URBAN TRANSPORT AND THE ENVIRONMENT

- AN INTERNATIONAL PERSPECTIVE -

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CHAPTER 6

POLITICAL CLIMATE FOR ENVIRONMENTAL POLICIES AND PROPOSALS FOR INTERNATIONAL MECHANISM

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Key Messages

- Environmental policy can only be implemented in a political climate which is positive towards environmental problems. Scientifically based identification of net social benefits is not sufficient to create and preserve a positive political climate. Issues of equity among stakeholder groups, among regions and nations, are equally important.

- In developed countries the technological and behavioural potential to reduce air or noise pollution as well as greenhouse gases is still not exhausted. It can be developed further through policy instruments which introduce the correct incentives. Environmental policies have to be designed according to the specific needs of countries and regions.

- Setting of environmental standards dynamically has challenged the industry and has proven most successful in reducing pollution. Continuation of this policy offers promise, provided that international competition in technology is fostered and discrimination policy favouring national industries is abandoned.

- Developing countries show the fastest increase of transport activity and its negative consequences. Moreover, a unit of reduction of environmental pollution, in these countries, can be realised at much lower cost. Therefore they need the environmentally most efficient technology, rather than the technology which they attract presently.

- In many developed countries the potential of modal shift and coordinated land-use policy is limited given the decreasing and aging population. Therefore the pressure for innovative solutions across countries and regions will come in the future from the cities of developing countries and countries at the threshold of industrial development.

- International arrangements are the key for introducing effective world-wide economic incentives to reduce environmental harm in urban areas, and at a global level. They presuppose special clearing and funding arrangements for environmentally sustainable transport initiatives in developing countries. A new mechanism called FEST (Financing for Environmentally Sustainable Transport) is proposed.
6.1 INTRODUCTION

Success in implementing various transport environment policies depends on a good balance between the political power of interest groups that stand to gain or lose from their implementation. In this section, some typical problems of implementing environmental policy in the transport sector are summarised.

- Even though the causes of these problems often look similar (for instance high motorisation, poor vehicle technology or insufficient public transport) the environmental impact varies with the regions involved, the populations exposed and the local climate conditions. As a consequence the various stakeholder groups can be affected in very different ways, so that their political support for or resistance to environmental policies will also vary.

- As the problems tend to involve parties with diverging interests, issues of fairness are likely to arise.

- As transport environment policies are implemented to solve various social or economic problems as well as environmental ones, it is important to ensure a proper balance between the sets of issues.

- As the causes of problems are sometimes unclear, it may take a considerable outlay of time and effort to achieve recognition and consensus for policies.

Points such as these make the political solution of problems more complicated. It is not enough to develop standard solutions, more than that it is important to create individually tailored policy actions, which are adapted to the local conditions including the degree of political acceptance.

In what follows, some examples are given for such individual policy actions. Taking cases from Europe, the U.S. and Japan, it will be underlined that environmental strategies in the transport sector can be effective if they are adjusted to fit the particular situation in each country or region.

Table 6.1.1 shows the major political occurrences concerning transport environment policies. Before 1970, the main measures taken by European countries were financial, including the injection of fuel tax money into the support of public transportation. Also in the U.S., financial assistance to public transit began with public subsidies. The program was started in 1964 and expanded rapidly until the eighties. In Europe as well as in the U.S. the political support for public transit coincided with movements of citizens to restrain the development of highways. At the same time, some legal measures have also been taken in the U.S. to regulate automobile emissions, including the proposal of the Clean Air Act of 1970 (Muskie Act) in the U.S. and the enactment of the “Japanese Muskie Act” in Japan.

In the 1980s, growth in awareness of some large-scale political developments, such as the increasing power of left-wing forces including the Green Party in Germany, coincided with growing concerns about acid rain in Europe and the Chernobyl radiation accident. In the 1990s,
with the growth in awareness of global warming, European countries started to adopt transport and land use policies based on the concept of a sustainable environment. At the same time, in the U.S., intermodal measures were undertaken to create more efficient transport systems, in particular in the freight transport sector. In Japan, in response to noticeable health damage caused by NOₓ and PM emissions along major roads around large cities, a number of lawsuits were filed in reaction to the deteriorating roadside environment and these have often resulted in court decisions against the government. In consequence, the laws to regulate emissions of NOₓ and PM along major roads have been progressively strengthened. In the U.K. and the Netherlands, comprehensive national traffic policies have been adopted. At the beginning of the 21st century, ECMT and OECD started to discuss target-setting traffic measures. "Environmentally Sustainable Transport (EST)" project was launched in 1994 by a working group of the OECD Transport Environment Policy Committee. The group’s objective is to refine the EST concept by means of both quantifiable and environmentally significant criteria. In the U.S., transport pricing issues recently changed from congestion pricing for high occupant lanes to value pricing for underutilised cars. However, implementation on a large scale is still missing. In Japan, the outline for anti-global warming measures was determined and the new green tax system and the access prohibition for vehicles not satisfying the emission standard has been materialised.

In the following some of the policies and cases mentioned in Table 6.1.1 are discussed in more detail.

| Table 6.1.1  Major political occurrences concerning transport environment policies |
|-------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Normal script: | Transport Measures | Western & Northern Europe | North America | Japan |
| | Topic: Vehicle and fuel Measures | Europe | National | Regional | National | Regional |
| Up to 1990 | | | | | |
| <pollution, traffic Congestion Internal decay> | | | | | |
| Protest Campaigns | > Lawsuits | | | | |
| 1990's | <(Local) environment> | environmental assessment | | | |
| EURO Standard | | | | | |
| •CO₂ reduction target of ECMT | | | | | |
| •OEC DET | | | | | |
| •EU transport systems | | | | | |
| •Reg. Transport Associations (Ger) | | | | | |
| •Heidelberg, Freiburg, Karlsruhe Models (Ger) | | | | | |
| •Bologna, Rome Models (#) | | | | | |
| •ISTEA: granting MPO authority in order to determine transport plans | | | | | |
| •Congestion pricing pilot project | | | | | |
| 2000's | <(Global environment)> | EST & Target setting | | | |
| OECD-EST: target to reduce CO₂ by 80% by 2030 | | | | | |
| •Cordon line pricing in London | | | | | |
| •Prohibition of vehicles not satisfying PM standard (Tokyo) | | | | | |
| •Prohibition for vehicles not satisfying PM standard (Tokyo) | | | | | |
| •Development of subway & expressways | | | | | |
| •Automobile NO₃ Act | | | | | |
| •Verdicts against government in traffic pollution | | | | | |
| •NOₓ & PM Act | | | | | |
| •Outlines for anti-global warming measures | | | | | |

*Note: The table above lists major political occurrences concerning transport environment policies up to 2000's. It categorizes policies based on time periods and regions, depicting various transport measures and their implications.*
6.2 Typical Political Trends Relating to Transport Environment Policies and Their Transitions

6.2.1 Cases in the EU Countries and Europe

Problem solutions through policy change in national or local government
- Dealing with inner city decline and problems of access to city centres.
Western European countries were among the first that had to deal politically with problems caused by the growth of motorised traffic. In these countries, the number of automobiles per 1000 people rose above 200 and around agglomerations above 300 in the 1960s and led to traffic congestion in the densely populated areas. In many cities, chronic traffic congestion impeded access particularly to the inner cities and the city centres. This brought significant impedance for commercial activities and stimulated people to move from the centres to the periphery. In this way, traffic development was already an important political issue before it became an environmental one. To stop the inner cities' decline in urbanised areas of Germany or the U.K., for example, politicians were challenged to improve the attractiveness and the accessibility of the city centres. A number of political measures had already been taken in Germany in the early seventies, including for instance the establishment of the GVFG (municipal funding law, 1971). According to this law a share of the revenues from fuel taxation has to be invested back into the local transport networks. As the political insight had established itself by this time that the problems of congestion in city centres were not to be solved by building more roads, the major part of this money went to the improvement of urban public transport. This policy to improve public transport went hand in hand with the city development policy to increase attractiveness of central areas by creating pedestrian zones and introducing parking regulation.

Policy towards heavy goods vehicles (HGVs)
- To reduce health damage to populations living alongside major traffic corridors.
The most radical case is AlpTransit in Switzerland. The suspicion -backed by medical studies - that serious respiratory disease were caused by emissions from heavy trucks passing through the cities and villages in the Alpine region led to vigorous protest movements, and even to the setting up of human chains to block the roads. Under the system of direct democracy prevailing in Switzerland, referendums can be conducted when it comes to basic problems of national policy. The principles approved are then binding on policy makers and have to be translated into practice. In 1992, in view of the health problems posed by HGV transit in Switzerland, the government ordered a referendum on a motion to prohibit any further increase of transit by foreign heavy goods vehicles through Switzerland. The prohibition motion was passed by 52\% to 48\%. A term of 10 years was set for its implementation, on the assumption that in this space of time alternative modes for freight transport such as a freight train shuttle through the Alps
could be provided. The government accordingly took action to plan, and start construction of, two new Alpine transit rail lines\(^1\), which included two major tunnel projects (the Gotthard tunnel, 57 km, and the Lötschberg tunnel, 35 km). In addition, a road user charge for trucks\(^2\) was introduced for the whole road network in Switzerland in January 2001. At the same time the weight limit for HGVs, which was previously 28 tons, was raised to 34 tons. It will in future be increased to 40 tons (the EU standard) according to an agreement with the European Union\(^3\). Interestingly, the level of the Swiss HGV charge is oriented on the average total social cost of the traffic, including external liabilities like environmental damage and accidents. Further, it is graded according to three environmental categories. Overall, this scheme gives rise to three basic incentives: (i) a better use of HGV capacity, (ii) a higher modal share for the railways, and (iii) a better fleet structure with priority going to more modern and environmentally friendly engines.

Germany has also announced the introduction of a charge on HGVs on motorways. This charge has to be based on the EU Directive for HGV charging, which does not allow a pricing system of the Swiss type. In particular the pricing regime has to be restricted to vehicles with 12 tons gross weight and more. The network affected includes only motorways and roads with similar construction characteristics (some exemptions apply).

The charge has to be oriented on the average total infrastructure costs of motorways, i.e. leaving external costs out of account, and it can be graded according to congestion (peak/off-peak, which is not applied in Germany) and the environmental performance of the vehicles (EURO-standards, which is extensively applied in Germany setting the difference between the charge for the environmentally worst and best category at 50%). The pricing system will be applied to all trucks, regardless of their country of origin. It will replace the existing so-called Euro-Vignette system, which is a time-based charge for HGVs. The new distance-based charge will be substantially higher than the Euro-Vignette. According to the cost estimates the charge will average about 15 cts per km\(^4\) (differentiated by axles and environmental performance), resulting in a financial load for HGV freight transport of about five times of the existing one. The charge was planned to be introduced by the end of August 2003. But this date had to be shifted because of manifold difficulties with the automatic charging system, which is based on modern GPS/GSM-based technologies.

A similar system has been introduced in Austria beginning with January 2004. It imposes substantially higher charges on the truckers (22 cts per vehicle km on the average), because of different geographic and traffic conditions compared with Germany (the method applied for the calculation of charges is similar to the German one). Austrian transport planners are still fighting to achieve the aim that overall emissions from trucks should not increase. An important element in this policy is the so-called eco-point system, which works as follows: A maximum value for pollutant emissions from trucks is defined and transformed into eco-points. These eco-points are allocated to the haulage companies of the different EU-countries according to their environmental performance. The eco-point policy, together with a strict policy towards truck noise, has fostered the development of an environmental friendly
technology (silent engines, low-emission trucks) so that Austria has become one of the most advanced EU countries with respect to its environmental policy in transport. Nevertheless, high amount of pressure is being put on Austria by the neighbouring countries and the EU Commission to relax this strict environmental policy and follow the common EU rules.

When it comes to environmental policy towards cars, the EURO standard is the only common policy instrument in Europe. User charges taking account of environmental costs do not explicitly exist. The use of motorways is partly charged for through a "vignette," i.e. a sticker system (in Austria, as also in non-EU Switzerland), partly through distance-based tolls (in six EU countries), and partly it is not charged for directly at all. In some countries such as the UK or Germany the high fuel tax (UK) or combined fuel and vehicle tax (Germany) are justified politically on arguments of the high costs of infrastructure and environmental protection. But in fact there is no legal link between the costs and the taxes because the taxes are not ear-marked.

*Shift to environment-oriented local government policies through elections*

-Putting the environment and public transport first.

In Germany in the 1990s, the Green Party became a strong political force in municipal, state, and national governments. At the same time, local governments began to hold more consultations with NGOs and with citizens about environmental concerns. The city of Münster established an environment bureau in 1992, which consulted with people on about 1500 cases a month at that time. In Heidelberg, a Heidelberg Transportation Forum was constituted to draft plans for sustainable transport systems with citizen participation. An environmental ticket for commuters was introduced in Freiburg, and in the region of Karlsruhe an integrated urban and regional tram/light rail system was developed, which also has direct links to the mainline intercity rail system. This integrated light rail system has proved to be an international prototype for the solving of commuting problems between regional sub-centres, city suburbs and the city centre.

In the U.K., the finance of public transportation systems and the load on the environment were major issues of the London mayoral election in 2001. Subsequently, the elected mayor, Ken Livingstone, has exerted a significant influence to establish a co-ordinated pricing and investment policy in London transport. With respect to pricing a zonal pricing system has been introduced for the downtown area of London (about 21 km²). Contrasting to a similar zonal pricing system in Singapore (introduced in 1975 and changed to an electronic system in the year 1998) the London area charge is fixed to 5 pounds in the time between 7.00 a.m. and 6.30 p.m. There are various forms of (manual) payments, which are controlled by videos of the license plates. Table 6.2.1 gives some facts on the project and the first experiences achieved.

A main feature of the London case is the co-ordination of policy actions, in particular the use of revenues for improving the urban transport system. This might be the reason for the unexpectedly high acceptance by the population. Better environmental quality is a by-product, which goes along with the reduction of congestion and the shift of traffic to public transit.
Table 6.2.1 Facts and first results of the London area pricing

<table>
<thead>
<tr>
<th>Political Strategies</th>
<th>First Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average car speed before introduction</td>
<td>Below 10 miles per hour</td>
</tr>
<tr>
<td>Opinion of citizens</td>
<td>More than 90% of citizens found: &quot;Too much car traffic in the London area&quot;</td>
</tr>
<tr>
<td>Costs of introduction</td>
<td>About 100 Mill. Yound</td>
</tr>
<tr>
<td>Entries, Exits, Signs</td>
<td>174 entries/exits, &quot;1000 signs&quot; for information of drivers</td>
</tr>
<tr>
<td>Road traffic</td>
<td>Speeding up of cars and lorries, faster and more reliable bus transport</td>
</tr>
<tr>
<td>Non motorised transport</td>
<td>Higher attractiveness, more safety</td>
</tr>
<tr>
<td>Average speeds on roads</td>
<td>Increase by 37%</td>
</tr>
<tr>
<td>Congestica</td>
<td>Decrease by 40% during daytime when pricing system is in action</td>
</tr>
<tr>
<td>Traffic volume on roads</td>
<td>Reduction by 16% in priced area</td>
</tr>
<tr>
<td>Journey times on road, average</td>
<td>Reduction by 13 %</td>
</tr>
<tr>
<td>Bus operation</td>
<td>Increase of speeds, adjustment of schedules, better reliability, better quality (300 new buses)</td>
</tr>
<tr>
<td>Revenues</td>
<td>Lower than expected (because of higher effectiveness); therefore problems with cross finance and provision of better underground service</td>
</tr>
<tr>
<td>Impacts on local business</td>
<td>Different judgement of business associations</td>
</tr>
</tbody>
</table>

Policy change and visions of national governments

- National or local visions for sustainable transportation systems and associated plans.

At the European Conference of Ministers of Transport held in 1995, a target was set to reduce CO₂ emissions by 25 % of that in 1990 during the period from 1995 to 2008. Since then, as an even more challenging future vision, the EST project of the OECD has fixed on a target to reduce emissions by 80 % in the time from 1990 until 2030.

Recently, strategies for sustainable transport systems have begun to appear as national planning targets, and associated plans have been drawn up. For example, in the Netherlands, the “Transport in Balance” plan (1996) and, more recently, the 21st century plan for front-loading railways, identified measures for the improvement of public transport as a key part of a comprehensive environment policy. In the U.K., also, “New Deal for Transport” (1998) was proposed as a plan for “integrated transport.”

At the same time, local governments, too, have started to adopt environment-oriented policies. In 1994, 80 local governments participating in the Conference on Sustainable Cities and Towns in Aalborg, Denmark, agreed to set up local agendas by 1996.

6.2.2 Cases in the U.S.

Establishment of comprehensive transportation planning organisations

- To foster a more efficient use of the transport infrastructure.

In the U.S., the rapid trend to motorisation continued in the 1960s, such that roads in large cities were heavily congested. Transportation plans were developed to cope with congestion and, because of the increasing complexity of urban transport, computer modelling was increasingly applied. The Chicago Area Transportation Study (CATS) was a first
comprehensive transportation study, conducted in 1960. A first model for transport and land-use, the Lowry Model, was developed in the course of the Pittsburg Area Transportation Study.

Meanwhile, with growing demand for better roadway planning, Metropolitan Planning Organisations (MPOs) were established in the mid of the sixties to carry out the Federal Highway Act in a co-ordinated way on the regional level. Their original mission was to develop regional transportation plans and investment programs, and later to assure that the plans were conforming with regional air quality plans.

In the 1980s, the federal U.S. government placed less emphasis on environmental issues. Renewed attention to environmental quality and a sense that transportation institutions and planning processes needed reforming led to the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991. This law aimed to reduce traffic congestion, air pollution, and oil use with a series of reforms and new programs. Included in the new law was funding for Congestion Pricing pilot projects, in ten areas throughout the U.S. An initial proposal was to increase the toll on the San Francisco Bay Bridge from $1.00 to $3.00 during morning and evening rush hours. Although many local citizen groups and the local business community endorsed the proposal, it ran into increasing opposition and was never adopted.

Following ISTEA, The Transportation Equity Act for the 21st Century, or TEA-21, was enacted in 1998. It included provisions for a new road pricing concept, “Value Pricing,” whereby vehicles with high occupancy are allowed to use dedicated lanes free of charge while low occupancy vehicles have to pay. These new lanes were known as high occupancy toll (HOT) lanes. Until now these concepts have not been implemented.

*Political conflicts concerning atmosphere environment*
- Tightened standards for atmospheric environment and resistance from the automobile industry.

Important air pollution control measures in the US include the Clean Air Act (Muskie Act) in 1970, the Clean Air Act Amendments of 1990, and California’s zero emission vehicle (ZEV) program first adopted in 1990 (but revised many times since).

The 1970 CAA established the National Ambient Air Quality Standards, the strictest in the world. The Act also established vehicle emission standards, requiring automakers to reduce the emission of CO and HC by 90% by 1975, and NOx by the same percentage by 1976. Although implementation of the standards was delayed as a result of intense opposition from the automobile industry, it was a landmark event. It was the beginning of aggressive efforts to reduce automotive emissions around the world.

In 1990, the California Air Resources Board (CARB) passed a set of rules (known as the low emission vehicle program) that required dramatic reductions in emissions but also required that all major automakers make available for sale a certain percent of ZEVs: 2% of all car sales in 1998, increasing to 5% in 2001, and 10% in 2003. Facing intense resistance from the automobile industry, the CARB reduced and deferred these requirements. Their actions were criticised by environmental lobbyists. Yet despite the delays and softening of the requirements,
the ZEV program had far-reaching and profound impacts on vehicle technology. It inspired major investments and improvements in battery and electric drive propulsion technologies, and played an important role in motivating automakers to develop, and in some cases to commercialise, hybrid electric and fuel cell vehicles.

**Policy challenge**

- To deal with global warming.

In the year 2000, President Clinton issued a President’s Order after COP6 (Hague Conference held in September, 2000) to reduce federal government vehicle consumption of petrol and diesel by 25% by 2005. The election of President G.W. Bush led to less intense support by the U.S. government of environmental policies, even to a refusal to ratify the Kyoto Protocol adopted in COP3. This decision by President Bush threatened the effectiveness of the Kyoto Protocol, which requires ratification by countries whose total share of greenhouse gas emission should be more than 55% (See also Section 1.3.1).

### 6.2.3 Cases in Japan

**Solutions through courts**

- Court orders for government compensation for traffic environment damage, orders to prohibit emissions, and responses by the government.

In Japan, with the rapid economic growth after World War II, various local environment problems have arisen since the 1950s. A typical solution for such problems is a lawsuit, which serves to examine the problem and to force the parties responsible, whether corporations or the government, to take measures. For example, following a spate of lawsuits concerning pollution in the late 1960s, the 64th extraordinary Diet session (the so-called “Pollution Diet session”) in November 1970 mainly discussed means of strengthening the law with regard to anti-pollution measures. Consequently, the government proceeded with the construction of systems to conserve local environments, including the establishment of the Environment Agency in 1971.

While conditions at the industrial plants that had been a major cause of pollution up to the mid 1970s improved, air pollution and noise caused by traffic became serious problems from the late 1970s on. As a result, many lawsuits were filed including those concerning traffic environment problems in the three metropolitan areas of Osaka, Tokyo and Nagoya including those on National Route 43 (1976), in Nishiyodogawa (1978), Kawasaki (1982), Amagasaki (1988), South Nagoya (1989), and Tokyo (1996). In addition, the necessity for measures against NOx became widely recognised as it became apparent that NOx concentrations had not decreased even after the implementation of emission controls. As a result, the Automobile NOx Act was enacted (in 1992) in order to apply the latest standard for emission control not only to new vehicles but also to those currently in use. The law does not allow vehicles not satisfying the standard to have their registration renewed.
One particularity of these road environment lawsuits was that they were filed against the government or against public corporations responsible for road management because the primary causes of the damage, automobile users, were not individually specifiable. Another was that the plaintiffs claimed compensation for damages caused by exhaust gas or noise as well as an end to emissions. Therefore, the points at issue in these lawsuits were the responsibilities of road administrators in the former cases, and the relationship between pollutant emission and health damages in the latter ones. In the early period, court decisions only required the government to pay a part of the claimed compensation and did not grant the demands for emission prohibition.

However, the recent verdict in the first instance trial for the Amagasaki lawsuit, in the west of Osaka, partially accepted the demand for emission prohibition, and a similar ruling was handed down in the first instance trial for the South Nagoya lawsuit (mentioned in the box 21 in Section 5.14). After that, the plaintiffs in both cases gave up their demands for emission prohibition while coming to settlements with the government on the condition that the government undertake environment conservation measures. Faced with this situation, the government has realised that it needs to take more stringent measures, and has proceeded with the enactment of an Automobile NO\textsubscript{x} and PM Law (2001) which both extends the scope of application of the existing Automobile NO\textsubscript{x} Act and widens the range of vehicle types and emitted substances. At the same time, in the Tokyo and Osaka metropolitan areas, an environmental road pricing strategy is being tried to guide major traffic movements away from the Metropolitan and Hanshin Expressways and onto the bayside highways situated in lower population districts.

**Measures by individual local governments:**

- Access restrictions for diesel vehicles.

With the growth in public environment consciousness, individual local governments in Japan have begun to implement various environmental measures in recent years. In particular, the Tokyo metropolitan government has voted to prohibit access to Tokyo for diesel vehicles not satisfying the PM emission standard from October 2003 under the municipal environment protection by law, which is based on the anti-pollution law as amended in 2001. Similar regulations have also been enacted in neighbouring prefectures such as Saitama and Chiba. Furthermore, Tokyo has adopted stricter measures than the national government against such things as the illegal use of light oil and controls of vehicles violating emission regulations. These measures were achieved mainly by the popular Governor Shintaro Ishihara, with significant support from citizens.

**Political sparring between administrative bodies**

- Difficulty of amending the automobile tax system, and the greater-than-expected effects of the amendment.

In Japan, the so-called green tax system was launched in April 2002, in order to reduce
automobile tax on low emission vehicles, or LEVs, and to increase the rate for old diesel vehicles. Since implementation, its effect has been so significant that the tax revenue in FY 2002 fell out much lower than expected because the share of LEVs qualifying for tax relief increased to twice the level estimated. In the face of such customer behaviour, automobile makers began to compete fiercely in the development of LEVs, recognising that makers without an LEV range will not be able to survive.

The draft bill for this tax amendment had been under deliberation since its proposal through the Global Environment Subcommittee in the Council for Transport Policy of the then Ministry of Transport as part of the government’s preparation for the Kyoto Conference in 1997. The bill was actually presented to the Diet in 2001. However, the enactment of the law was delayed for one year due to the disapproval of the Roads Bureau in the Ministry of Construction and out of concerns in the Central Environment Council about problems of its harmonization with the environment tax. Such delays can often occur in Japan. Generally, important political innovations are not examined in public, but rather the adoption or abandonment of policies is decided by political sparring between Ministries such as in the above case of conflict between the then Ministries of Construction and Transport. This is a historically engrained practice in Japan. As for the automobile industry, resistance against this tax varies from one company to another. Some automobile makers and parts makers are aggressively developing eco-friendly cars while other automakers are not taking positive actions.

### 6.3 Direction of Ecological Transport Strategy in Developed Countries

#### 6.3.1 Acceptability Cycles

The political climate towards environmental challenges in industrialised countries is characterized by three main streams:

First of all, the well-known “Kuznets effect” leads to increasing awareness of environmental problems correlated with increasing disposable income of people (see for example Kuznets, 1955; de Bruyn and Heintz, 1999). As a consequence the political support of environmental policy is growing as well as the willingness to join international initiatives to reduce global environmental risk.

Secondly, the activity of environmental interest groups is growing. There is a wide spectrum of such groups, with well organised global organisations like Greenpeace on one side and dispersed local pressure groups on the other side, fighting against practically all major transport investments – even if they lead to global environmental benefits (problem of overshooting).
Thirdly, there is a latent resistance of powerful industries against environmental policy because they are afraid to lose market shares and profits. Environmental policy might disturb the usual product life cycles or influence production costs, which stimulates the affected industries and their associations to lobby against this policy. In particular the argument is frequently used that working places were at risk if environmental policy would become more restrictive. In this context scientific insights into environmental risks are doubted - in particular regarding the matter of the man-made causes of the greenhouse effect.

Obviously the third stream, that of resistance, is heading in the opposite direction and interferes with the first two streams with the result that the acceptability of environmental policy over time is comparable to a business cycle. Time periods with relative stability are followed by time periods of fluctuations either in favour of or against environmental goals. Two points have furthermore to be taken into account when it comes to the best timing and intensity of environmental actions:

(1) Environmental awareness is closely related to individual experience and observed reactions of nature as for instance the dying of forests or catastrophes (earthquakes or high water episodes). If there has not been direct evidence of problems for a protracted time people will tend to forget about the importance of environmental protection.

(2) Even if there is a general willingness to accept environmental actions, specific programs will be refused if they are not well balanced. This means that a fair distribution of loads from environmental programs can be even more important than the efficiency of the program itself. On the international scale this problem is evident: National governments tend to refuse programs in cases where they expect higher loads for their country compared with others. In this context, the problem of "environmental arbitrage" has to be considered. This occurs when national environmental policy is crowding out industries, which then move to countries with lower environmental standards. In such a case the overall result of a national environmental policy can be negative, at the end of the day.

It follows from these observations of human behaviour and societal phenomena that environmental policy can hardly be expected to be continuous and stable. In democracies it usually follows acceptability cycles. But it seems to be possible to dampen the amplitude of such cycles through a set of policy actions, which are incentive-compatible in the way that they foster private initiatives to save environmental resources. In the following argument a bundle of such policies are discussed which contribute to create an environment of private and public decision making, or in other words a political climate, for reducing long-term and global environmental risk.
6.3.2 General Idea: Creation of the Right Incentives

It is evident that all types of environmental problems could be solved under a benevolent dictatorship providing for an internalisation of externalities within a long-term precaution policy. Several authors in the fifties and sixties argued that externalities are basically a phenomenon of the market economy, which is based on individual egoism and profit seeking and shifts responsibility for environmental cost away from the individual (see for instance Kapp, 1950). Political reality has shown that such an ideological approach to the environmental problem is wrong. By the time of the breakdown of their regimes at the end of the eighties socialist countries were performing worse with respect to environmental efficiency than capitalist countries. An example is East Germany where heating and electricity production were based on burning brown coal ( lignite) with old technologies, leading to extremely high emissions of SO$_2$, CO and CO$_2$, particularly in cold winter periods. Incidentally, the main reason why Germany after unification is performing so well with respect to CO$_2$ emissions is the changeover in the East to West German modes of technology for energy production.

Benevolent dictatorship could also mean that in a democracy the state would take full responsibility for the environment and act as a repair shop for the market economy. Environmental protection would be regarded as a public good like national defence. This would however presuppose that the state had perfect information on the best ways to mitigate environmental risks and an administration able to carry out the appropriate actions efficiently. Such a regime would necessarily have to issue strict temporary regulations and see to their enforcement through state institutions. In democracies the existence of such institutions would be closely bound to the acceptability cycle, i.e. environmental control agencies could only be established after a period of catastrophes and would most probably be abolished some years after.

An alternative way to foster environmental concerns is to integrate them into a market regime in such a way that individual responsibility is encouraged and the ecological control of the state is reduced. An ecological market economy, no less than a conventional one, needs a set of constitutional and regulatory conditions to guarantee its long-term sustainability. Within the constraints of this framework individuals should be left free to seek for their individual advantages. The essential mark of an ecological market regime would be that reduction of environmental damage is to be seen as a market-adapted individual strategy, which pays off for individual decision makers.

When it comes to discussing market-conformable incentives for protecting the environment, economists tend to restrict their thinking to the problem of setting prices right. But this traditional approach is too simple and would only work in an environmental dictatorship through a policy of total market control. In contrast to this, the creation of an ecological market economy is a much more complex undertaking which includes a whole range of national policies, the setting up of new institutions and the negotiating of binding international agreements. In the following subsections some important aspects of the creation
of such an economy are discussed, beginning with some well-known instruments and concluding with a sketch of an international framework for ecological market economies:

- Development of better environmental technology and appropriate policy instruments to promote it.
- Development of technology for infrastructures.
- Restructuring of the taxation and charging systems.
- Introduction of tradable emission certificates for technology developers.
- A framework for an ecological market economy.
- Fostering of international solidarity.

6.3.3 Development of Better Environmental Technology and Appropriate Policy Instruments to Promote It

Hydrogen technology
A change in the long term from fossil to hydrogen based energy production is frequently forecasted. The reason is twofold: First, the reserves of crude oil that can be exploited at low cost, are not expected to last for more than about five more decades, assuming that the energy demands in developing and threshold countries grow rapidly in the future and add to the already high consumption in the industrialised countries. Secondly, it is becoming more and more difficult to meet environmental challenges – in particular those posed by CO₂-emissions – through improvements in conventional technology.

The private car manufacturing industry has already responded to this challenge and developed several paths forward for technological adjustment. DaimlerChrysler, Toyota, Honda, Ford, General Motors, and others are developing fuel cells for vehicles, with test buses operating since 1993 and cars since about 1998. Automakers have tested two technology alternatives: fuel cells supplied from hydrogen stored on board, and fuel cells supplied by hydrogen produced on board from liquid fuels. The first option requires the use of expensive hydrogen storage tanks, that are also bulky and/or heavy, depending on whether storage is gaseous (under high pressure), liquid (at very low temperatures), or solid (in metal hydrides). Initially designed vehicles mostly use compressed gas storage. The second option, to "reform" methanol or petrol-like liquids into hydrogen on board the vehicle, allows the use of inexpensive, compact storage tanks. If petrol is the fuel, the existing petroleum product distribution system can be used to deliver it. The disadvantage of reformers is that they are expensive, emit some small amount of pollutants, are less energy efficient, and require more complex fuel cell system designs. Most car companies prefer direct hydrogen fuel cells, though some oil companies continue to develop reformer technology. Some automakers, especially BMW and Ford, are also pursuing the use of hydrogen in internal combustion engines.
Conventional lines of technology development

Conventional lines for technology development are:

- Hybrid propulsion
- Use of natural gas
- New diesel engine technology
- New petrol engine technology
- New composite material for vehicle manufacturing
- Development of sensor technology and of intelligent software agents.

For the further development of conventional technologies little state encouragement is needed. It is sufficient for the industry to know that environmental standards are becoming tighter in the future. Finding out the best ways to develop conventional technologies can be left to market competition. The state should be wary of fostering or restraining particular technologies because this might de-motivate research in those areas. In the following subsection we give an example for a political problem which arises if a technology is superior for global but inferior for local environmental policy.

The example of diesel technology: restrain or encourage?

For decades diesel engines have been used to power heavy freight vehicles and buses, because they are more fuel efficient, durable, and reliable than petrol engines, require less maintenance and tend to have lower lifecycle costs (Sperling, Dwyer and Brodrick, 2002). Diesel engines also produce less CO, HC and CO₂. On the other hand they produce higher levels of NOₓ and particulate matter. The diesel engines formerly used in trucks emitted clouds of black dust, which became a growing concern for environmental policy amid the emerging public awareness of environmental risk. Also, the first generation of diesel cars showed similar characteristics. According to the WHO, the particulate matter emitted from diesel engines, especially in the small particle range between PM10 and PM 2.5, can cause serious health problems and in particular increase the risk of cancer.

In the past few years diesel technology, especially for car engines, has undergone rapid change. NOₓ and particle emissions have been substantially reduced, even if not reaching the exhaust reduction performance of modern petrol cars. Given that the US and Japanese legislations make no distinction in principle between diesel and petrol propulsion, but set limit values for emissions according to the best performing technology, there is no real reason to favour diesel technology. On the contrary: Diesel bans have been seriously considered by air quality regulators in California and Tokyo. European legislation sets less stringent standards for diesel, which might be interpreted as allowing a trade-off between the greenhouse gas advantage and the particulate matter disadvantage of the diesel engine. Within this regulative context, the European automobile industry has focused on developing diesel technology for car propulsion for three motives:

- lower fuel tax compared with petrol (partly offset in some countries, like Germany,
by higher vehicle taxation for diesel engines;
- lower fuel consumption and faster progress in achieving further reductions;
- competitive advantage for European car manufacturing industry over Japanese and US car manufacturers.

As fuel prices and taxation are based on liters sold, people are used to comparing diesel and petrol vehicles on fuel consumption in liters, which gives diesel an edge of approximately 20-25% for the same horsepower class. But diesel fuel is heavier, and if one reverts to the more appropriate base of kilograms or grams per kilometre driven, the diesel advantage shrinks to 11-15%, even taking into consideration the faster warming up time of diesel engines when starting cold. In the year 2000 newly licensed diesel cars consumed on average 157 grams per km compared with 177 grams per km for petrol cars, according to a standard test cycle. Although this advantage is modest, it still does represent some contribution to CO₂ reduction, which is further increased by the longer life of diesel engines and the energy savings that follow from this (lower upstream effects). Therefore the European Commission and the member states have seen no reason to withdraw the tax benefits and laxer emission regulations for diesel cars. Together with the other motives, this has led to a rapid growth in the market share of newly licensed diesel cars, from 19.4% (1990) to 42.1% (2001).

![Graph showing percentage of diesel vehicles (cars and LDVs) as a percentage of all newly licensed vehicles up to 5 tons in Western Europe]

Source: ACEA Statistics.

**Figure 6.3.1** Diesel vehicles (cars and LDVs) as a percentage of all newly licensed vehicles up to 5 tons in Western Europe

To promote confidence in the bright future for diesel vehicles, Volkswagen came out with the 3 l Lupo, a mini car, which consumes less than 3 liters per 100 km. The same manufacturer presented a 1 l mini car at the world exhibition EXPO 2000 in Hanover. The former and new CEO of Volkswagen drove this car from Berlin to Hanover to prove that it actually consumed less than 1l/km in ordinary use. Although the company has no plan to produce this car for the market, it can be regarded as a clear symbol for the marketing potential of diesel technology and for the commitment of the industry to energy saving.
While diesel cars consume less fuel, it is also well known that they produce more NO\textsubscript{x} and particulate matter. The Euro emission standards foresee a substantial reduction of particulate matter from 0.05 g/km (EURO III, presently in force) to 0.025 g/km in 2005 (EURO IV). Further reductions are suggested by environmental agencies and expert groups, down to a level of 1.5 μg/km (See Section 3.2.2).

NO\textsubscript{x} reduction targets in Europe are less challenging (0.5 g/km in EURO III and 0.25 g/km in EURO IV, which is about three times the target value for petrol engines and six times the Californian standard). While most producers have adjusted their technical development to the medium-term EURO standards, the French PSA (Peugeot, Citroen) came out with a revolutionary particle filter, which already meets the planned standards for the long-term future. The costs of this filter is only a few hundred euros and long-distance tests have shown that there is no fall-off in efficiency over time and no release of secondary emissions through the burning of particles. The burning process is performed automatically and is not noticeable either to the driver or to people outside the car (e.g. pedestrians). While the car manufacturers not adopting this technology are trying to deter policy makers from new decisions with respect to reduced emission standards, environmental groups are active in demanding that the best emission-reducing technology currently used should be used to set the standard for the next EURO directive in 2005. In the case of NO\textsubscript{x} reduction, too, technologies are now available that would allow the EU standard to be set more strictly.

It is important to mention, also, that only a part of the particle problem is due to exhaust emissions. Major parts are related to road, tire and clutch abrasion, as well as to re-suspension (for both road and rail transport). Recent studies (see INFRAS, 1999) indicate that about 80% of road PM10 emissions are caused by non-exhaust processes (see Table 6.3.1). A reduction of combustion-based emission factors therefore has little effect on the total PM10 emissions, and non-exhaust factors will account for a bigger share in the future. One might argue against these findings that PM10 is not the best indicator, and that in the case of PM2.5, which is supposed to present a higher risk of cancer than the bigger particles, the share of combustion-based particles is higher. This is true. Nevertheless, this fact that combustion-based particles account for only a part of the total PM concentration should prompt us to question environmental policies which are based only on partial statistics for emissions from combustion processes.

<table>
<thead>
<tr>
<th>Means of Transport</th>
<th>Non-exhaust PM10 [g/km] or [g/travel km]</th>
<th>Mean percentage of exhaust PM10</th>
<th>Mean percentage of non-exhaust PM10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td>0.12</td>
<td>12%</td>
<td>88%</td>
</tr>
<tr>
<td>Buses</td>
<td>1.2</td>
<td>37%</td>
<td>63%</td>
</tr>
<tr>
<td>LDVs (Low Duty Vehicle)</td>
<td>0.21</td>
<td>56%</td>
<td>43%</td>
</tr>
<tr>
<td>HDVs (High Duty Vehicle)</td>
<td>1.2</td>
<td>31%</td>
<td>69%</td>
</tr>
<tr>
<td>Rail (passenger)</td>
<td>2</td>
<td>49%</td>
<td>51%</td>
</tr>
<tr>
<td>Rail (freight)</td>
<td>2</td>
<td>61%</td>
<td>39%</td>
</tr>
</tbody>
</table>

Figure 6.3.2 shows forecasted emission concentrations of soot and particulate matter along a main arterial road in Berlin for the year 2010. This picture indicates that, although the emissions from engines will be reduced substantially there will be still a problem with particulate matter in the future because of the non-exhausts processes. The latter are highly dependent on the weight of vehicles and their speeds, which lead to the conclusion that environmental policy should not only promote cleaner combustion technology but also lower weight and lower speed. On the side of technology there is also the challenge to develop new compound material for brakes or new rubber/plastic compounds for the tires.

Summarising the discussion the diesel technology has caused a political dilemma situation and provoked different political responses world-wide. The first lesson from this debate is to look at the problem as a whole, i.e. in this case on reducing all particulate emissions and not only those from combustion processes. The second lesson is to set the environmental limit values independent from technology, i.e. neither subsidises nor prohibits a particular technology. The third lesson is that dynamic standard setting is a most effective and — in the technological sense — non-discriminatory instrument. A technology like diesel may need some time to meet the standards for particular indicators such as PM or NOx emissions. In this case a phase of transition is justified, if the technology is promising with respect to other indicators (CO2). As soon as technical solution is at sight — here in form of the particle filter — there is no reason to take exemptions from the general environmental standards set.

Source: IVU (2002).

**Figure 6.3.2** Forecast for concentration of soot and particulate matter along an arterial road in Berlin

**Conclusions for public technology policy**

To create a framework of conditions favourable for environmental technology, the following instruments of policy are helpful:

1. **Dynamic standard setting for environmental pollutants.** First the Californian and Japanese standards, and more recently the European standards for vehicle emissions have proven most effective instruments. Practically all pollutants except for particulates and CO2 have been substantially reduced. This policy stimulates competition in technology, because new standards can be presented as a selling point to customers as much as three years before they become obligatory.

2. **Tax reductions for new technology.** A successful strategy to accelerate the effect of an instrument like (1) is to offer tax reductions for improved environmental technology (in Europe, for instance, for EURO IV and V engines, when the
obligatory standard for new vehicles is still EURO III).

(3) *Pilot applications of new technology.* Pilot applications in public sectors (e.g. public transport) can help the industry to test new products and get first responses from the customers. This is only necessary for new technology; the further development of conventional technology can then be left to the market.

(4) *Public research and development for complementary technology.* In the case of hydrogen powered vehicles the basic problems are the production and distribution of hydrogen. State-funded research and technology can provide more assurance for industry as it begins to invest in the new technology.

(5) *Education, moral suasion and campaigns.* Education, and media publications, are necessary in order to change the attitudes of consumers, by encouraging an increasing awareness of long-term environmental problems. To convert changed attitudes into changed behaviour, a host of policy actions are needed to make sure that environmentally friendly behaviour is not penalised by economic disadvantages.

As the example of the diesel engine shows, it is not recommendable to bind public policy to a particular type of technology. For instance public subsidies for natural gas engines or supplementary taxation on diesel engines would be counterproductive. But there is also no reason for protecting diesel technology as it is done in Europe. Lower taxation for diesel fuel has traditionally been intended as a lightening of the burden for commercial traffic (heavy freight trucks powered by diesel engines). But they are a distorting influence on technological competition (even in cases where the lower fuel tax for diesel is offset by a higher vehicle tax, as in Germany). A discrimination free development of diesel technology can be justified by the argument that in the long run it seems to be a good deal more difficult to achieve reductions of CO₂ through technological change, whereas there is rapid progress in reducing NOₓ and particulate matter in diesel engines. With respect to energy saving some producers see a higher potential for the diesel even compared with hybrid technology (regarding also the upstream emissions). As a competition of technologies is always helpful as an incentive for environmental progress, environmental legislation in California and Tokyo runs the risk of overshooting while the protection/subsidisation policy in Europe might be said to be help conserving conventional diesel technology too much. A more even-handed treatment of technologies would leave development teams with enough incentives to improve environmental performance through the use of different technologies.

6.3.4 Technology Development for the Infrastructure and for New Transport Systems

The provision of infrastructure is broadly under the control of the state and can therefore serve as an instrument of environmental policy. First, the design of the infrastructure can influence
the consumption of energy. For example, lower gradients, curves and serially coordinated traffic lights in cities can help to stabilise traffic flow and reduce fuel consumption for vehicles. Secondly, development can be preferentially extended in favour of more environmentally friendly modes of transport in order to encourage a shift in demand, for instance, from road and air to rail and inland waterways. The European Commission is advocating a strong modal shift in their White Paper from 2001 on common transport policy. Although it is clearly stated there that the railway sector has declined in its market share and has failed to benefit from the increasing transport demand because of deficient quality and excessively high prices, the Commission argues that their concept of improved sustainability in transport presupposes a strong market position for the railways in the future. Accordingly, the high priority projects in the so-called Trans-European networks consist in the first instance of plans for railways (10 out of 14 projects). Confronted with the problems of integrating the 10 accession countries from Central Europe, the Commission aims at preserving the present market shares of the railways in these countries (about 35%), even though a clear decline is evident in the market tendency (since the fall of the iron curtain and the political changes in the CEE countries the railways there have lost about 50% of their market volume).

Sustainable infrastructure policy includes the provision of integrated systems for users. This means the constructing of transport chains from elements of high economic and ecological efficiency. An example is container freight using different modes of transport. The development of integrated systems requires three elements:

- efficient links, i.e. fast and economic interoperable transport within a coordinated transport network,
- efficient nodes, i.e. fast and economic transfers of people or goods between different modes of transport,
- efficient control of the entire transport process through an information system.

In particular, the development of efficient communication systems is a key factor for an integrated transport system. The provision of pre-trip, in-trip and post-trip information allows a more efficient organisation of passenger transport from both an economic and an ecological point of view. In freight transport, the development of telecommunication systems has contributed to the globalisation of production processes and to their integration through transport systems. In a similar way, telecommunication systems can also be used to determine the best global options for environmentally compatible production and transport, once the incentives are set right. To give one example: At present the European railway system does not allow for a perfect tracking and tracing of cross-border freight trains, cars or containers. Therefore the transport of higher valued goods is often entrusted to the road haulage industry because they can guarantee a perfect control of the whole transport process. This goes to show that the concept of an integrated transport system currently suffers from a deficiency of key elements including, in particular, standardisation and efficient communications. An environmental transport policy thus needs to develop a more holistic approach in order to
analyse just which elements of alternative transport chains are missing.

6.3.5 Restructuring the Taxation and Charging System

Taxation policy is the economist's basic instrument for solving disturbances caused by external factors. In the neo-classical standard models, taxation is optimally orientated on the difference between social marginal costs and the average private cost required in order to restore equilibrium. In this model world, the institutional aspects of who is imposing the tax and what the tax revenues are to be spent on do not enter into the consideration. Therefore no difference is made between taxation, charges or market price, and no need for the earmarking of revenues.

However, in reality the institutional aspects do play a most important role. The state is not a very efficient institution for traffic management and the optimal operation of systems, as we know from institutional economics ("X-inefficiency of the state": Leibenstein, 1978). Therefore there is a need for deregulation, meaning that institutions outside the public budget domain are put in charge of infrastructure management. Obviously, however, in a partly deregulated transport sector it is necessary to differentiate clearly between taxes, charges and market prices. Taxes are fixed by the state and in general not dependent on the subsequent type of expenditure (no hypothecation). Charges can be fixed by state bodies or state owned enterprises on the basis of the costs incurred for providing a particular service. Market prices are arrived at by state-owned or private enterprises on the basis of elasticity of demand (contestability), the state of competition, and objectives of cost recovery or profit seeking, eventually restrained by regulations (e.g. price caps). Charges and market prices are assumed to lead to revenues which are earmarked for the sector in which they are collected.

When responsibility for the transport infrastructure is transferred to some form of private enterprise, then the management needs to have some control over the basic decision variables of quantity and price. Under such an arrangement, the state can expect efficient management only with respect to internal costs, not with respect to external ones. Consequently environmental issues can be fully reflected only in the general public taxation system, to a lesser extent in the charging systems of public agencies and in no way in market pricing arrangements within the deregulated private industry. There are several scientific groups who argue that a clear separation of management and public issues, including environmental conservation, makes for a favourable institutional framework, because it makes the difference in roles of the state and the managing enterprise transparent (see for instance the arguments of the German Scientific Advisory Board of the MOT (2000), criticising the system of social marginal costing proposed by the European Commission in their White Paper on Fair Pricing for the Transport Infrastructure from 1998).

Once infrastructure supply is entrusted to a public administration or a publicly controlled firm, the charging system can come to reflect environmental costs. An interesting variant of this option is included in the European Directive for charges on heavy goods vehicles on
motorways. It states that average infrastructure costs (without external costs) are to be the benchmark for charging. Deviations from this benchmark are possible if the environmental performance of vehicles is variable. A differential charge between the environmentally best and worst performing vehicle categories is allowed, but it is has to be guaranteed that heavy goods vehicles as a class do not pay more than the incurred infrastructure costs.

Table 6.3.2 Differentiation in use-of-infrastructure charges on heavy goods vehicles on German motorways in cents per vehicle km

<table>
<thead>
<tr>
<th>Year</th>
<th>No of axles</th>
<th>Category A</th>
<th>Category B</th>
<th>Category C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>up to 3</td>
<td>10</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>4 and more</td>
<td>12</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>2005</td>
<td>up to 3</td>
<td>11</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>4 and more</td>
<td>12</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>2010</td>
<td>up to 3</td>
<td>10</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>4 and more</td>
<td>12</td>
<td>15</td>
<td>18</td>
</tr>
</tbody>
</table>

Note: A,B,C are environmental categories (A best, C worst)

A system like this contrasts with the principle of social marginal costs often proposed. Although – in terms of neo-classical economy – it is less efficient in the static sense, it gives users powerful incentives to go for the best in environmental technology. These dynamic incentives stemming from the simple pricing system are probably stronger than incentives induced through marginal cost pricing, because in the latter system marginal environmental costs are generally outweighed by marginal congestion costs.

Furthermore, the revenues from social marginal cost pricing can be substantially lower than the social costs (as several of the marginal cost elements are decreasing with increasing traffic), which means that this pricing system can never work in a decentralised organisation with self-financing units.

In any case, there are good reasons to apply a package of different policy instruments instead of a single uniform pricing system so as to be able to select the right lever points for decision making from the point of view of the parties affected. Other pricing instruments might include

- fuel or energy tax, or a CO₂ tax,
- a differential license tax depending on environmental performance.

In the UK fuel taxes have been increased in line with a medium term policy that now makes UK fuel taxes the highest in a European (and World wide) comparison. No earmarking has been adopted. In Germany a green tax on energy consumption has been introduced, with increasing rates from 1999 until 2003. The revenues are earmarked for the most part to reduce the cost of social insurance. A double dividend was expected: The rising cost for mobility would reduce traffic and environmental problems, while lower labour costs would help to increase employment.
The lessons learned from this green tax on fuel consumption are twofold. Obviously traffic demand has reacted to the cost increase. In 2000 the number of passenger kilometres dropped by 2%, and has remained stagnant in 2001 and 2002, in Germany. This means that although the car stock has gone on increasing there has been a clear de-coupling of passenger transport demand from GDP. The use of the revenues has also helped to keep social insurance payments stable for some years. In 2003 they have to be increased again, however, because of slow growth in the economy. Overall, one can draw the conclusion that the basic objectives of the green tax have been achieved.

The response of those affected, however, seems quite different. They believe that the green tax is socially unjust and merely goes to fill gaps in the public budget, using car drivers’ money to do so. In the face of this decreasing public acceptance, the ruling parties in Germany have erased the green tax from their program so that 2003 was the last year in which the tax rised. Also in the UK, increasing resistance set in once the tax had reached a level that people felt placed constraints on their mobility decisions. From these observations one can see that green taxes, which are effective in substantially influencing the behaviour of people are hardly sustainable because their acceptability wanes over time to the point that governing parties run the risk of losing the next elections.

The experience with differential rates of vehicle license tax according to environmental performance has been generally positive. Acceptance is high and it has also proved effective as a means of favouring cleaner technology. Many examples show that people are willing to spend on cleaner technology even if the financial benefits obtained through lower taxation are considerably less than the additional cost of the car purchase. This underlines the fact that positive feedback can be more effective than negative in motivating people to declare their latent preference for environmental protection. In the case of negative incentives, such as the green tax, negative responses are predominant, as has been reflected in the protest actions of associations and automobile clubs against the tax. A major problem of the claimed “double dividend” certainly seems to lie in the fact that the source of taxation and the spending destination are so completely different that it is hard for the taxpayers to make out the benefit from their payments.

6.3.6 Introduction of Tradable Emission Certificates for Enterprises

International environmental policy is traditionally based on inherited practice and regulation. The Kyoto Protocol of 1997 has opened a new path for the use of more flexible mechanisms in the form of market type instruments, which can be used to achieve the overall target of reducing emissions of 6 specified greenhouse gases by the period 2008-2010 by 6 % for EU nations (on average, compared with 1990). According to the Protocol, it is also possible to fulfil the defined standards by the buying or selling of emission certificates. Such a trade with emission certificates will be of particular interest for the states of the former Soviet Union,
which presently produce only about 60% of the greenhouse emissions they did in 1990 because of the intervening economic decline. They could benefit from selling emission certificates, for instance, to the US – although the latter country has unfortunately refused to sign the Kyoto Protocol, leaving their contribution to the international mechanism a still open question.

Both theoretical reasoning and practical experience suggest that emission trading will be a most effective instrument, because it uses individual market forces. As it is left to the individual agents whether to stick with old technology and buy the necessary amount of certificates or whether to apply new technology and save the cost, many small steps of internal adjustment can be expected in each country’s economy. This individually driven and flexible mechanism presents a contrast with the principle of benevolent environmental dictatorship with which we opened this discussion. This advantage of market-like procedure has to be traded off, however, with the disadvantage that emission trading does not necessarily guarantee fair and equitable solutions. This was the major concern of the European Union in the Kyoto negotiations and the reason why the EU was more in favour of the regulatory instruments. Meanwhile this attitude has changed, the EU ratified the Kyoto Protocol in May 2002 and now fully accepts the flexible mechanisms.

In addition to the country-based trade of emission certificates the EU Commission proposed in 200 to introduce a Europe-wide trade with greenhouse emission certificates on the enterprise level, beginning in 2005. Directive COM 2001/581 states that particular enterprises in the energy production sector and big industrial energy consumers are obliged to participate in the emission trading.

Presently there is little experience in Europe with emission trading on the enterprise level. The BP company is one of the few outstanding exceptions. BP have introduced the system within their organisation and achieved remarkable success, which encourages policy makers to apply the instrument on a broader scale. Nevertheless a number of problems do have to be solved before introducing the system continent-wide:

- Initial allocation of tradable permits
- Definition of indicators and measurement on the enterprise level
- Control and enforcement
- Sufficient assurances for the participants
- Transparency of the price setting mechanism (banking)
- Penalty rules.

At present simulation studies and applied game experiments are being carried out (see Ehrhart et al., 2003) to gain more insight into the mechanisms and possible pitfalls.

In the transport sector greenhouse gas emissions are due in the first instance to the practical use of transport vehicles – but this leaves aside the problems with upstream and downstream industrial activity. One mechanism for bringing the vehicle manufacturing industry as a factor into the discussion would be by assigning the CO₂ emissions during the
expected life of a vehicle type to the vehicle manufacturers, who would then pass the burden on to the consumer.

6.3.7 A Framework for an Ecological Market Economy

Most of the issues presented above are well-known and frequently mentioned in national or cross-border transport policy. A major problem of putting such ideas into practice is that national initiatives are not positively rewarded to the same extent that failings are penalised. If a strict environmental policy only applies within the borders of one country, environmental arbitrage will follow, in the sense that foreign firms will thereby enjoy lower costs and production locations will be transferred out of the country, without bringing any benefit for the environment. A second problem has to do with the different levels of industrial development. As developing countries have a lower level of environmental technology, it is much cheaper for them to achieve environmental progress in terms of investment per unit of emission reduction. Thus an effective environmental policy needs a global framework. This ought to consist of the following elements:

- World-wide agreements on emission reduction.
- World-wide agreements on the mechanisms of reduction policies.
- Social balance resource management.
- Co-financing of environmental activity in developing countries.

In this context it is important that the developing countries do not follow the path of development of the industrialised countries, which owe their rates of economic growth in large part to the depletion of their natural resources. Developing countries should have some way of deriving profit from the preservation of their resources.

In this sense, the Clean Development Mechanism of the Kyoto Protocol and the agreements on the joint fulfilment of environmental standards are most important milestones because they include the developing countries in a positive way in the reduction mechanism. In the first phase these countries would profit from their lower greenhouse gas production and be able to sell emission rights, but in the subsequent phases of development they would be most interested in applying cleaner technologies. The aspect of co-finance is of crucial relevance because it is necessary to support developing countries in the transition phase to a better technology so as to ensure that they are able to afford it.

Co-finance does not only mean that development aid is increased and international funds are created to support the appropriate investments in developing countries (see Section 6.5.4). Co-finance also means that these countries are placed in a better position to help themselves, i.e. that they are able to finance projects from own resources. This will only be possible if the industrialised countries agree to a reformulation of the WTO rules, so as to give the developing countries a better chance to compete in world markets with products that they can produce.
relatively well using their existing resources. In many cases this will mean agricultural products. Looking at the barriers to trade in agricultural products in the EU, the US and Japan, it is easy to identify one of the keys to a better balance of trade on the world market. The industrialised countries are keen on free markets for industrialised products, for which they have the superior production factors. On the other hand they are afraid of free markets for agricultural products, because developing countries can produce these at lower costs. The present WTO rules reflect this bias and are one reason for the developing countries’ inability to finance the adoption of environmentally better technology from own resources.

Currently there are a number of more or less radical initiatives to fight global trade imbalance. One of the more radical ones is ATTAC, which has French roots. Greenpeace and the Club of Rome are more modest proponents of policy alternatives. In recent years a particularly European initiative for an Eco-social Market Economy has been created, which has Austrian origins and was established by the former Austrian Vice-Chancellor, Josef Riegler. His main contention is that the “labour-capital” model of the social market economy needs developing more in the 21st century towards a strategic triangle of sustainability with “economic efficiency,” “social fairness” and “ecological precaution” as its three sides. The dynamics of market forces should be used in furtherance of ecological goals and as a curb to limit human capacity with respect to natural resources (see Radermacher, 2002).

6.4 ENVIRONMENTAL POLICIES IN DEVELOPING COUNTRIES

6.4.1 Motorisation in Developing Countries

Transportation plays a central role in economic, social, and environmental development. The goal of transportation is to move goods and passengers efficiently, while limiting negative impacts on the natural and social environment. Although simple to state, the goal is difficult to achieve. It requires a variety of organisations and institutions in the public and private sectors and at the local, regional, national, and even international levels to operate in concert. It requires continuous balancing of desires and needs within the context of existing institutions and shifting political and economic interests. Pragmatically, it requires finding the appropriate mix of private and public transportation.

The pivotal issue is motorisation. Vehicle ownership is soaring in most major cities in developing countries, leading to rapid increases in transportation energy use and greenhouse gas emissions. The desire for personal vehicles is powerful and pervasive. Personal vehicles, from scooters to large company cars, provide a high level of access to goods, services, and activities, along with unmatched freedom and flexibility. For many, cars and light trucks are also valued as a status symbol and as a secure and private means of travel. For businesses, these vehicles are an efficient means of increasing productivity. Vehicle ownership, size, usage,
and energy consumption are increasing almost everywhere in the world (Schipper and Marie-Liliu, 1999).

The challenges posed by motorisation are unprecedented for these countries. When the more developed countries were building their transportation infrastructure, their populations were small compared to those in the developing world today and the cost of motorised vehicles was relatively high. Today's megacities of the developing world are already huge and still expanding. There is little time or money to build public transportation systems or to expand roads to handle the new traffic. The result is serious congestion, economic and environmental damage, and major safety problems. Yet, the problems are not uniform: each city and country faces different circumstances.

Vehicle ownership is pivotal for a variety of reasons. Rapid increases in motorised transport are swamping infrastructure capacity in most cities of the developing world (National Research Council, 1996). Many cities in developing countries are experiencing extreme traffic congestion (DuPont and Egan, 1997; Faiz et al., 1997; Birk and Reilly-Roe, 1993), and most are not able to build enough new road infrastructure to keep pace with vehicle demand (World Bank, 1996). Ralph Gakenheimer of MIT asserts, despite increasing motorisation and road-building, that "mobility and accessibility are declining rapidly in most of the developing world" (Gakenheimer, 1999).

Energy use is increasing faster in transportation than in any other sector, and fastest of all in developing countries. Transportation energy use in developing countries has been increasing at over 4 percent per year over the past 20 years, far exceeding the world average rate of 2.7 percent (Dargay and Gately, 1997, p.1121). Because virtually all this energy is in the form of petroleum, increases in transportation energy use translate into large increases in carbon emissions. A recent report by the World Bank projected that carbon emissions from transportation would increase three times faster in developing than in developed countries between 1986 and 2010 (Faiz, 1993).

Motorisation not only leads to much greater energy use and the need for more road space, it also transforms lifestyles and places much greater stress on the environment. The energy and greenhouse gas (GHG) challenges are just the tip of the iceberg. The larger challenge for the developing nations is to devise strategies that increase accessibility for broad segments of the population at an affordable price without causing major environmental problems.

It is important to identify policy instruments and investment strategies that will most effectively slow the growth of transportation-related GHG emissions in developing countries. Because controlling GHG emissions is a low priority in most of the developing world, such policy instruments and investment strategies must be framed within each country's economic, social, and environmental goals. For economic as well as environmental reasons, developing countries need to examine alternatives to the car-centric development and investment patterns that prevail in most of the industrialised world (World Bank, 1996, p.11). At the same time, it must be recognised that people everywhere value the benefits of owning personal vehicles. Thus, it is also important to explore opportunities to make personal transportation available in
the most economically, environmentally, and socially sustainable manner possible.

6.4.2 Transport Financing

Many megacities of the developing world are still expanding, and several are approaching income ranges where vehicles become affordable for large segments of the population. In many of these already large cities, relatively little space is devoted to roads — less than 10 percent in many Chinese cities versus 15 percent in pre-auto Manhattan (National Research Council, 1996). The dearth of roads — and haphazard development patterns — increases the challenge of accommodating the growing use of vehicles.

“...Most [developing country] cities have developed and expanded with such a spatial incoherence that it is very difficult to organise cost-effective public transport. In the absence of land-use planning, and where illegal settlements become the only viable source of housing for most low-income groups, cities expand in a haphazard manner, with very densely populated settlements of different sizes interspersed with large areas with little or no development and often low density suburban developments for middle and upper income groups. This greatly increases the cost of providing public transport.” (United Nations Centre for Human Settlements (HABITAT), 1996)

The timeline for transport system development in today’s less developed countries is compressed compared to that of cities and nations that have already completed the process. The rapid speed of development creates pressure for substantial investments within a relatively short time period. Finding the resources to finance the needed infrastructure investments is a challenge in many parts of the developing world.

Multilateral lending institutions have had an important influence on the development of the transport sectors in many countries since they are the major lenders to government for large public infrastructure projects. This historical role as financiers of major infrastructure has more recently been challenged by the emergence of private sector finance sources (Gwilliam, 1997). Among these new potential sources of financing is the Clean Development Mechanism (CDM), created by the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change. The details of CDM are described in Section 6.5.3.

Another set of innovative private financing schemes is related to privatisation of public facilities and services. Many parts of the developing world, particularly Latin America, are selling roads, ports, railroads and other facilities, or sometimes just the operating rights, to private companies as a means of financing the operation and expansion of those facilities. While privatisation is an attractive solution to the funding woes of developing country governments, the process of privatisation creates a new mix of winners and losers that merits close scrutiny.

Chile has pursued privatisation of inter-urban transportation facilities and services
perhaps more aggressively than any other nation. In 1990, to put an end to long periods of deferred investment, the government launched an ambitious franchising program for both roadways and freight railways. Today, all of the main highways in Chile are built, financed, and operated by private companies. In the future, smaller roadways and even urban streets may be privatised as well. Freight railways or the right to use the tracks have been sold to private operators, resulting in greatly increased business on the affected lines.

Financing of urban infrastructure and services has also been a problem in many developing cities, again leading to interest in privatisation. The bus system in Shanghai is a prime success story. In the late 1980s, the bus system owned and operated by the local government was notorious for offering poor service and requiring very large subsidies. This bus system was converted from an entirely state-owned enterprise into a number of separate bus companies. The transition was gradual, with each bus company receiving a decreasing amount of government funding over several years. Eventually, each one was forced to become financially self-sufficient (Zhou et al., 2001). The result is an efficient and financially viable bus system.

Not every bus privatisation story is as rosy, however. When Santiago, Chile fully deregulated its bus system between 1975 and 1988, the network expanded and waiting time at bus stops dropped. However, fares doubled; older, more polluting, and more dangerous vehicles were used; and traffic congestion worsened as many small buses replaced the larger ones. In 1990, when regulation of bus routes returned along with a more restrained privatisation scheme, most of the problems were mitigated (O'Ryan et al., 2002).

Financing urban transit services is a problem for most governments. More affluent passengers choose personal vehicles, leaving transit services with declining revenue and a poorer clientele. As indicated earlier, this starts a downward spiral, in which transit operators downrate the quality of service and fewer people choose public transportation. This downward spiral has provided opportunities for private companies and innovative services. Among other responses, private bus companies and van services step in to provide superior service for select market segments. Extreme outcomes are found in Karachi, Pakistan, where the public bus operator carries only 18 percent of all public transport trips (National Research Council, 1996), and in South Africa, where private jitneys carry two-thirds of all transit passengers (Prozzi et al., 2002).

Most observers agree that privatisation of transport services and infrastructure should be tackled carefully, with route and fare regulation in the first instance and with toll regulation in the second. The main lesson from international experience with bus system privatisation is that the benefits “depend critically on whether effective competition can be established and maintained in the industry.” (Gomez-Ibáñez and Meyer, 1993, p.24)
6.4.3 The Importance of Institutions

Dealing effectively with the challenges of rapid population growth, rapid motorisation, and large groups of low-income travellers would be difficult for cities with substantial financial and institutional resources. Many developing cities have limited funds and planning expertise, and inexperienced local institutions to implement plans and enforce policies. For these cities, effective transport planning, infrastructure development, and policy implementation is extremely difficult. Tembele et al. (1998) remark, "... experience of the last two decades in Sub-Saharan Africa shows that the big problem is not a lack of good ideas about how the urban transport situation can be improved. The real bottleneck is the absence of a capable and dedicated urban government .... It is not lack of money .... Expenditures on transport are actually far too high already."

In Delhi, the problem lies in the lack of coordination between the many institutions that are jointly responsible for maintaining the city’s transport system. The scale of the problem is illustrated by the following small example. The Public Works Department constructed pedestrian tunnels under a number of busy streets in the city but failed to coordinate with the government agencies that jointly determine the location of bus stops. As a result, pedestrians made little use of the tunnels. After the mismatch was identified, the bus stops were eventually moved, but most failures of this type are not so easily resolved.

Buenos Aires, Argentina provides another example of such institutional difficulties. With a history of non-coordination between different modes of public transit, the city found it politically impossible to pass a law to form a metropolitan transport planning organisation. Recognising the seriousness of the problem, the city successfully procured a loan from the International Monetary Fund to build cooperative relationships “bottom-up” between transport stakeholders through small projects (Turco and Arcusin, 1998).

**Box 22 Non-Governmental Activities for Clean Air in Manila**

In the Philippines, the role of non-government organisations has been significant in the advocacy of various issues including the promotion of clean air and air quality awareness. Launched in June 2001, the Partnership for Clean Air (PCA) is a multi-sectoral coalition composed of civil society organisations, government agencies, academic institutions and other private organisations with the purpose of increasing public awareness, facilitation of strong collaborative involvement among all sectors, strengthening of the capacities of awareness program implementers to ensure continuity, and mobilize resource for effective public information and education. The operations and business plan of the PCA Secretariat are supported by the Asian Development Bank.

There are several civil society groups that have been advocating for clean air: Concerned Citizens Against Pollution, Bantay Kalikasan (“Protect the Environment”), Schools for Clean Air, Green Forum and the Firefly Brigade (World Bank, 2002). The “Bantay Kalikasan” organisation is the environmental component of the ABS-CBN
Foundation, which is a foundation of a major broadcasting network in the Philippines. It has also produced television commercials for the Partnership for Clean Air. Its “Bantay Usok” Project is utilising telecommunications (mobile phone text message, e-mail, phone, fax) to report polluting vehicles in roads and had been deputised by the Land Transportation Office to apprehend smoke-belching vehicles. Another NGO, Swisscontact, launched its “Clean Air Manila” Project in March 2001 to increase public awareness and technical skills to reduce air pollution from motor vehicles and its “Clean Bus” component is currently conducting pilot activities on 2 selected bus companies, introducing internal inspection and maintenance and economical driver training. The Firefly Brigade is an organisation of cyclists advocating the use of bicycles for transportation and has already organised several mass bike rides in Metro Manila.

6.4.4 Pathway Choices

Transport-related decisions made now can have an enormous effect on greenhouse gas emissions for years to come. One size and style of transport plan definitely does not fit all.

However, all pathways to slow the growth in GHG emissions and local air pollutions include the following six elements:

- Build new infrastructure
- Improve traffic management
- Restrain growth in use of the vehicles that consume the most space and energy (i.e., cars)
- Make the transportation system more environmentally friendly using technical fixes
- Strengthen and coordinate relevant institutions
- Improve public transit and non-car modes of transportation

Governments in different areas choose different mixes of policy instruments to influence the development of their local transportation systems, as discussed earlier. The following four case studies provide examples of success.

Scenarios of GHG emission trajectories

The Pew Centre on Global Climate Change analysed four case studies, under the direction of Daniel Sperling -- two concerning cities, Delhi and Shanghai, and two concerning countries, Chile and South Africa (Bose et al., 2001; Zhou et al., 2001; Prozzi et al., 2002; O’Ryan et al., 2002). Each study included scenarios of high and low GHG emission trajectories for the transport sector for 2020, along with brief stories of how the city or country might arrive at those emissions levels. Figure 6.4.1 presents the high and low emission trajectories for each of the four cases, measured as increases from 2000 to 2020. On the vertical axis, 1 represents emissions in 2000, 2 represents twice the 2000 level, and so on. The assumed economic growth
rate was equal for both scenarios, but different for each city or region, based on official or consensus forecasts of economic growth.

![Graph showing greenhouse gas emissions due to transport](image)

**Figure 6.4.1** Greenhouse gas emissions due to transport: results from scenario analyses (ratio of forecasted emissions in 2020 to actual emissions in 2000)

Only South Africa showed a possibility of reduction, mostly due to anticipated population declines and shifts away from the highly carbon-intensive synthetic fuels that now comprise about 40 percent of the country's fuel mix. Emissions growth will be rapid in Shanghai, chiefly because of strong projected economic growth, urban decentralisation (resulting in more and longer trips by personal vehicles), and rapid increases in long-restricted car ownership. Rapid increases in Delhi are mostly due to large population increases. While these increases are large in some instances, the differences between high and low scenarios are also substantial, suggesting that policy intervention can have a considerable effect in restraining transport-related GHG emissions.

**Box 23 Four Case Studies**

Massive increases in transport-related greenhouse gas emissions are unavoidable in the near to medium term in the developing world. In countries with expanding economies, even the strongest transport and greenhouse gas reduction strategies will be overwhelmed by rapid urbanisation and motorisation. Nonetheless, there are many opportunities, often at very low cost, to restrain these increases. In the longer term, enhanced technology can be used to reverse them.

**Delhi.** Rapid growth in population and poor transit services are combining to encourage increased vehicle ownership – especially of scooters and motorcycles – leading to very large increases in pollution, traffic congestion and greenhouse gas emissions. The case of Delhi demonstrates that personal transport can be secured at relatively low incomes – providing mobility benefits but at a high economic, environmental, and social cost. So far, Delhi has largely failed to respond to these transportation-induced challenges. Continued failure to do so will further accelerate vehicle ownership and its negative consequences.
Shanghai. Rapid economic growth and planned decentralisation in this very densely populated city, together with the local and national promotion of the auto industry, are likely to lead to rapid increases in motorisation, energy use, and greenhouse gas emissions. So far, Shanghai has been a model of balanced investments in roads and transit, integrated transportation and urban land use planning, and effective restraint of vehicle ownership and use. Whether it can continue to manage its transportation demand as it expands economically and spatially remains to be seen. If it succeeds, it can be a worldwide model.

South Africa. South Africa has very high levels of per capita vehicle ownership and greenhouse gas emissions for a country of its income. The direct causes are reliance on carbon-intensive synthetic fuels, long commutes for black workers, protected vehicle manufacturing, and subsidies for “company cars,” all related to the country’s apartheid legacy. With a weak economy, limited public funding, high greenhouse gas emissions, and increasing reliance on the private sector, South Africa provides an attractive opportunity for using the Clean Development Mechanism to attract foreign investment.

Chile. With wealth, but a skewed income distribution, vehicle ownership is high, causing severe air pollution in the capital city and high per capita levels of energy use and greenhouse gas emissions. As one of the most enthusiastic and sophisticated countries in the world at transferring transportation infrastructure and services to the private sector, Chile has the potential to pioneer market-based approaches to transportation and environmental challenges. The motivation would come from the rising awareness of air pollution.

To follow or not to follow the path of developed cities

Affluent cities that were built after the advent of cars, such as Los Angeles and Houston, are highly car dependent. Older cities that were built earlier, such as New York and Paris, have dense city centres where most trips are by walking or transit services, but are surrounded by low-density suburbs with a high use of cars. Do cities in developing countries need to find a different transport development pathway than these developed cities of Europe, North America, and Japan?

Megacities such as Delhi, Bangkok, and Santiago have weak institutions, similar to those of pre-car cities in Europe and North America. But consider the differences:

- Many of today’s developing megacities are far larger and often far more densely settled than pre-car New York and Paris.

- The cost of today’s personal vehicles is much less than that of early 20th century vehicles. The cost difference is especially great because today’s citizens have access to low-cost scooters and motorcycles, and to a used vehicle market in most cities. (This is due to the higher quality and longer life of today’s vehicles, and to the large spread of legal and quasi-legal gray markets for used cars from Japan and elsewhere.)
- The consequences of mistakes (and inaction) are now far greater. Traffic congestion is a mounting problem in almost all cities of the world, but it is more critical in the developing country megacities. They tend to account for a larger share of their nation’s economic activity and the congestion in them is occurring at lower vehicle ownership levels (implying relatively greater dysfunctions in the future).

The motorisation challenge is great in countries with modest economic growth, but especially so in cities with vibrant economies. However, cities in developing countries also have some advantages as they confront motorisation. These include access to a worldwide store of knowledge and experience, and an array of superior communication and transportation technologies. Connections are much easier now than in the past, electronically and physically, and can be accomplished more cheaply, cleanly, and efficiently than ever before.

Some of the principles developing countries might follow in pursuing a more economically, socially, and environmentally attractive path include the following:
- Integrate residential and economic activities
- Seize the chance of pursuing enhanced technologies such as 4-stroke motorbikes
- Use market-based policy instruments and private sector suppliers and operators where this brings benefits
- Preserve the attractiveness of non-motorised options
- Discourage the use of full-sized cars in cities
- Positively pursue conventional and unconventional alternatives to current car usage and ownership patterns

Emerging cities and nations are highly vulnerable to economic and environmental disasters, but they are also in a position to avoid the mistakes and detours of the past, and to take shortcuts to a better future.

6.4.5 Future Strategies

The most important overall observations are the following:
- **Rapid motorisation — and rapid growth in transport-related greenhouse gas emissions — are unavoidable in the developing nations.** Most developing countries today have low per capita transportation emissions, largely because few people have access to personal transportation. But rapid motorisation will soon change this.
- **The relationship between car ownership and income is not fixed.** While it is true that income is the primary factor behind motorisation — accounting for about half the growth in vehicle ownership — there is much variation in vehicle ownership between cities and countries at similar income levels.
- **Once people have personal vehicles, they drive them.** This is because the cost of
operating a vehicle is relatively low compared to the fixed cost of purchasing one. Meeting peoples' needs for mobility while restraining the growth in the number and types of vehicles that use the most space and energy is critical.

- There are many sensible policies and strategies that could be implemented that would slow the growth of greenhouse gas emissions from the transportation sector. Key strategies include increasing the relative cost of using full size personal cars and enhancing quality and choice in alternative transportation modes.

- Many of the strategies for slowing and eventually reducing greenhouse gas emissions from transportation have local as well as global benefits. Local benefits include reduced air pollution, less traffic congestion, and lower expenditure for road infrastructure.

It is important to explore strategic paths and alternative future choices that could break the link between economic growth and greenhouse gas emissions in developing countries. Successful efforts already underway in some developing countries demonstrate that a more sustainable transportation future is possible. But is there a single city that can be looked to as a model for others? The answer is "no." There are cities that have embraced innovative and effective strategies, but none represents a universally applicable model or pathway.

Nonetheless, developing nations should not adopt entirely different transportation systems than those that currently operate in OECD countries. There is no silver bullet or leapfrog technology at hand. The reality is that most transportation modes and technologies are already international. The fundamental desire for personal transport, and for more access at less cost, is universal. It is neither realistic nor fair to ask those in the developing world to deprive themselves of the things they need and want - including access to cars.

Instead, developing countries can choose a more sustainable growth path. They can learn from the experiences of industrialised countries in crafting integrated land use and transportation plans, encouraging more efficient forms of vehicle ownership and use, and accelerating the introduction of environmentally sensible vehicle technologies and fuels.

However, the economies and populations of many of these cities are growing at unprecedented rates and personal vehicles are often available at relatively low cost. Policy and investment decisions with far-reaching implications must be made quickly, or the consequences will be economically, environmentally, and socially disastrous. But even with sophistication and the best of managers, the choices are not obvious. Blindly copying the choices of other cities would be ineffective in most cases. The elements of a successful transportation strategy are likely to vary greatly depending on local circumstances and institutional strengths and weaknesses.

Without new measures, greenhouse gas emissions from transportation in the developing countries will exceed those in the industrialised world sometime after 2010. While the need to limit greenhouse gas emissions may not look like a driving force for developing countries in the foreseeable future, many of the strategies that address greenhouse gas emissions would also
address the more immediate problems of local air pollution, access to basic transportation, and infrastructure financing pressures. This report focuses on strategies and policies that not only slow the growth of greenhouse gas emissions, but also provide these attractive shorter-term benefits as well.

6.5 POLITICAL CLIMATE FOR ENVIRONMENTAL POLICIES AND INTERNATIONAL FUNDING MEASURES

6.5.1 The Needs for International Cooperation

Environmental resources are public goods in the global economy that have the characteristics of “non-exclusiveness” and “non-rivalry” (see Samuelson, 1954; Musgrave, 1959). “Public goods,” in this connection, means resources that affect the whole earth. Generally, the causes of environmental damage are spatially remote from those subject to its effects. Indeed, the countries and regions affected may even be on the other side of the earth. Therefore, an appropriate price can neither be arrived at in the domestic market of any one country nor steered by a single national government.

While the marginal reduction in CO₂ emissions per unit investment may be small in developed countries where facilities are already energy-efficient and relatively clean due to the use of advanced technologies, much larger reductions per unit investment can be achieved in developing countries where improvement in energy use is likely to be substantial. In the case of local environmental problems, the areas of significant improvement will vary depending on the location of the problem cause. In the case of a global environmental problem such as CO₂ emissions, the benefit may extend everywhere, no matter where the problem originates.

An economically efficient environmental policy should in general focus on measures that lead to a high reduction per unit of investment. As mentioned in Section 6.4, as a result of the rapid growth in personal incomes, and the consequent increase in car ownership, the main source of environmental damage can be expected to shift from the developed to the developing countries. It will therefore become more important to establish a substantial framework of measures for the transfer of money to those areas.

6.5.2 Funding Systems for Environmental Protection

While it is most important to involve developing countries in an international program of countermeasures against environmental pollution and climate change, these countries clearly do not have the financial resources for such policies. It is for this reason that international funding systems have been established, in particular GEF (Global Environmental Facilities)
and ODA (Official Development Assistance).

**Global environmental facilities (GEF)**

GEF is a funding system operated by the World Bank, the UNEP (United Nations Environment Program), and the UNDP (United Nations Development Program), which began with a pilot scheme in 1991, and was then launched as a full-fledged system in 1994, following the discussion about the funding for international environmental measures at the 1992 Earth Summit. The GEF system aims to provide funds to combat global environmental problems. More specifically, it funds measures against global warming, against loss of biological diversity, against pollution in international waters, and against damage to the ozone layer. It is also designated as a funding system for the Biodiversity Treaty and the United Nations Framework Convention on Climate Change. Between 1991 and 2002, the GEF has allocated about $1.59 billion in grants for 471 projects to mitigate climate change.

"Sustainable Transport" was recently added as one of the major areas of concern for GEF. But the amount of money actually devoted to the transport sector is only about $60 million, covering just 15 projects. Of these, 7 projects are for the introduction of fuel cell buses, 4 are in support of transport planning, 2 are for feasibility studies, and 2 are for constructing cycle lanes. One of the reasons why the number of proposed projects for this sector is so small is because of the difficulty in estimating reductions, given the complicated nature of the mechanisms leading from transport activities to CO₂/pollutant emissions.

![Graph](image)

*Source: Ministry of Foreign Affairs of Japan (2002).*

**Figure 6.5.1 ODA in the transport sector in Japan**

**Official development assistance (ODA)**

As local environmental problems and traffic congestion continue to grow more serious in developing countries, the developed countries have begun to offer them aid on a wide scale in various areas of transport. Figure 6.5.1 shows the trend of ODA supplied to date by Japan. Looking back over these years from 1996 to 2001, the amount devoted to transport improvements has increased its share by 20%, to reach 50% of total ODA. This is an indication for the big needs for assistance in the transport field among aid recipients.
The principal problem here is how to design projects that contribute to the creation of an ecological market economy. Although the environment has become an important area to be addressed in project setting, there is not yet a systematic evaluation system in place for this purpose.

6.5.3 Effectiveness and Problems of Clean Development Mechanism (CDM)

The situation of CDM

The CDM (Clean Development Mechanism) allows a developed country (a signatory of the United Nations Framework Convention on Climate Change Annex I: a country for which an emission reduction target has set) to add a GHG (greenhouse gas) reduction in a developing country (for which a target has not been set) to its own reduction achievement as a CER (Certified Emission Reduction) if the GHG reduction is achieved through an anti-global warming project implemented by the developed country. CDM is one of the Kyoto Mechanisms that was proposed at COP3 held in Kyoto in 1997 and endorsed at the Johannesburg Summit in 2002. Although the details of requirements for its implementation are still under discussion, the general framework called the “Marrakech Accord” was agreed at COP7 in 2001. Another term of importance here is JI (Joint implementation), similar in concept to the CDM, and referring to a project implemented through cooperation by signatories of Annex I.

Figure 6.5.2 shows CDM business models, taking railway construction as an example. The body implementing the project alongside the developed country can be a railroad company, a trading company or the government itself, which is also the project planner. The project owners are given credits for the GHG emission reduction as a CER. The project planner offers the project plan and fund, and in return will gain the profits from the project and a CER. To gain as high a CER as possible, the project planner will want to adopt a project with the highest feasible GHG reduction, while the government, by funding the project, can also gain a CER to add it to its own GHG reduction total. At the same time, the developing country, as the aid recipient, can also gain a CER with the new infrastructures for railroads and transferred technologies. And 2% of the CER is channelled into an assistance fund, which can be widely drawn on for the benefit of developing countries. Thus, thanks to the CDM system mentioned above, both the host and the donor country can gain an additional profit, a CER, not obtainable through conventional forms of aid. For this reason, this system may prove more effective as a means of maximising the economic benefits for both countries and thus potentially provides an excellent incentive for reducing GHG emissions.

However, at the present time, the number of actual CDM projects in the area of transport is very small. The present reality is now that CERUPT (Certified Emission Reduction Unit Procurement Tender) and ERUPT (Emission Reduction Unit Procurement Tender) in the Netherlands and the PCF (Prototype Carbon Fund) operated by the World Bank have been
working on CDM/JI projects since 2000 and 1999 respectively, but the projects implemented so far have all been in the energy sector, with not one in transport.

In the AIJ (Activities Implemented Jointly) Japan Program implemented in a pilot phase in 1996-1999, only one transport-related GHG-reduction project was included— a scheme for improving traffic flow by changing the signalling of traffic lights was adopted, for Bangna, Thailand in 1996. Since 1999, the Japanese Ministry of the Environment has also been undertaking initial feasibility studies of projects for realising CDM/JI. As of 2002, 24 projects had been implemented, but no transport projects.

![Diagram](image)

**Figure 6.5.2 An implementation of CDM to a railway construction project**

**Problems of CDM in the transport sector**

The following factors account for difficulties in procedures for the introduction of CDM in the transport area.

**In a project planning phase.** Because the CDM is geared to the proposal, planning and implementation of projects by enterprises in the private sector, most CDM projects are expected to make profits commensurate with the investments. For example, recyclable energy projects, of which many have been proposed as CDM projects, depend on a system, which allows them to make profits by selling the energy produced, and also to earn benefits through acquiring CERs.

On the other hand, aid for developing countries in the transport field has mainly been offered for the construction of infrastructures. Because enormous amounts of funds are required to implement such projects and the business risks are high, means of funding may become a large issue. And because such projects are usually of a highly public nature, private sector enterprises are unlikely to involve themselves in these projects for motives of straight profitability. Even if the CDM is applied to such a project, the project might not turn out
profitable compared with its business scale, even if there is a CER to be gained. On the contrary, it might take up a lot of extra time and cost to follow the procedures necessary for pursuing the project under the CDM.

**In a validation phase.** Most applicants for DOE (Designated Operational Entity), the status required for validating a proposed CDM project, are consulting companies for ISO (International Organisation for Standardisation). This is because the validation processes for CDM projects are similar to the ISO procedures. Since the construction and public service industries already lag behind in their response to ISO, this tends to mean that they are not ready for the CDM, either.

**In a registration phase.** After the validation of a proposed project, it is registered and approved as an official CDM project by the Executive Board (EB). The “Marrakech Accord” specifies the following seven conditions for a proposed project to be registered as a CDM project: 1) Eligibility, 2) Emission additionality, 3) Financial additionality 4) System boundary, 5) Baseline, 6) Monitoring plan and 7) Risk management.

In the case of a project in the transport sector, a logical rationale for conditions from 4) to 6) may be technically difficult. In fact, there is a general term “technical problems,” referring to this situation. The projects with the hardest to solve technical problems tend mainly to be those involving the construction of infrastructures. This is because a) the system boundaries may be very broad due to the indefinite number of users and the existence of effects spreading over into various other areas, b) monitoring may be difficult due to the above-mentioned broad boundaries, and c) the baseline may be difficult to identify if the project has not yet been implemented.

These points can be illustrated from the example of a railway construction, which is quite a popular form for overseas aid to take. The “system boundary” (step 4) is the circumference of the area in which GHG emissions change as a result of the railway and other public transport that serve to define the spatial and temporal area that is to be assessed. But it is difficult to gather data other than for people’s transport choices. The “baseline” (step 5) is the total amount of GHG emissions, which would occur without the railway’s construction. To obtain this, the transport demand up to the year 2012, the first term of the CDM, needs to be estimated. And “monitoring” (step 6) is the method of keeping check on the amount of GHG emissions after railroad construction has started. There are difficulties in determining the system boundary because it has a wide range and is continuously changing. What is more, even if the application of all the steps 1-6 mentioned above is possible, it is still necessary to estimate the additional costs required for the CDM implementation compared with the expected CER benefit. In actual practice, the use of the in-service railroad may not conform to the estimate made before its construction. For reasons like these, projects such as railway constructions may carry a great risk.
6.5.4 Proposed Mechanism for FEST

(Funding for Environmentally Sustainable Transport)

In the sections above, GEF, ODA and CDM were presented and explained as the major funding systems for transport projects to prevent further environmental damage in developing countries. Although these systems have achieved a certain amount of good, it is obvious that they have not functioned sufficiently well as all-round environmental measures, especially in the transport sectors of developing countries.

It is not easy to establish a new funding mechanism from scratch. Therefore it might be a better idea to optimise the utilisation of the existing systems by:

a) Avoiding double charging

b) No wasting of time and energy on creating superfluous organisations

c) Avoiding the need to pay for additional handling costs in any new funding system

Therefore, a future priority must be to discuss the most comprehensive applications of possible existing systems within the transport sector. As one example of effective comprehensiveness, a system of “FEST (Funding for Environmentally Sustainable Transport)” shown in Figure 6.5.3 has been proposed. This system coordinates the use of GEF to fund a project and of the CDM to enhance the incentives for GHG emission reductions. The upper part of the figure shows the flow of procedure for the GEF and the lower part shows how the GEF is coordinated with the CDM.

One of the areas of difficulty in applying the CDM to the transport sector is fund procurement. The FEST system aims to encourage private companies to become involved by utilising the GEF as a fundamental funding system which is able to absorb the risks in the actual implementing of projects businesses and in the gaining of CERs (because of the uncertainty of GHG reduction estimates). However, because the existing international funding systems may not easily lend themselves to the principle of additionality, a new scheme might need to be introduced, such as environmental funds, the establishment of which is currently being discussed among private companies.

As well as this, the technical problems in the procedures for the validation and registration of a proposed CDM project need to be solved. In the current situation, a project with specific effects such as the introduction of fuel efficient vehicles can easily satisfy the conditions. On the other hand, a project with broad effects such as those that result from the construction of infrastructures may have technical problems when it comes to defining the system boundary, baseline and method of monitoring. However, these problems can be solved by using various methods such as traffic demand prediction, flow simulation and models for the estimation of the environmental load, all of which have already been developed in the fields of traffic planning and engineering. To apply these methods to the procedures for the CDM, suitable positioning and normalisation rules for candidate systems are necessary. Tasks of this sort can be carried out using the Validation System shown in Figure 6.5.3, the rapid
realisation of which is now under preparation.

For projects in the transport sector, the incentive of the CDM is not as effective as it might be because the Kyoto mechanism itself is still under discussion and there are many uncertainties. However, the possibility of benefiting from the CDM in the transport sector still exits. Typical cases where the CDM might have been applied can be seen in Cairo, Bangkok, Manila and other large cities in developing countries. In these cities, severe traffic congestions have been reduced by constructing traffic systems that include rail transit components such as subway networks. In cases like these, GHG emissions from traffic activities can be considered as minimised. Therefore, it ought to be possible to register a project of this kind as a CDM project by applying some suitable method of evaluation for GHG emission reductions in order to assure profitability through the earning of a CER. Finally, looking to the future, all parties concerned in the transport sector should actively commit themselves to a discussion of how to devise procedures for CDM projects, and at the same time should develop GHG-emission estimating methods for the validation and registration of a transport sector CDM project, which could then be applied to actual projects in order to evaluate how profitability increases.

**Figure 6.5.3 FEST system coordinating GEF and CDM**
END NOTES

1. These are called NEAT as an acronym for Neue Alpen-Transversale (new alpine transit lines)
2. Trucks with a gross weight of 3.5 tons and more.
3. Switzerland is not a member of the European Union, but located in the heart of the EU such that Swiss transport policy has a strong interest in a close co-ordination with the EU.
4. The German government planned to use a part of the revenues to compensate the trucking industry for the increase of overall fiscal burdens. As this has not been agreed on by the European Commission it was decided to reduce the user charge to 12.4 cts per vehicle km in the starting phase.
5. PM10 (PM 2.5) denotes particles with a diameter of 10 (2.5) micrometers.
6. For instance, in Delhi, scooters and motorcycles with 50-150-cc engines cost as little as $400 when new, and much less when used.