of the past five years

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:

- **Environmental Impact Assessment of Roads** (report published in 1994, and Seminar held in 1994). 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.

- **Roadside Noise Abatement** (report published in 1995 and Seminar held in 1995). 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.

- **Recycling for Road Improvements** (report published in 1997). The report 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.

- **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 is 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.

On 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.

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.

One of the main recommendations of the report was to undertake a **Field Test of Selected Performance Indicators for the Road Sector** in order to evaluate their applicability in road administrations. A field test involving 15 indicators has been conducted over the past two years in a dozen road administrations from OECD countries. One of the selected indicators concerns the environmental programme in place by road administrations. The results of the field test, including a detailed description of the 15 indicators, will be issued in early 2000.

Recent Activities

The joint *OECD/PIARC* research project on the "**Transport of dangerous goods through road tunnels**" is a joint venture research project on the transport of dangerous good through road tunnels. Although rare, accidents involving dangerous goods in tunnels can be catastrophic with the potential for considerable loss of life and damage. This project will produce recommendations to internationally standardise regulations for transporting dangerous goods through road tunnels. Decision making tools are also being developed for the operating authorities, including a quantitative risk assessment model and a decision support model. In addition the cost-effectiveness of risk reducing measures will be evaluated. Final technique and policy reports are expected in mid 2000.

Air Quality Modelling and Improvements

Air quality effects of increasing traffic and congestion (including CO_2 emissions) have become a transport, health, and social priority in most OECD Countries. The project on **Cost and**

Benefits of Strategies for Air Quality Improvement, highlighted this topic. The project focuses on CO_2 emissions and cost-effective evaluation models as a tool to assess various improvement measures. Transport accounts for approximately 30 percent of CO_2 emissions from fuel combustion in the OECD countries and road traffic is the major contributor. The expected outcome of the project is to improve strategies to reduce air pollution levels caused by road traffic for implementation by OECD Member countries as part of their sustainable transport policy agendas. Final report is expected in October 2000.

Sustainable multimodal transport strategies

The Steering Committee of the RTR, has created an Advisory Group to study the different impacts of relieving road traffic congestion and its associated environmental and social effects. It has drafted a set of recommendations for creating a strategy for the implementation of **Intelligent Transportation Systems (ITS)**. It represents the application of advanced computing and communications technologies to transport. ITS have the potential to provide significant benefits to society by reducing congestion, and hence, the negative impacts of transport on the environment, as well as enhancing the efficiency and safety of transport overall. The RTR programme is investigating the potential benefits that could arise from the implementation of these technologies, including their capacity to contribute to sustainable transport development. The main focus of the research on ITS is to develop a policy framework for OECD Member countries that will assist in realising these potential benefits. A draft report is due in November 1999.

Two projects treat the international dimensions of intermodal transport. The first is the **Trilateral Logistics Project** (TRILOG). TRILOG aims to examine changing logistics operations and intermodal transport in the Asia-Pacific, European and North American regions in order to identify barriers to transport efficiency within these individual regions and between the regions. Three Taskforces for these regions have been established to conduct the regional analyses and research. The project will stimulate the development of concepts, comparable assessment and exchange of experiences on logistics for freight transport on a multi-regional basis. The draft final report is expected in April 2000.

While growth in transport is still taking place mostly on roads intermodal/multimodal transport solutions have the potential to improve efficiency and promote environmentally friendly transport means. Despite a wish to promote intermodal transport in most OECD countries there are still a number of barriers to integrated transport solutions. In 1998, the OECD established an **Intermodal Freight Transport Advisory Group** to identify key areas for research on Intermodal Transport seen in a global perspective. The following four areas have been identified for future research: Institutional Aspects, Benchmarking, Economic Instruments, and Freight Transport Corridors. Results from the first two projects will be available in 2000.

The first **Intermodal Transport Sub-group on Institutional Aspects** started its work in 1999. The aim of this project is to compare and assess the effectiveness of organisational structures for government institutions in developing integrated transport policies. Transport policy and organisations have mainly proceeded along modal lines, which may hinder a co-ordinated multimodal approach to achieving seamless transport. The project will compare transport organisations and regulatory reforms in Member countries and set recommendations on the most effective structures. The draft final report is expected in April 2000.

The second **Intermodal Transport sub-group on Benchmarking** aims to develop benchmarks for assessing the relative efficiency of modes/modal combinations and intermodal transfers, and to identify sources of inefficiency that could contribute to modal choice. The draft

final report in expected in October 2000 meeting.

A workshop on **Sustainable Transport Development** was held on 19 November 1999. The objectives of the workshop were to:

i) identify key issues relevant to promoting sustainable transport development; and

ii) develop a suite of recommended transport research projects on sustainable transport.

The workshop will focus on the following key issues:

- Economic Growth and Transport Growth.
- Transport and air quality.
- Transport Management and Operation.
- Land Use and Urban Planning.

As a follow-up to this Workshop a conference on **Environment and Transport Beyond the year 2000** will be held in Sardinia the 15-16 June 2000. The objective of this conference will be to discuss in detail the key issues identified at the workshop. The conference should provide a springboard for possible issues that could be included in the next three years term of the RTR programme.

http://www.oecd.org/dsti/sti/transpor/road/index.htm

Influencing Road Traffic demand

The objective of the study is to identify policies and practices that could help member countries to promote the development of sustainable transport systems by enhancing the use of alternative modes of transport and managing road traffic volumes. The main focus of the study will be on strategies and measures that have proven successful in reducing road traffic demand and increasing the efficient use of existing road infrastructure among various OECD countries. The draft final report is expected in October 2000.

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.

2.3 Development Co-operation Directorate (DCD)

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

Environmental sustainability is one of several objectives for development co-operation towards the 21st century adopted at the thirty-fourth High Level Meeting of the *Development Assistance Committee (DAC)* in May 1996. 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. "**Shaping the 21st Century: The Role of Development Co-operation**" through *its Working Party on Development Assistance and Environment* and with the support of *DCD*, the *DAC* has undertaken a substantial body of work aimed at assisting partner countries strengthen their environmental management capacities.

The main thrust of this work is 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 include work on capacity development in environment, planning for sustainable development, and technology co-operation in support of cleaner production in developing countries.

Capacity Development in Environment (CDE)

CDE involves improving practices relevant to the environment in all spheres, strengthening efficiency and coherence of public policies across a wide range of policy fields as well as of institutional structures at the national, regional and local levels. As part of the follow-up work to *UNCED*, the *DAC* has acknowledged CDE as a particular area of concern for development co-operation. Subsequently to a Workshop on CDE in Costa Rica in 1993, the *DAC* developed and adopted a new set of guidelines on "**Donor Assistance to Capacity Development in Environment**" (1995) and a conceptual guide "**Developing Environmental Capacity: A Framework for Donors**" (1995).

The **OECD Workshop on Capacity Development in Environment**, which took place in Rome on 4-6 December 1996, has marked the most recent step in an ongoing effort to bring CDE to the ground level. The workshop presented a unique opportunity to generate broad support among policy makers and development co-operation staff in OECD countries and in partner countries for the pro-active pursuit of CDE as a vital part of sustainable development strategies and programmes.

In follow-up to the recommendations which came out of the Rome Workshop and based on the analysis of more than 40 case studies, a reference document for both decision makers and practitioners, "**Capacity Development in Environment: Principles and Practice**", was issued in May 1997.

Planning for Sustainable Development

National Plans for Sustainable Development are seen as a powerful mechanism for countries to convert sustainable development principles into practice. *DAC* Ministers have recently endorsed their implementation as a major development goal. The integration of transport related activities in such strategies become increasingly important, as transport is a major source of environmental degradation in a growing number of countries.

The *DAC Working Party on Development Assistance and Environment* has been engaged in a range of activities in support of developing countries efforts toward drafting and implementing such strategies. Main activities include: an OECD Workshop in Ottawa, Canada in October 1993 which was jointly organised by *DCD* and the *Environment Directorate*; the publication of "**Planning for Sustainable Development: Country Experiences**" (1995); a Workshop on "**Donor Co-ordination and Harmonisation of National Planning for Development**", jointly organised together with the *United Nations Inter Agency Committee on Sustainable Development (IACSD)* in October 1995; and the establishment of an informal contact group between the *Working Party* and *IACSD* Members.

The main focus of future work of the *Working Party* is to encourage local ownership of the planning process and to contribute to strengthened co-ordination capacities of partner countries.

Technology Co-operation in Support of Cleaner Production in Developing Countries

In aiming at the reduction of resources used in production and increased levels of in-house recycling, cleaner production methods can have direct implications on transport needs. Moreover, transport issues can be an integral element of cleaner technology approaches, as the concept calls for a comprehensive and integrated pollution prevention approach applied to production, products and services.

Technology co-operation in support of cleaner technology has been a key element of the Work Programme of the *Working Party on Development Assistance and Environment* since 1993. Actions in this work include the adoption of the "**Common Reference Paper on Effective Technology Transfer, Co-operation and Capacity Building for Sustainable Development**" by the *DAC*; the joint organisation of an international workshop together with the Environment Directorate of the OECD, held in Germany in 1994; the publication of "**Promoting Cleaner Production in Developing Countries: The Role of Development Co-operation**" (1995).

At present, the *Working Party* is carrying out a survey of donor policies and programmes in support of a more rapid diffusion of cleaner production in developing countries with a view to develop good practices guidance for donors.

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.

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 structures 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 have been discussed: 1) the social acceptability issue and questions related to user tolls; and 2) the public-private financing of urban transport infrastructure projects.

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.

2.6 Environment Directorate (ENV)

http://www.oecd.org/env/ccst/

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

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.

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

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 commonalties 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 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 1998 **Improving the Environment through Reducing Subsidies,** The Environment Directorate's *Economics Division,* analysed the impact of government regulation on road transport. In most countries taxes related on road have increased, both to recover 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.

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.

Indicators and statistics on transport and environment

Sectoral indicators on transport have been developed by the *Group on the State of the Environment* in consultation with ECMT and published in OECD reports on the state of the environment in OECD countries. An environment monograph on **Indicators for the Integration of Environmental Concerns into Transport Policies** (1993) drew up indicators around three major themes: i) sectoral trends of environmental significance; ii) environmental impacts of the sector activity; and iii) economic linkages between transport and environment. Data on transport are collected regularly, and a chapters on this subject was included in the reports "**The State of the Environment 1991" and 1991, 1995, 1997 Compendium of Environmental Data**.

Environmental Performance Reviews: the OECD has been entrusted by its Member countries to launch a programme with the principal aim of helping countries improve their environmental management. Environmental performance review reports for individual countries typically included chapters on the integration of environmental and transport policies.

Chemical risk management

The *Chemicals Group and Management Committee* has been examining the issues associated with chemical accidents (see section 1.1) and with the use of leaded gasoline since 1990 as part of its **Chemical Risk Management Programme** activities on lead. 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 to the environment due to the use of lead in gasoline. Reports have been published in 1998 **Phasing Lead out of Gasoline the Experience with Different Policy Approaches in Different Countries** and a review of **Implementation of OECD Environment Ministerial Declaration on Risk Reduction for Lead** in 1999. In 1998 an issue paper **Older Gasoline Fuelled Vehicles in Developing Countries their Importance and the Policy Options for Addressing them.** was prepared.

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/

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 which were presented were automobile related: **End-of-Life Vehicles** and **Lead-Acid Batteries**. The report of the **Waste Minimisation Workshop** was published in 1996.

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 policy-making. 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 make-up, 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.

Current and planned work

The project on **Environmentally Sustainable Transport (EST)** has been 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 and 3.2) provided substantial input to the project as have ongoing **EST Expert Workshops** and *Working Group on Transport* Meetings.

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 – completed in 1996 - involved a review of relevant activities of Member countries as well as the development of the definition and criteria for EST.
- Phase 2 has 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 is to be the "back-casting" exercise. It comprises the identification of packages of policy instruments whose implementation would result in achieving the EST scenarios. Phase 3 will also involve the assessment of the social and economic implications of the BAU and EST scenarios.
- Phase 4 will refine the criteria for achieving EST and develop policy guidelines for governments towards environmentally sustainable transport.

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 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 will concentrate on the identification of policy instruments and the economic and social aspects and implications for achieving environmentally sustainable transport. Phase 3 will describe possible policy pathway for EST and has 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.

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_2), nitrogen oxides (NOx), 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 prepared for being 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, into particular policy makers. The study stresses the need that policies towards EST should review the transport investment strategies and adjust them accordingly favouring more sustainable transport modes and developments

The **Sustainable Consumption and Production: Case study on Travel and Tourism** is building on the previous work undertaken in the OECD Environment Directorate, the objective of the project is to support Member countries in their efforts to promote and achieve more sustainable patterns of consumption and to support and influence the international work programme being co-ordinated by the United Nations Commission on Sustainable Development (UNCSD).

The study will discuss the environmental impact of tourism activity at the local, regional and global scales and will focus on a number of factors including air and water pollution, biodiversity loss, energy and resource use and greenhouse gas emissions. This discussion will put the impacts from tourism-related travel into the wider context of environmental impacts from tourism activities in general. In particular, the study will seek to highlight the relative environmental impacts of domestic versus

international tourism and on-site versus travel-related impacts.

The objective of the **Environmental Outlook and Strategy (EOS)** activity is to develop an integrated, economy-based outlook of the possible environmental situation for the OECD area in 2020. The Environmental Outlook Report developed by the Secretariat will include an analysis of trends, the development of longer term outlooks and alternative policy options for modifying this outlook. This will serve as background for developing the Environmental Strategy for Ministers in 2001.

A preliminary trends report for the transport sector has been prepared partly based on the EST project and 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, 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 are envisaged during the first quarter of the year 2000.

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 country a greater level of detail or breakdown may be needed, the actual measurement of indicators at these levels is encouraged and lies within the responsibility of individual countries.

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

3
INTERNATIONAL ENERGY AGENCY (IEA)

http://www.iea.org/

Transport 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. 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_2 emissions. The report also helps explain why prior analyses have produced conflicting results.

The 1994 **IEA/OECD Scooping 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_2 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.

b) Symposia

The IEA has worked jointly with the OECD and 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, the first in October 1995 in Paris, first of the topics concerning road vehicle technology. The discussion dealt with Hybrid Vehicles, Advanced Engines and Lightweight Materials. The result was that this initiative responded to a strong need and that technology co-operation under the aegis of the IEA would strongly help 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.

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, 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_2 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.

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

3.2 Recent work

In 1998, IEA published **Benign Energy**? **The Environmental Implications of Renewable,** The report examines the different aspects of using renewable. 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 vehicle, road infrastructure and motor vehicle 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_2 emissions: Flexing the Link – A path for the World Bank,** introduces the IEA's decomposition analysis of energy consumption and CO_2 emissions to the World Bank's Global Overlays programme and links it to different policy approached employed in the different countries under scrutiny. A key message is that in developing countries, while CO_2 concerns are minimal, many strategies to improve traffic safety, reduce congestion and pollution, reduce oil consumption, etc., will reduce or restrain CO_2 emissions indirectly.

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_2 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_2 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_2 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_2 emissions. The purpose of the seminar was to advise 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 to be developed. International co-operation among private and public authorities will be necessary to restrain CO_2 emissions from transportation.

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

4
EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT (ECMT)

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

The 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. 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 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_2 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.

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

4.1 Activities of the past ten years

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**

Warming, 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 was published in November 1997. Also a resolution on internalising transport externalities was taken 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 are likely to be effective.

A major part of 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_2 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_2 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. 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, ECMT consulted Member and Associate Member countries in 1996 requesting information on CO_2 emissions from transport and on policies and measures in place or envisaged to limit 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_2 Emissions from Transport"**, contains the conclusions of this survey it shows that only a small number of countries have developed focused strategies for CO_2 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_2 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 of safeguards for the environment and the definition of the role for the authorities was held in the **14th International Symposium on Theory and Practice in Transports Economics at Innsbruck** the 21-23 October 1997. It resulted a publication of "**Which Changes for Transport in the Next Century".** This report analyses the recent government intervention in the transport sector that has not produced optimum results. At the same time, transport was growing faster than was desirable if the sustainability goal was taken into account. As far as the environment was concerned, targets for stabilising greenhouse gas emissions could not be achieved.

The question in the center of the discussions is how could 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/CO_2en.pdf

4.2 Recent work

The **Strategic Environmental Assessment in the Transport Sector,** published in 1998, underline 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 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.

http://www.oecd.org/cem/pub/pub/pubforth.htm#freight
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