Division 44
Environmental Management, Water, Energy, Transport

Economic Instruments for Sustainable Road Transport

An Overview for Policy Makers
in Developing Countries

Deutsche Gesellschaft für
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Transport and Mobility

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An Overview for Policy Makers
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“... in no other major area are pricing practices so irrational, so out-dated, and so conducive to waste as in urban transportation.”

William S. Vickery,
1996 Noble Prize laureate in Economics
(quoted from ICLEI 2000)

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Overview

This book shall serve as an introductory guide for policy makers in the transport sector of developing countries. As part of policy reforms towards sustainable road transport, Economic Instruments are increasingly considered as an option. In this regard, every policy maker faces at least the following basic questions:

- Why should a sustainable road transport strategy be pursued? What will it entail, and what is the role of Economic Instruments? – **in chapter 1**.

- How should a strategy that uses Economic Instruments be set up? – **in chapter 2**.

- What have other countries and regions done? Is there international "best practice" experience with Economic Instruments to learn from?
  – **in chapters 3 and 4**.

- What do we learn from a wise use of Economic Instruments? – **in chapter 5**.

In the past, Economic Instruments were mainly implemented in OECD countries. Most of the international experience, thus, stems from this group of countries. Increasingly, however, non-OECD countries recognise the potential of Economic Instruments. It enables them to pursue both development goals and raise public revenue while guaranteeing mobility for the people at the same time. Therefore, it is crucial to revisit international experience with Economic Instruments and understand their potential contribution to sustainable development in developing countries.

Chapter 1

The challenge: sustainable road transport

The transportation of goods and passengers is increasing world-wide. A large share of this transport can be attributed to motor vehicles which often have serious impacts on human health, environmental quality, urban development patterns, road conditions, and road safety. Increasingly, developed and developing countries are seeking strategies to guarantee individual mobility, and at the same time trying to improve ecological and social conditions. Sustainability is increasingly adopted as a framework for designing and implementing such strategies. Due to their predominant role, road transport issues are of particular concern. For a "sustainability approach" to road transport a number of questions must be addressed:

- What is "sustainable road transport"?
- What are the policy options within a sustainable strategy?
- Which role do Economic Instruments play in such a strategy? In particular: When should they be used? What are their limitations? How can Economic Instruments contribute to sustainable road transport? What types of Economic Instruments are there?

Chapter 1 discusses these questions and outlines the concepts involved in a strategy for sustainable road transport, the goals that can be achieved and the role of Economic Instruments in such an approach.

What is "sustainable road transport"?

"Meeting the needs of present and future generations."

Strategies for sustainable road transport can easily be derived from the broader concept of sustainability. Generally speaking, sustainable development implies meeting the needs of the present generations without compromising the ability of future generations to meet their own needs (WCED 1987). This entails three dimensions:

Sustainability covers economic, environmental and social aspects.

- **economic sustainability (economic efficiency):** although public debate about sustainability often focuses on ecological goals, in fact, a sustainable development cannot be achieved unless the effects on the economy, employment and the provision of goods are considered;
- **environmental sustainability (ecological stability):** this requires that the environmental balance is not overburdened by human emissions and resource use in order to guarantee the functional stability of present eco-systems, both on a local and global scale;
- **social sustainability (distributional/social equity):** social and distributional needs are met by ensuring a fair distribution of resources, poverty reduction, stable human development, public participation, and democratic policy formation.

For the transport sector, sustainability can be specified.

Still, this general approach has to be further broken down in the transport sector, and adapted to the specific needs of developing countries. Table 1.1 summarises a number of possible policy objectives for road

Table 1.1: **Why support sustainable mobility?** Sources: UN ESCAP 2000; Cracknell 2000

Economic goals	Ecological goals	Social goals
- Provide infrastructure for sound economic development and employment - Allow for cheap, fast and high-volume transport - Reduce congestion - Strengthen rural-urban interlinkages - Create sound financial basis for public transport - Allow for different transport options - Raise revenue for infrastructure and transport facilities set-up, operation and maintenance	- Improve health and safety in transport - Reduce pollution on local, regional and global level; contribute to climate stabilisation - Reduce land take - Integrate environmental and economic dimensions in transport planning and development - Develop an environmentally sensitive strategic framework	- Guarantee transport services and access for all social groups - Focus on transport for the (urban) poor - Improve methods of addressing transport problems of the poor - Protect poor against adverse changes in transport policies - Ensure democratic participation in transport policy decision-making

transport as found in practice and in literature. If the concept of sustainability is taken seriously, all three dimensions have to be considered simultaneously. It quickly becomes clear that selective measures will not be sufficient. A sustainable transport strategy requires a comprehensive and well-balanced set of measures to address the wide range of goals; furthermore, sustainability must incorporate a long-term view.

Further information about Sustainable Transport, including general issues and the theoretical background, as it is presented in this and the subsequent sections can be found in UN ESCAP 2001. Also see Cracknell 2000 for urban transport issues, and OECD 2001 for a break-down of goals into various transport demand management strategies.

What are the costs of transport?

Costs play a central role in any sustainable transport policy.

To pursue sustainable development, costs play a central role in determining transport policy. Basically, two major categories of costs have to be distinguished:

Internal costs stem from the provision (construction, maintenance) and use of transport infrastructure. These costs have to be recovered from infrastructure users or from the public. Internal costs are the basis for all decisions on the transport market. They largely determine both individual mobility demand, and transport supply via rentability decisions of transport providers or calculations on the economic feasibility of infrastructure projects, etc.

External costs, on the other hand, are not part of supply or demand decisions on the transport market. They are external to these decisions. They stem from (mostly negative) side-effects of transportation, such as congestion, accidents, emissions and pollution, noise, and aesthetic factors which all negatively affect people and/or future generations. They are rarely borne by road users. Even countries that have implemented the "user pays principle" (every transport user pays for all costs he/she incurs), basically apply it to internal costs only, and do nt factor in the external ones. As a consequence, road transport is too cheap and its use inefficient. This results in negative environmental and social effects that would be less severe if external costs were borne by road users as well.

Therefore, it is important to

- **make internal costs internal.** In many countries internal costs of transport are not yet borne by road users. Transport investment is often provided free of charge and paid for from the general budget.

Road users should pay for both internal costs ...

When state revenues from the transport sector are lower than investment in the sector then the transport sector is subsidised out of the general budget. Road users do not pay the full costs they cause.

... and external costs.

- **make external costs internal.** With proper accounting in place, internal costs may be determinable, but external costs are extremely difficult to measure. Thus, any attempt to make road users pay exactly for the costs they cause is an illusion. Nonetheless, according to various empirical studies and experience from all over the world, external costs of transport are significant; even with high charges on vehicles, fuel, road use etc., external costs

Table 1.2: **Internal and external costs of road transport, and selected policy options** (Note:Options marked with an asterisk are Economic Instruments)

Cost component	**Policy Option** (selection)
1. Internal costs	
- infrastructure construction and maintenance (variable and fixed costs)	use-charges fixed charges public procurement
- transport equipment construction and maintenance	
2. External costs	
- congestion	- congestion charges - parking fees - traffic management
- accidents (material, persons, animals)	- road safety policy (standards, traffic management, education) - risk-related insurance premiums (= specific user-charges)
- emissions/pollution (air, water, soil, climate change, acid rain etc.)	- environmental standards (vehicles, fuels) - traffic management (e.g. speed limits) - use-charges - specific urban measures (e.g. parking policy, restricted access)
- noise nuisance	- standards - use-charges - planning policy
- visual intrusion - ecosystem fragmentation - etc.	- landscape and city planning

are still far from internalised. The risk of overestimating internalisation requirements is low.

Sensitive internalisation approaches will not seek to achieve full-cost pricing immediately. Price hikes would be too extreme to be economically sustainable. Adjustment of market structures, transport use, behaviour, technologies and supply/demand patterns needs time. This time must be reflected by sound long-term strategies. Internalisation (both of internal and external costs) is an indispensable element of sustainable transport, but it must be achieved step-wise not shock-wise. Only then will it have a greater chance of being accepted by all market participants and gain sufficient political support. Table 1.2 summarises major types of internal and external costs, and provides some policy options to mitigate their consequences.

Though an exact internalisation of costs is an illusion, the general direction is clear: road transport is currently too cheap.

What are the policy options?

There are basically four different elements in a sustainable transport strategy:

There are four types of instruments: regulation, cooperation, economic incentives and information.

- **Regulatory and Planning Instruments:** The regulatory approach administratively sets standards, restrictions, administrative procedures, etc.. Regulatory Instruments basically follow a command-and-control approach.

- **Cooperation Agreements:** Cooperative approaches try to get all the people engaged in a specific issue involved in a process of voluntary communication and negotiation. The aim is to reach a consensus on policy goals and to design voluntary measures to reach these goals. Cooperative solutions can be found in various forms, including all kinds of negotiations between states and/or private entities.

- **Economic Instruments:** Market-based approaches use economic incentives and/or disincentives to pursue a policy goal. The price mechanism serves as a vehicle for policy enforcement. By changing the price of private transport supply and demand, the decisions of the users and providers can be guided into more favourable directions. Two basic instruments exist:

  – **Price instruments** have an immediate influence on prices, e.g. by imposing a tax on specific goods;

– **Quantity instruments** restrict the availability of a good and leave the formation of prices to the market. Auctions and bidding schemes are examples of quantity instruments in effect.

- **Information Instruments:** Information about transport issues can serve as a basis for more rational transport decisions of transport users and suppliers. The choice of transport modes, the acceptance of policy measures and the use of vehicles can be improved through moral suasion and transport-related education. Information instruments include public awareness campaigns, public information procurement and public acceptance monitoring.

Table 1.3: **Selected transport policy measures**

Regulatory and Planning Instruments	Cooperation Agreements	Economic Instruments
- standards for production, processes, emissions, noise, road safety, haulage etc. - restrictions on market access (e.g. public transport) - concessioning regulation (taxis, public transport etc.) - administrative procedures for infrastructure planning, public procurement, road maintenance - traffic regulation, drivers' education - physical measures (pedestrian zones, route-area controls, road space reallocation) - infrastructure planning - regional development and land-use planning	**Between state and private entities:** - public private partnerships - "voluntary" reduction agreements - eco-labelling, ISO 14000, road safety schemes **Between states:** - international agreements on infrastructure set-up, use, regulation - bilateral / multilateral cooperation - administrative cooperation of regulatory bodies and authorities **Between private entities:** - Cooperative Approaches between non-governmental organizations and enterprises - compensation agreements (joint implementation of measures etc.) - cooperation on technical standards and procedures, R&D cooperations	**Price instruments:** - taxes/charges on purchase, use, sales and/or scrappage of vehicles, fuels, etc. - taxes/charges on transportation access, transport market access, infrastructure use, etc. - modal subsidies (with similarly diverse applications as taxes) - price differentiations in various forms (type of engine, type of fuel, transportation mode, time of day, type of road, etc.) **Quantity instruments:** - certificates of entitlement - tradable (pollution) permits - auctions (e.g. for vehicle licences) - bidding schemes (e.g. franchise bidding for operators)

Table 1.3 gives some examples of Regulatory Instruments, Cooperative Agreements and Economic Instruments. Traditionally, Regulatory Instruments play a major role in the transport sector. Most countries firmly regulate the provision and use of transport infrastructure and services. For instance, road safety can best be enhanced by issuing a set of rules and standards for vehicle design, driving conduct, inspection and maintenance, etc. For environmental protection, many countries have introduced emission standards and safety regulations for the transport of dangerous goods, such as gasoline.

Increasingly, however, policy makers are supplementing the use of Regulatory Instruments with Cooperative Agreements and Economic Instruments; these instruments allow them more flexibility in their pursuit of sustainability and are more efficient. In particular, direct price instruments, such as taxes and charges, are becoming a major policy focus. However, quantity instruments such as auctions are also being applied, as is the case with the Singapore Vehicle Quota Systems (see Chapter 4).

How can Economic Instruments contribute to sustainable road transport?

In general, a sustainable road transport policy contributes to three types of (hardly separable) policy objectives:

- the use of economic mechanisms to pursue environmental, social and economic development goals such as
  - **outcome objectives**, i.e. specific quantitative goals for transport mode patterns, reductions of emissions, air and water quality, road safety, accident reduction, etc., and/or
  - **activity objectives**, i.e. induce specific economic/ environmental/ social behaviour, environmental awareness, raise environmental and social sensitivity in individual and public decisions, etc.
- the recovery of costs of transport, and/or
- the creation of additional revenue to finance public expenditures.

There are no specific measures attributable to each of these goals.

Rather, many transport policy measures can be used to pursue all of these goals at the same time. For revenue creation, Economic Instruments – such as taxes and charges – are indispensable. The scope of charged transport-activities and the revenue raised vary considerably depending on the specific Economic Instrument used.

Furthermore, it should be borne in mind that each revenue-oriented measure influences transport behaviour, demand and supply patterns. People will try to avoid and reduce levies by changing transport modes, technologies, times and routes. In order to achieve sustainable development these collateral effects should be anticipated and taken into account when designing and implementing transport measures. Otherwise, economic, social and/or environmental policy objectives may not be attained.

Which types of Economic Instruments exist?

There are three basic types of Economic Instruments in transport policy.

In the transport sector, there are various possible Economic Instruments. The main categories are as follows:

- **Charges and taxes** aim at increasing the price of transportation per unit or value of transport use. They should be levied as a means to reduce transport demand in general, discourage the use of certain modes of transport, or certain transport technologies. Charges are normally directly linked to the public provision of services (such as road use charge, parking fees, etc.), whereas taxes do not have this direct link to any particular service. Rather, they are seen as specific sources for the general budget.

- **Subsidies** aim at decreasing the cost of certain transport modes, such as public transport or multimodal transport. Here, financial incentives shall encourage switching towards the favoured transport patterns. It would be counterproductive, however, to subsidise fuels for private motorised transport and public transport at the same time.

- **Auctions and bidding schemes** are used to put a price on transport in a regime that quantitatively restricts access to transport. E.g. – as in the case of Singapore (see Chapter 4) – when the number of cars is administratively restricted, auctioning can assign licenses or certificates to those market participants with the highest willin-

gness to pay. In the case of bidding schemes in public transport, operators can bid for a concession to operate a particular part of a network.

Table 1.4:
Survey of economic incentive measures

Type of incentive or disincentive	Possible Economic Instrument(s)	Selected Economic Measure(s)
- Discourage motorized vehicle ownership	- tax/charge on vehicle purchase/ownership/ scrappage	- annual vehicle tax - registration tax/charge - (re)sales tax/charge - scrappage tax/charge
	- restricting the number of vehicles and/or new registrations	- auction schemes competitive bidding for new licenses - licensing car ownership
- Discourage motorized vehicle use - Encourage switch to public or non-motorized transport	- tax/charge on vehicle use	- fuel tax - pay-at-the-pump (sur)charges - tax on vehicle miles traveled (VMT fees)
	- tax/charge on road and/or infrastructure use, - restricting access to urban centres or special areas	- parking fees - city tolls - road pricing - bridge tolls - cordon pricing - congestion pricing
	- subsidies for public transport and/or multimodal transport (modal subsidies)	- subsidised public transport fees - subsidies for public transport networks and operation - tax-deductable public transport expenses - P&R schemes
- Encourage lower emission technology use and innovation	- taxes/charges on vehicle purchase/ownership/ scrappage, - taxes/charges on vehicle use, - taxes/charges on road and/or infrastructure use	- tax differentiations based on emissions - carbon/energy taxes - emission fees - emission-based surcharges - subsidies, tax rebates for low emission vehicles/technologies

These basic types of Economic Instruments can be applied in various forms and ways. Table 1.4 provides a survey of the most important incentives/disincentives and different possible Economic Instruments to implement these incentives. The right hand column gives some examples of measures that can be applied. Many of these measures will be discussed in more detail in the subsequent chapters. Subsidies may be a pragmatic second best solution when measures such as road pricing are not feasible.

Why should Economic Instruments be used?

Economic Instruments have many advantages.

Economic Instruments are characterised by their use of market forces, i.e. the price mechanism, to achieve policy objectives. There are two groups of Economic Instruments: price instruments (such as taxes, charges and subsidies) and quantity instruments (such as permits or certificates). The use of market forces to influence transport demand and supply is what makes Economic Instruments advantageous in the pursuit of a sustainable transport policy:

- **Revenue generation.** Price instruments usually generate additional revenues. In many countries fuel and vehicle taxes play a major role for state funding and financing of transport policy programmes.

- **Market-economy compatibility.** By using the price mechanism as a vehicle for cost internalisation, market allocation processes are not distorted.

- **Enforcing the user-pays-principle.** By charging for the use of infrastructure and vehicles, only transport users pay for the costs of their mobility. These costs include infrastructure set-up, maintenance, environmental damage, etc.

- **Incentive-based transport policy approach.** As part of demand side management, Economic Instruments can contribute towards reducing transport demand, change the modal split by inducing substitution (e.g. in favour of public transport) and change transport behaviour. On the supply side, Economic Instruments can enable fair competition among the transport modes and induce incentives for technical change and higher efficiency of vehicles.

- **High effectiveness.** By using price information, the "user pays principle" can be reached efficiently. Economic Instruments leave room for individual optimisation, and thus allow for cost-minimising transportation.

- **Dynamic incentives.** Economic Instruments can set dynamic incentives for substitution, technical change and the research and development of pollution abatement technologies.

- **Greater flexibility.** In general, Economic Instruments offer more flexibility than Regulatory Instruments as individuals and firms can more flexibly adapt to economic incentives than to administratively set restrictions.

What are the limits to Economic Instruments?

However, there are some limits to the use of Economic Instruments as well.

Despite the advantages given above, there are several draw-backs that possibly reduce the degree of implementation of Economic Instruments:

- **Uncertainty about the right level of levies.** Correct prices require information about the level of internal and external costs. Due to valuation problems this information may not be adequately obtained, thus making it difficult to set levies at the "right" level. Furthermore, policy objectives can only be reached indirectly as Economic Instruments only set up a framework within which each individual makes his or her own decision. Such market reactions cannot be predicted correctly, hence the use of Economic Instruments may require several readjustments in order to reach a certain policy objective.

- **Uncertainty about the reaction lags.** Reaction times of market participants may be long. Increases in fuel prices, for instance, show only little reductions in fuel demand (so-called small elasticities) in the short run, but greater elasticities in the long run (cf. Oum et al. 1990).

- **Unpredictable and unstable revenues.** Despite their large potential to create revenue, Economic Instruments may sometimes be a shaky basis for revenue generation. This is particularly the case with environmentally motivated price increases, which trigger substitution, technical change and a reduction of environmental use. This successful decrease in environmental use will thus correspond to a decrease in revenue.

- **Competitive disadvantage.** The use and intensity of Economic Instruments differ nationally and internationally. This may result in competitive disadvantages for countries, regions and cities with strong transport levies.

Economic Instruments can only form a part, though an important one, in a sustainable transport strategy.

Taking the above concerns into account, Economic Instruments should always be embedded in a broader policy strategy for sustainable transport. This strategy should include other types of instruments for short-run steering, the averting of risks and dangers, international transport policy cooperation, and revenue generation. Table 1.5 summarises the main decision criteria when to use and when to avoid Economic Instruments.

Contrary to some economists' belief, Economic Instruments merely provide one of the building blocks towards sustainable development. Unless this block is neatly fit into the overall framework of a comprehensive sustainable transport strategy, transport policy may fail. It is only within a sustainable transport framework that Economic Instruments can play a crucial role in achieving economic, social and ecological goals simultaneously.

Thus, while focusing on Economic Instruments, in the next chapters it must be borne in mind that the measures discussed always have to be regarded as being just part of a greater sustainable transport strategy which at the minimum includes other measure as listed in the "strategy tree" in Figure 1.1.

With these blocks in place, a sustainable transport strategy may indeed allow for the foundation of a sustainable development of transport structures and volumes. The next step, certainly, is to specify the different strategy elements.

Table 1.5: **Decision criteria for Economic Instruments**

Economic Instruments should be implemented ...	Economic Instruments should <u>not</u> be implemented ...
- to improve economic efficiency of the transport system; - to set economic incentives for technical change/development; - to raise start-up capital for public transportation; - always in the form of a medium- to long-term policy measure; - step-wise (not shock-wise) and readjusted foreseeably and frequently;	- in areas with pressing environmental damage and health risk; - as the sole type of transport instruments; - for short-run policy objectives that require quick transport demand and supply changes; - as the sole source of public revenues; - without safeguard-measures that prevent loss of competitiveness; - when enforcement is unlikely due to strong public resistance and very limited institutional capacities.

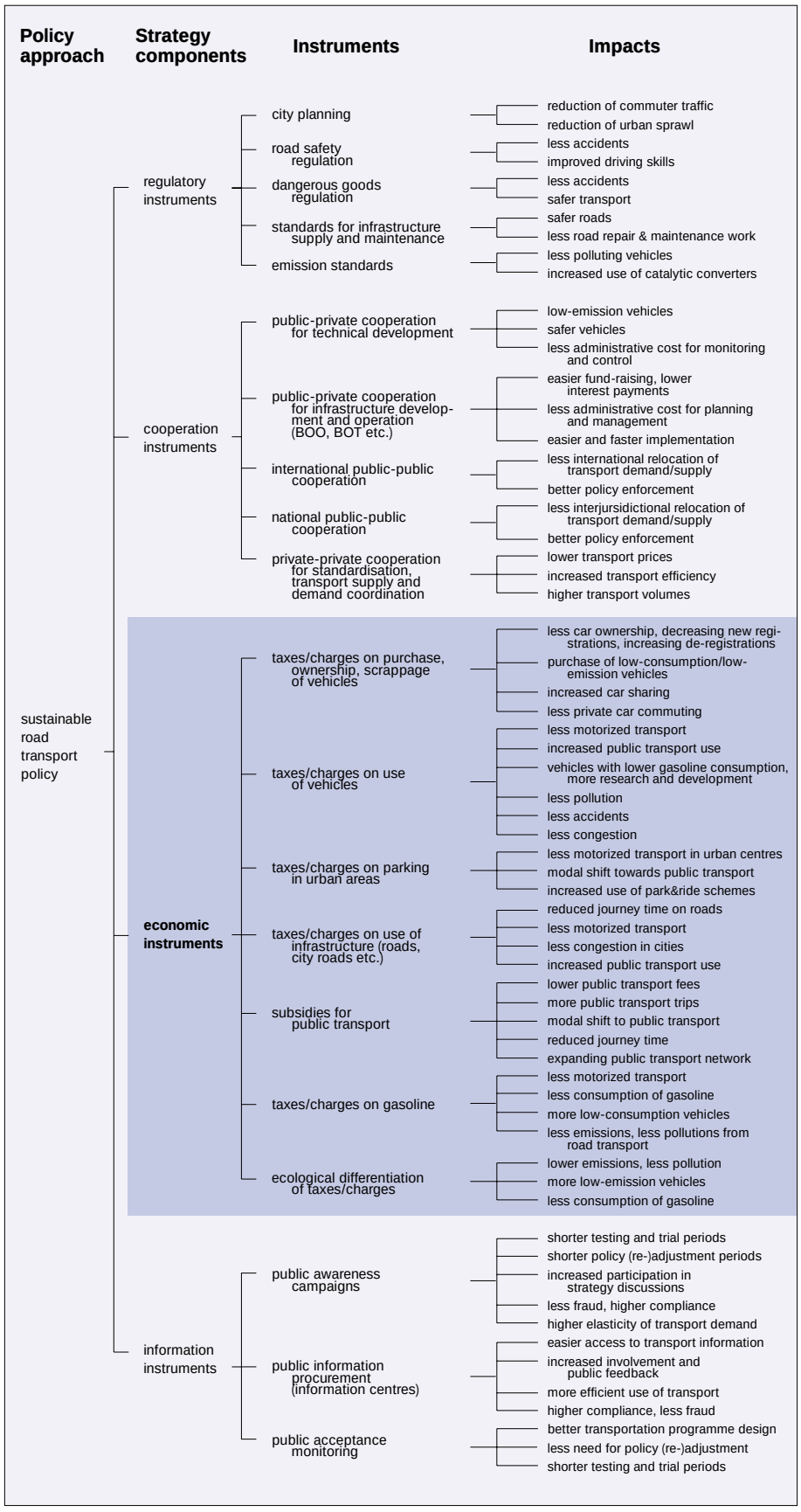


Figure 1.1:
Strategy tree for a sustainable road transport policy

Chapter 2

Getting started: putting theory into practice

Steps to implementation.

To implement Economic Instruments within a sustainable transport framework requires a couple of strategic actions and decisions. The following steps are particularly important:

1. Get people together and set economic, environmental and social objective(s)!
2. Conceptualise a comprehensive road transport strategy!
3. Evaluate feasibility of Economic Instruments!
4. Choose the appropriate Economic Instrument and its specifications!
5. Determine institutional requirements for implementation and control!
6. Determine funding, financing and revenue allocation!
7. Determine adjustment period and schedule for implementation (”action plan”)!
8. Create and/or raise public awareness and acceptance!

These steps incur many decisions in details which cannot be discussed here in general terms. They will vary between transport modes, countries, cultures and involved social groups. Nevertheless, some basic elements, approaches, decision criteria and experiences may be delineated.

Step ❶
Get people together and set economic, environmental and social objectives!

The setting of goals is essential but depends on many factors.

In the first step the requirements for sustainability are broken down to the specific needs of the country or local community. Therefore, it is crucial to initiate a discussion process involving represenatives of the major groups from decision makers in the administration and the public and those affected by transport and transport measures. Typically a working group consisting of the main stakeholders will be formed, including

- several **public authorities** (including road transport office, legal office, public works office, press/public relations office, treasury/finance office, taxation office, parking office, traffic police, planning boards, environmental offices) and parliamentary representatives,
- **transport market participants** (e.g. industry, private transport users, public transport institutions),
- **NGOs** with interest in environmental and social issues,
- the **press and media**.

In order to avoid conceptual mistakes it is crucial to get all major stakeholders together and involve them in formulation of proposals, design, set-up and implementation of measures from an early stage on. The initial discussion process has to address at least the following key questions:

- Where do we stand? Which policies are in force? What are their advantages and shortcomings?
- What do we want to achieve economically, ecologically and socially? Is there a priority area? Which goals must be accomplished first?
- Which policy objectives shall be set quantitatively and which qualitatively (outcome and activity goals)?
- How can we measure success in the different policy areas? Which indicators shall be used? Are they reliable?
- Are the policy objectives chosen realistic? What is the time-frame to accomplish high-priority and low(er) priority goals?

There are no blue-prints for policy goals.

Examples of specific outcome and activity goals for the transport sector can be found in existing national policies and international agreements and in various studies for sustainable development. These examples may serve as a rough guideline for environmental policy formation. Table 2.1 exemplifies how policy objectives may be formulated and broken further down to required outputs and results (as quan-

Policy objective	Required output and results	Measures and activities
Economic objective: Reduce annual deficit of public transport	**through expenditure reduction:** - reduce fuel consumption by x % within next year	- training of bus-drivers - inspection & maintenance - ...
	- optimize line network	- franchise bidding* - bus line concessions - ...
	- ...	- ...
	through revenue increase: - increase number of passenger trips by x % within next year	- introduce low tariffs for commuters* - introduce parking fees* - introduce bus-lanes - tax private car use* - restrict private car use - introduce tolls for private cars in (inner) cities* - ...
	- increase state funds according to deficit	- earmark revenue from road pricing for public transport* - earmark revenue from parking fees for public transport* - increase subsidies from general budget - ...
	- ...	- ...
Ecological objective: Reduce emissions of local pollutants (SO2, NOx, particles)	- reduce SO2 / NOx / particles emissions from private cars by x % until 2004	- promote use of catalytic converters - differentiate fuel tax by pollutants* - grant tax exemptions for ”clean cars”* - ...
	- ...	- ...
Social objective: Provide safe means of transport	- reduce number of traffic accidents by y % within the next 8 years	- promote insurance premiums that are differentiated by the specific safety risk of individuals (e.g. differentiated by age, past accidents, etc.)* - introduce inspection and maintenance schemes - ...
	- ...	- ...

Table 2.1:
Examples for policy objectives, results and activities

titatively measurable results of policy measures), and specific measures and activities (as a plan for actions). Note that Economic Instruments (marked with an asterisk in Table 2.1) typically are complemented by other instruments.

Step ❷
Conceptualise a comprehensive road transport strategy!

Economic Instruments are most effective as part of a comprehensive policy strategy package.

Experience shows that transport policy is most effective when measures are not taken isolated, but as part of a comprehensive transport policy mix. In order to avoid conflicts between goals set in Step 1 measures must complement each other. Although there is no ”blue-print” for ideal policy packages, some general guidance can be drawn from recent experience.

Based on a large number of studies the OECD has developed six ”policy packages” that aim at providing a sound transport management in the areas ”management of the need or desire to travel”, ”management of the travellers' choice of transport mode”, and ”management of users' use of the transport network” (see OECD 2001, pp. 154-158). Table 2.2 outlines the strategy package elements.

It is important to know where we stand.

As a first step towards a concept of a sustainable road transport policy it is important to analyse the existing policies and conditions, and to identify those Economic Instruments already in use. Therefore, it is important to know and identify the special conditions in a country or community. For example, many ”master plans” already include requirements for parking areas and zoning. Also, climate and topography play a significant role: a mild climate and gentle topography might provide incentives for a larger share of non-motorised transport. Regions with serious urban sprawl might also be wise to revise their land-use policy prior to introducing Economic Instruments.

Further information about comprehensive transport strategies can hardly be given in a general sense. Comprehensive strategies must be designed in a country- or city-specific way. There are, however, some examples in OECD 2001 for comprehensive transport strategies, and in UN ESCAP 1999 for road safety. It might also be helpful to seek advice from case studies with a similar policy background, e.g. as they are presented in chapters 3 and 4 of this book. Also see ICLEI 2000 for helpful orientations how to pursue the process of setting up the agenda for the introduction of Economic Instruments.

Table 2.2: **OECD Strategy Packages**
Source: OECD 2001, pp. 155-158

Policy direction	Strategy package	Package elements
Combining initiatives aimed at managing the need or desire for travel	# 1: Provide viable alternatives to driving alone while gradually increasing road transport costs	- Create Park&Ride lots at major approaches to large cities, allowing car drivers to park for free and switch to public transport. - Establish safe and centrally located parking areas along the highway network for rideshare participants. - Improve quality and attractiveness of public transport. - Enhance car-sharing association membership and integrate car sharing and public transport through mutual discount arrangements and free parking sites for car-poolers at transit stations. - Change transport allowances to tax/cash-out parking subsidies in order to promote use of ridesharing and public transport for commuter transport. - Increase fuel prices and/or introduce road pricing. Use revenue to reduce labour market taxes, improve public transport and/or compensate low-income groups. - Introduce marginal cost pricing systems such as variable mileage/kilometre-based charges.
	# 2: Integrate land-use and TDM measures	- Create institutional arrangements which allow for the co-ordination of land-use decisions and transport infrastructure investments, road traffic operations and public transport management. - Apply smart growth programmes focusing on higher densities, mixed-use and favourable mortgages for homes located in multi-modal areas. - Avoid construction of major leisure, shopping and cultural facilities outside city centres and along the highway network at the expense of development in the city. - Apply transit-oriented development and promote new urbanism focusing on the development of neighbourhoods that encourage walking, biking and transit use.

Table 2.2: **OECD Strategy Packages**
Source: OECD 2001, pp. 155-158
[continued]

Policy direction	Strategy package	Package elements
Combining initiatives aimed at managing travellers' choice of modes	# 3: Introduce green transport plans	- Start by promoting voluntary transport plans to private and public companies. - Improve alternatives to single-occupancy vehicle transport in terms of quality, reliability, price, etc. - Add financial incentives for the use of alternatives financed by parking pricing. - Create local and regional transport management authorities. - Make free parking at the work place subject to taxation; thereby motivating employers to consider transport alternatives. - Offer transport allowances which benefit ridesharing and public transport. - Require all major work sites to have green transport plans.
	# 4: Implement traffic reduction measures in city centres along with logistics innovations for freight transport	- Implement parking management in city centres. - Improve public transport to/from/in the centre connected to Park&Ride stations in the suburbs. - Promote show-rooms (where merchandise can be viewed) combined with lower prices if the good is collected from centres located at/close to Park&Ride stations. - Institute freight transport regulations in the city centre. - Improve co-operation between freight distributors, and increase use of technology to increase freight capacity.

Table 2.2: **OECD Strategy Packages**
Source: OECD 2001, pp. 155-158
[continued]

Policy direction	Strategy package	Package elements
Combining initiatives aimed at managing the user's use of the network	# 5: Institute road user charges in co-ordination with intelligent traffic management systems	- Introduce a system of variable road user charges. Charges may vary dependent on factors such as the time of the day, the congestion level, and the type of roadway chosen for the given trip. Charges should be lowest in off-peak periods and on the highway network; thereby reducing traffic on arterial congested roads. - Use variable message signs to display dynamic traffic information regarding delays and queues, and estimated travel time. Use of a variety of media to convey information to travellers such as via Internet, cable television, highway advisory radio, a traveller advisory telephone system, and traveller information kiosks located in key areas such as transit centres, shopping areas and major employment sites. - Make dynamic traffic information and route planning available on the Internet. - Implement ramp metering on highways.
	# 6: Promote virtual mobility and a more flexible labour market	- Define a national or regional telecommunication strategy promoting telecommuting. - Promote the use of teleconferences instead of meetings whenever possible. - Promote flexible working hours for the labour market such as staggered hours and the possibility to work part-time at home before coming into office. - Revise tax regulations on IT-equipment and telecommuting if feasible.

Step ❸
Evaluate the feasibility of Economic Instruments!

Are Economic Instruments adequate in the specific national or local context?

The third step towards the use of Economic Instruments is the evaluation of their feasibility in the given transport policy context. Table 1.5 has already given some general idea when Economic Instruments should or should not be implemented. For practical purposes, however, further criteria have to be considered. Therefore, the following questions have to be answered:

- **Appropriateness.** Are Economic Instruments appropriate to achieve the goals derived from Step 1? Do goals require immediate action, e.g. to eliminate environmental risks (then Economic Instruments should not be used)?

- **Technical feasibility.** Is there a working price mechanism available? What kind of equipment and technical knowledge is required?

- **Financial feasibility.** What does it cost to implement Economic Instruments and to operate systems based on Economic Instruments (e.g. costs from technical equipment such as road toll booths, maintenance costs and staff, etc.)? Are there cheap technical alternatives? Can other Economic Instruments or non-Economic Instruments achieve the same results at lower costs?

- **Institutional Feasibility.** Are there sufficient institutional capacities to pursue set-up, implementation, enforcement, management and control of Economic Instruments?

- **Public acceptance.** Is there strong public resistance to Economic Instruments? Is public resistance stronger than against other measures?

There is institutional experience with Economic Instruments in developed ...

For most developed countries, the specific literature favours Economic Instruments as in these countries sufficient institutional capacities for any kind of policy option can be assumed. These countries typically have much experience with Economic Instruments (see Table 2.3). Shifting transport policy approaches from regulatory instruments to Economic Instruments may thus be institutionally easy.

... and developing countries.

Many developing countries, however, have little experience with Economic Instruments in road transport policy. But that does not make a general case against Economic Instruments. All countries have tax authorities and, hence, some institutional experience with economic measures. This experience can and should be used as a basis for the introduction of Economic Instruments.

According to the impact of road transport on people's lives, priority should be given to immediate needs and dangers, e.g. through road safety measures. These typically do not include Economic Instruments. But Economic Instruments play a central role in medium- to long-term development of transport demand and supply. Here they should be effectively implemented in order to achieve sustainable transport development through the use of market-based incentives. From a policy maker's point of view, the urgency of action is based on the following priorities:

1. **Immediate action** in case of direct health risks and dangers through legislation, standards and regulation;

2. **Medium- to long-term action** to implement incentive measures aiming at changes of transport demand through Economic Instruments;

3. **Long-term action** to influence long-term development paths by measures such as city planning or road network development planning.

	Australia	Austria	Belgium	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Japan	Luxembourg	Mexico	Netherlands	New Zealand	Norway	Poland	Portugal	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States
Motor Fuels																											
- Leaded/unleaded differential	+	+	+			+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	
- Gasoline (quality differential)							+																+				
- Diesel (quality differential)						+	+				+					+			+	+			+				
- Carbon/ energy tax		+				+	+		+								+		+				+				
- Sulphur tax																			+				+				
- other excise taxes (excl. VAT)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+
Vehicle Registration																											
- Sales/excise/ registration tax differential		+	+	+		+	+			+	+	+	+	+		+	+		+		+		+	+	+		+
- Road/registration tax differential		+	+	+	+	+			+	+	+	+	+			+	+		+			+	+	+	+		+
Direct Tax Provisions																											
- Free company car part of taxable income							+		+																		
- employer-paid commuting expenses part of taxable income	+		+			+	+		+												+	+	+			+	+
- Free parking part of taxable income	+																										+
- Commuting expenses deductible from taxable income if public transport is used																											+

Table 2.3:
Examples of Economic Instruments in environmental transport policy in OECD countries
Sources: OECD 1997, pp. 20-22

Step ❹
Choose the appropriate Economic Instrument and its specifications!

What are the most appropriate Economic Instruments?

When choosing an Economic Instrument the following issues have to be considered:

- **Type of instrument.** Which type of instrument shall be implemented? Which kind of incentive/disincentive structure shall be created? What is the object of regulation (emissions, fuels, vehicles, city entry, road use, technology, etc.)?

- **Specifications.**
  - Which burden/subsidy shall be levied/granted? Shall there be differentiated rates, and what kind of differentiation?
  - Who has to pay, or: who is eligible for subsidies?
  - How shall revenues be raised (time of payment(s), charging mechanism, etc.)?

- **Introduction.** What is the time-frame for phase-in procedures and the timing of strategies?

Before using Economic Instruments, the goals should be clear. They should be used to set economic incentives (or disincentives).

Other issues, including the characteristics of important Economic Instruments and case studies from different countries, will be dealt with below. In general however, any transport framework based on Economic Instruments should have the following key characteristics (UN ESCAP 2000: pp. 185-186):

- **Comprehensibility and transparency.** Any instruments' pricing structure should be understood by users whose behaviour it is meant to influence; no undue transaction costs to identify the appropriate information should exist;

- **Stability and foreseeable development.** Measures should not fluctuate or be altered arbitrarily or in unpredictable ways, phase-in and/or phase-out periods should be carefully designed and well communicated;

- **Measurability, cost effectiveness and objectivity.** The data required to calculate charges etc. should be objectively measurable, cost-effective to collect and unambiguous to apply (e.g. for billing purposes);

- **Cost-reflectivity.** The costs imposed by the pricing scheme should reflect the real costs of transport (i.e. ideally both internal and external costs) in order to meet the objective of economic efficiency;

- **Political and institutional support.** Strong political commitment is often crucial for the implementation of Economic Instruments, and to set up institutions for their enforcement.

Without these characteristics it is unlikely that an Economic Instrument will be accepted by the public or achieve its goals.

For further information about the options and limitations of Economic Instruments and their use, see the subsequent chapters and UN ESCAP 2001.

Step ❺
Determine institutional requirements for implementation and control!

Which institutions are needed in order to effectively implement the chosen Economic Instrument?

As Step 5 several crucial institutional decisions have to be taken:

- **Lead agency for programme set-up.** The lead agency is responsible for a successful planning, implementation and management of the project. Potential lead agencies include state agencies, local and regional agencies, new public entities, and private companies. The selection depends on various factors, including jurisdictional power needed for implementation, level(s) of government involved, public participation, the possibility that new authorities might better administer new programmes, experience and the capacities of existing bodies.

- **Operation authorities.** Which kind of institutional body is necessary for the management and operation of Economic Instruments as part of a sustainable transport strategy? How many different state and private authorities are involved? In Singapore, for instance, implementation and management of urban transport has been successfully institutionalised by merging four different authorities from public administration and transport. In many developing and developed countries, however, a major obstacle to a comprehensive transport strategy is the division of powers among many different institutions and a lack of coordination between these authorities.

- **Involved jurisdictional bodies.** The third institutional issue corresponds to a clear understanding of which level of government has the jurisdictional authority and the administrational power to initiate the set-up of Economic Instruments. Basically, there are two models: the **centralist approach** (where all powers are located in a central government) and the **federal model** with power allocated according to the principle of subsidiarity. In this model state-level (federal level) authorities are responsible for national policy goals, and community-specific goals are pursued most effectively and directly on local level (e.g. urban congestion issues); however, specific legal framework provisions that guarantee the required local autonomy are necessary preconditions for local policy-making.[1]

In order to have a sound institutional arrangement, it is essential that transport management authorities possess several key-conditions (cf. Cracknell 2000), i.e.

- well-defined responsibilities and accompanying powers;
- embedding in an institutional framework that recognises and legalises the formal role and responsibilities of transport management institutions;
- de-politicised management in order to avoid changes in staff and programmes when political situations change;
- interest in operational efficiency, e.g. through contracting out of transport management functions and commercialisation;
- appropriate funding, e.g. through economic measures in transport policy as discussed below.

Further information: The selection of a lead agency has been carefully studied in the U.S. (U.S. Environmental Protection Agency 1997, chapter 4). Institutional issues also play an outstanding role in Cracknell 2000 (urban transport) and OECD 2001 (general transport).

[1] The structure of this book follows the federalist model. In most countries, local authorities have some, albeit often very limited, decision power. This allows for individual policies in cities and regions. Therefore, chapter 3 refers to central/federal authorities, and chapter 4 to local decision makers. If, however, policical decision-making in a specific country follows the centralist model, then the measures discussed in chapter 4 may just as well be applied by the central government.

Step ❻
Determine revenue allocation!

How should revenues be used?

A highly controversial issue is the allocation of revenues from economic instruments such as taxes and charges. Revenue allocation, however, is a crucial factor for public acceptance of transport measures. For instance, revenues from Economic Instruments can have a positive equity impact if they stem from relatively rich transport users and are used for poverty reduction. Basically, there are five options for revenue allocation:

- **Addition to the general budget.** In this case Economic Instruments serve as an additional source of revenues. This approach is consistent with the general rule of taxation that all taxes should enter into the general budgetary process and should then be distributed at the discretion of political decision-makers. The main purpose of Economic Instruments in the transport sector is then to increase transport costs and thus remove price distortions. This contributes to the internalisation of transport costs and thus to sustainable transport.

- **Earmarking for transport sector investment.** The earmarking of revenues constitutes the basis for a self-financing of the transport sector. Revenues from the transport sector are dedicated to specific expenditure items in the transport sector such as road maintenance and rehabilitation works, the upgrading of existing roads or the construction of new roads (e.g. via so-called road funds), cross-subsidies of certain sub-sectors or specific transport modes (e.g. in order to promote environmentally friendly modes).

  A number of surveys indicate that earmarking of revenues for transport sector investment increases public acceptance of Economic Instruments (Vougioukas 1999). In this case revenues serve as a basis to make alternative transport modes more attractive. Charges on individual car use make that mode of transport less attractive (push factor), whereas comfortable and reliable public transport at reasonable prices offers a promising alternative (pull factor). This approach is therefore often referred to as ”push-and-pull” strategy.

  In the past, earmarking of transport revenues was opposed by many international agencies like the World Bank and the IMF as it was seen as reducing the flexibility of governments in managing macro policy and flexibly setting national priorities. Today, however, it is recognised that earmarking, e.g. in the form of ”Road Funds”, can compensate for political or administrative myopia and

help to secure steady financial flows to finance infrastructure investment and maintenance. In the U.S.A., for instance, all fuel taxes are dedicated or earmarked for specific trust funds. Road funds are also implemented or under discussion in many developing and transformation countries. For example, many Eastern European countries, including Bulgaria, Hungary, Latvia, Lithuania, Poland, Romania and Slovenia, have Road Funds or earmarked schemes to allocate revenue from transportation charges to finance road maintenance, public transport and road safety measures (cf. Berger 2000). Chapter 3 provides a case study about the Mexican Environmental Trust Fund.

In any case, whenever an ear-marked system is postulated for reasons of financial continuity or public acceptance, the consequence is that an appropriate institutional setting has to be established. This should secure an efficient implementation of long-term investment plans. In some cases the setting-up of specific public administrations, state-owned enterprises or private enterprises may be useful.

- **Revenue-neutral redistribution.** In order to lower the overall tax burden on society as a whole, additional revenues from Economic Instruments in transport policy can be rebated. In this case, however, it should not be given to the original tax-payers of the Economic Instrument – this would eliminate the incentives set by the Economic Instruments. Rather, lump sum (i.e. equal per-capita redistribution) or redistribution-oriented rebate schemes should be used. Possible approaches could, for example, be transportation subsidies to the poor, or to the rural population.

- **"Double dividend schemes".** Revenues can also be used to alleviate distortions from other government activities, for example to reduce distortions from income taxation, to support retirement funding schemes, etc. In this respect Economic Instruments have additional benefits in another, unrelated area (the so-called "second dividend"). First experiences with this type of revenue allocation stem from industrialised countries only. Germany, for instance, uses revenues from its eco-tax component in fuel taxation to reduce social insurance expenditure.

A related but more specific form of revenue allocation concerns the question of the funding of specific transport projects via Economic Instruments. Basic options for the financing of such projects include state funding (with either national, regional or local funding), or private funding. The latter can, for instance, be implemented through BOO/BOT models (build, own, operate / build, own, transfer) where

If infrastructure investment is to be financed by the private sector, Economic Instruments are crucial for cost recovery.

the private sector invests in infrastructure and is allowed to recover investment costs by collecting tolls for a certain period of time. Examples can be found for each of these models. The specific merits and shortcomings of each model cannot be discussed here in detail. This requires careful study of the efficiency of public versus private provision, and of the given jurisdictional and institutional background. However, in a world of limited state budgets, private funding is becoming increasingly attractive for policy makers throughout the world. In particular, toll schemes, as discussed in Chapter 3, are becoming more and more widely used to finance expensive but economically advantageous transport projects such as highways, bridges, tunnels etc.

Further information about revenue allocation is provided in the subsequent chapters for a number of case studies. Additionally see the documentation of the ECMT/OECD Workshop on "Implementing Strategies to Improve Public Transport for Sustainable Urban Travel," Athens, Greece, June 3-4, 1999.

Step ❼
Determine adjustment period and schedule for implementation!

How should economic instruments be implemented and improved?

The remainder of decisions relates to the specifications of the instruments proposed, and the plan of action for their implementation. This includes phase-in/out times and procedures, target groups, etc. There is no general rule of how to proceed in these steps.

Usually, before phasing in Economic Instruments, there is an extensive testing phase to determine and evaluate how a specific transport market reacts to the introduction of Economic Instruments. As a general approach, the introduction of Economic Instruments follows a multi-stage approach:

1. **Political plan of action, discussion and design** of Economic Instruments;

2. **Trial period** with selected testing areas, and evaluation of results;

3. **Redesign of Economic Instruments** according to evaluation results, and plan of action for actual phase-in procedures;

4. **Phase-in with modest rates and speed**, long adjustment periods, step-wise increases of rates;

5. **Evaluation of first results after some years**, cut-off point or redesign if necessary;

6. **Full implementation of measures**, and coordination of Economic Instruments with other measures;

7. **Control and readjustment of measures** for the time of use of Economic Instruments.

Step ❽
Raise public awareness and acceptance!

Successful implementation of Economic Instruments ultimately depends on political support and public acceptance. Any (additional) levy on private car or motorcycle ownership or use will be opposed if it is ”sold” to the public merely as an additional charge instead of a contribution to improve the (city) environment, economy or social equity. Hence, public acceptance should be raised, for instance, by

- **earmarking revenues** (as discussed above), for instance to pursue a push-and-pull-strategy rather than mere push measures,
- **considering equity issues** in the design of Economic Instruments (for instance with higher taxes on private cars than on motorbikes, cf. U.S. Environmental Protection Agency 1997, ch. 5-6),
- **public awareness and acceptance campaigns** explaining the goals of Economic Instrument schemes to the public,

The "Car Free Day" in Surabaya (Indonesia) is the result of a successful GTZ public awareness campaign.

- **raising political support from government officials**, e.g. through emphasising positive equity impacts and revenue creation potentials of Economic Instruments,

- **involving the public and major stakeholders** in the discussion and (re)design process of sustainable road transport policy (as required in Step 1),

- **establishing a foreseeable implementation time-schedule** with step-wise introduction of Economic Instruments instead of sudden changes or ”big bang strategies” (ECMT 2000).

Additionally, public awareness and acceptance can be raised when there are possibilities to set a (good) example. A recent OECD report states (OECD 2001, p. 73): ”Despite their potential to significantly influence travel demand, economic measures remain hindered by real or perceived concerns about political fall-out and negative public reaction to pricing schemes. … Strong political leadership, supportive coalitions, and a well-informed public are necessary elements to bringing pricing schemes to fruition.”

Chapter 3

The national framework: laying the basis for sustainable road transport

On a national or federal transport policy level, Economic Instruments should be implemented as part of a nation-wide transport strategy. The most important examples of such national economic measures include:

- **vehicle taxation** (section 3.1),
- **fuel taxation** (section 3.2),
- **national road pricing schemes** (section 3.3).

These instruments are implemented in many developed and developing countries. Fuel taxes and vehicle taxation are among the most important sources of state revenues in many countries. They should be seen as an integral part of modern transport policies as they allow for flexible transport demand management and sound revenue generation.

The subsequent chapters outline the basic approach on how to use these instruments, and provide some case studies to see how these measures are implemented internationally. Many developing countries have been hesitant to implement Economic Instruments, though. International experience, thus, still often can be found in OECD countries only. Nevertheless, the (best practice) cases chosen also carry important insights and lessons for developing countries, too.

Vehicle Taxation

Vehicle taxation as a policy instrument

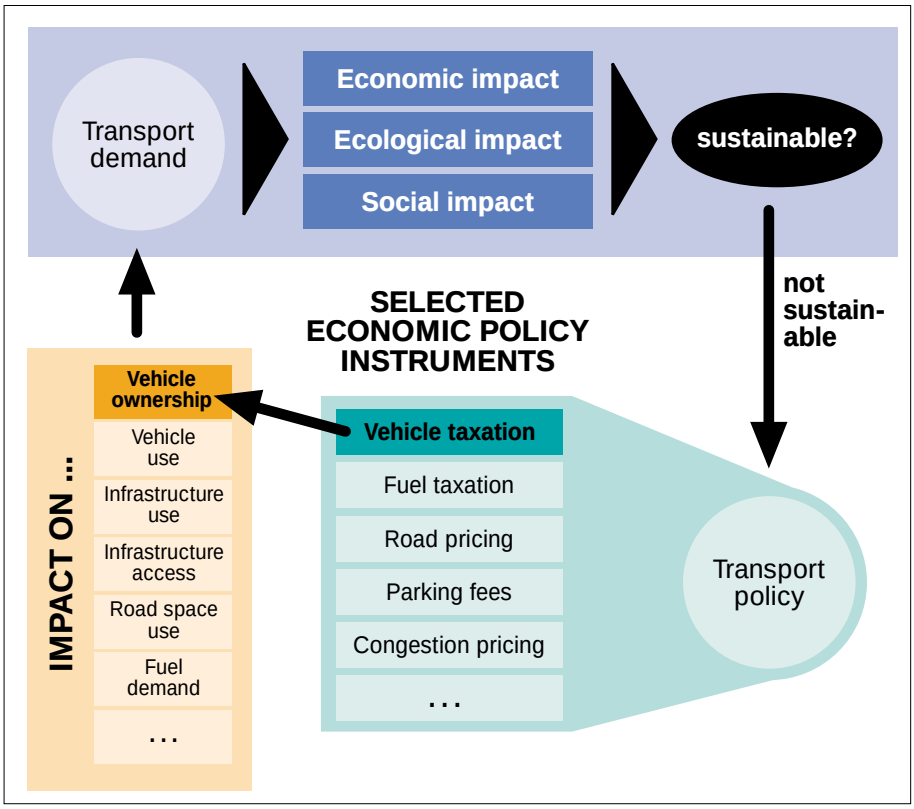
The basic idea

A major part of transport costs consists of fixed costs. These should be recovered via vehicle taxation.

Recovering fixed costs. It is estimated that more than 50 per cent of all infrastructure costs in transport are fixed – that is, they are not dependent on the actual road use. Therefore, it is argued, the actual road use of an individual road user should not be the basis for charges. Instead, every user should be charged more or less the same, as everyone who wants to drive a vehicle needs roads. This reasoning gives way to vehicle taxation: Once you have a vehicle, you will use roads – and once you want to use roads, you should make an equal contribution to finance the necessary infrastructure by paying a vehicle tax. In this respect, a vehicle tax can be seen as an entrance fee – as a ticket to enter the road network.

Other, less sophisticated justifications of vehicle taxes directly aim at reducing the number of vehicles, and/or restricting car ownership. As vehicles increasingly congest cities world-wide, restrictive measures on vehicle ownership combined with promoting and improving public transport are increasingly seen as an option to reduce traffic and its external effects, such as congestion, pollution, and accidents (Allport 1996, Gilbert 2000).

Figure 3.1: **Vehicle taxation as part of transport demand management**



Sales tax versus annual tax. Vehicle taxation can take two forms: as a sales tax, or as an annual vehicle tax / registration fee. The sales tax adds a tax element to the purchasing price and may significantly increase the price of a vehicle, thus discouraging the purchasing of a new vehicle. An annual vehicle tax may have a similar effect. However, by spreading the tax amount over many years the perceived burden for the potential buyer can be reduced. It also does not put a particular burden on new cars but rather treats all cars, both new and used ones, alike. In addition, an annual tax offers more flexibility as tax rates can be changed over time. If, for example, additional infrastructure improvements are to be financed through an increase in vehicle taxation, all vehicle users are affected equally with an annual vehicle taxation scheme (whereas a sales tax increase would only affect those buying a new car).

Vehicle taxation can take the form of a sales tax or of an annual tax. In general, the latter is more favourable as it offers more flexibility.

Optional features

Differentiating by vehicle type. It is true that a large part of infrastructure costs is independent of the actual road use once the infrastructure is in place. However, the initial design and quality of infrastructure is not at all independent of vehicle type. For motorbikes, for example, small roads would be sufficient, whereas for motorcars, for 7.5 t vans and even more so for 40 t trucks the requirements for infrastructure (and the costs involved) become increasingly demanding. It is thus obvious that charges should be graded according to vehicle type – and this is done in many countries where vehicle charges increase with the type, size or engine performance of a vehicle.

Vehicle taxation should be differentiated by vehicle type.

Differentiating by vehicle price. Differentiation by vehicle prices can serve to pursue social goals. Car ownership and the type of vehicle depend on household incomes. Levying higher vehicle taxes on new and/or expensive cars (used by rich households) while reducing levies for old, used and/or cheap cars (used by the poor) allows for differentiating the tax burden. Rich transport users will contribute more to infrastructure financing. This approach has been successfully implemented in Indonesia and Kyrgyzstan, for instance.

Differentiating by emission and noise levels. Often differentiation is also based on the external cost argument that vehicles causing higher external costs (in particular costs of environmental damage) should be charged more than vehicles which cause less external costs. For example, in many European countries vehicle taxation is differentiated according to specific emission standards – with the higher tax on the more polluting vehicles. This is supposed to be an incentive for vehicle-owners to switch to more environmentally-friendly cars or to refrain from buying polluting cars in the first place (see case study for Germany and the Netherlands). In addition, this tax differentiation also offers an incentive

The differentiation of vehicle taxation may also account for individual levels of air pollution and other external costs.

for car manufacturers to develop more environmentally-friendly vehicles as, due to the possible tax savings, consumers tend to favour such cars.

Shortcomings

Vehicle taxation relies on a comprehensive vehicle registration system.

Vehicle registries are a prerequisite. In order to administratively implement vehicle taxation, vehicle registries have to be kept by an administrative body. These, however, do not always exist in developing countries. Thus, in order to introduce vehicle taxation, a comprehensive system to centrally register each car and to make the car database accessible to the charging authority would have to be build up first – but this can only be done in the long-run. In addition, for effective car registries suitable mechanisms for the de-registration of vehicles (in case of scrapping, sale, etc.) have to be included as well.

A similar problem applies to the optional feature of differentiation by vehicle type or emissions. Here, in addition to the mere registration of vehicles, information about engine power, emission levels, etc. would have to be available first.

Vehicle taxation does not depend on actual road use ...

Limited scope of economic incentives. Following the ”user pays principle”, every motorist should bear the costs that he or she causes. As a large share of these costs consist of variable costs (maintenance, traffic management, etc.), charges should vary with road use. This, however, is not the case with vehicle taxation which is completely independent of road use and should thus only cater for fixed cost recovery.

But even fixed costs are not completely independent of road use: Every road has a maximum capacity. As soon as this limit is reached, additional lanes (or even new roads) will have to be built – which does of course increase the fixed costs of transport infrastructure. Hence, not even fixed costs in transport are really fixed. In fact, all infrastructure costs do increase with increasing traffic.

... and thus does offer no incentives for an efficient use of transport infrastructure.

It is thus an important disadvantage that vehicle taxation offers no economic incentives for motorists to make efficient use of transport infrastructure. Furthermore, rural areas may be systematically disadvantaged through vehicle taxation. As in rural areas access to public transport and the quality of services usually is much lower compared to inner cities, shifts from individual car use to public transportation is much more difficult and the rural population more heavily depends on car use. With this car dependence, any vehicle taxation scheme may put an extra-burden on the rural population (Farrington et al. 1997).

Conclusions

Vehicle taxation is important for revenue generation ...

Vehicle taxation is a stable source of revenue. Vehicle taxes are in place in most OECD countries. The taxation of vehicle ownership is in line with the classical argument for taxing ”luxury goods”, i.e. putting a levy on those who can afford more expensive goods. Since the vehicle population is relatively easy to determine, and in many countries vehicle registration and licensing are well-established, a vehicle tax scheme should be easy to apply using the existing bodies of vehicle registry and administration.

... but it should never be the only instrument in transport pricing.

The role of vehicle taxation in a transport pricing policy. A general vehicle tax should never be used as the only instrument in charging for the provision of transport infrastructure. Hence, a pricing policy should not exclusively rely on the rather static instrument of vehicle taxation. It should rather make significant use of use-related charges as well in order to promote efficient use of transport infrastructure. This leads to the issue of fuel taxation.

International experience: Vehicle taxation in the world

Throughout the world, vehicle taxation is used as a stable source of state revenues. It is fairly easy to collect once a comprehensive system of car registration is in place. Many developing countries, too, have vehicle taxation schemes in force, or they are planning to introduce them. Often, there are historical experiences with charges on horses, carriages and other types of vehicles to build on. However, vehicle tax schemes vary significantly from country to country.

In 2000, GTZ carried out a world-wide survey of fuel and vehicles taxation. For this survey, data for tax rates for an average passenger car of 1,400 cc (such as a Toyota Corolla) were collected. A summary of the results can be found in Figure 3.2.[1]

Potential for revenue generation. The national potential for revenues from vehicle taxation may be roughly estimated by analysing national vehicles fleets. As an example, in Table 3.1 potential revenues of an increase of an annual US$ 10 per vehicle are calculated for selected countries. These rough estimates are based on vehicle fleets as stated in the ”IRF World Road Statistics 2000”.

Table 3.1: **Potential revenues of an annual vehicle tax of US$ 10 per vehicle for selected countries** Vehicle data source: IRF World Road Statistics 1999, calculations by authors

Country	Number of vehicles (both passenger cars and trucks) [vehicles in use, 1996]	Potential revenues of an annual vehicle tax of US$ 10 [Mio. US$ p.a]
Bolivia	362,000	3.6
Burkina Faso	58,600	0.6
China	10,549,000	105.5
Indonesia	3,250,925	32.5
Kenya	387,620	3.9
Malaysia	3,734,753	37.3
Mexico	13,033,000	130.3
Philippines	953,611	9.5
Thailand	4,515,721	45.2

1 Further details of the survey can be found in the GTZ publication ”Fuel Prices and Vehicle Taxation, Second Edition, September 2001”.

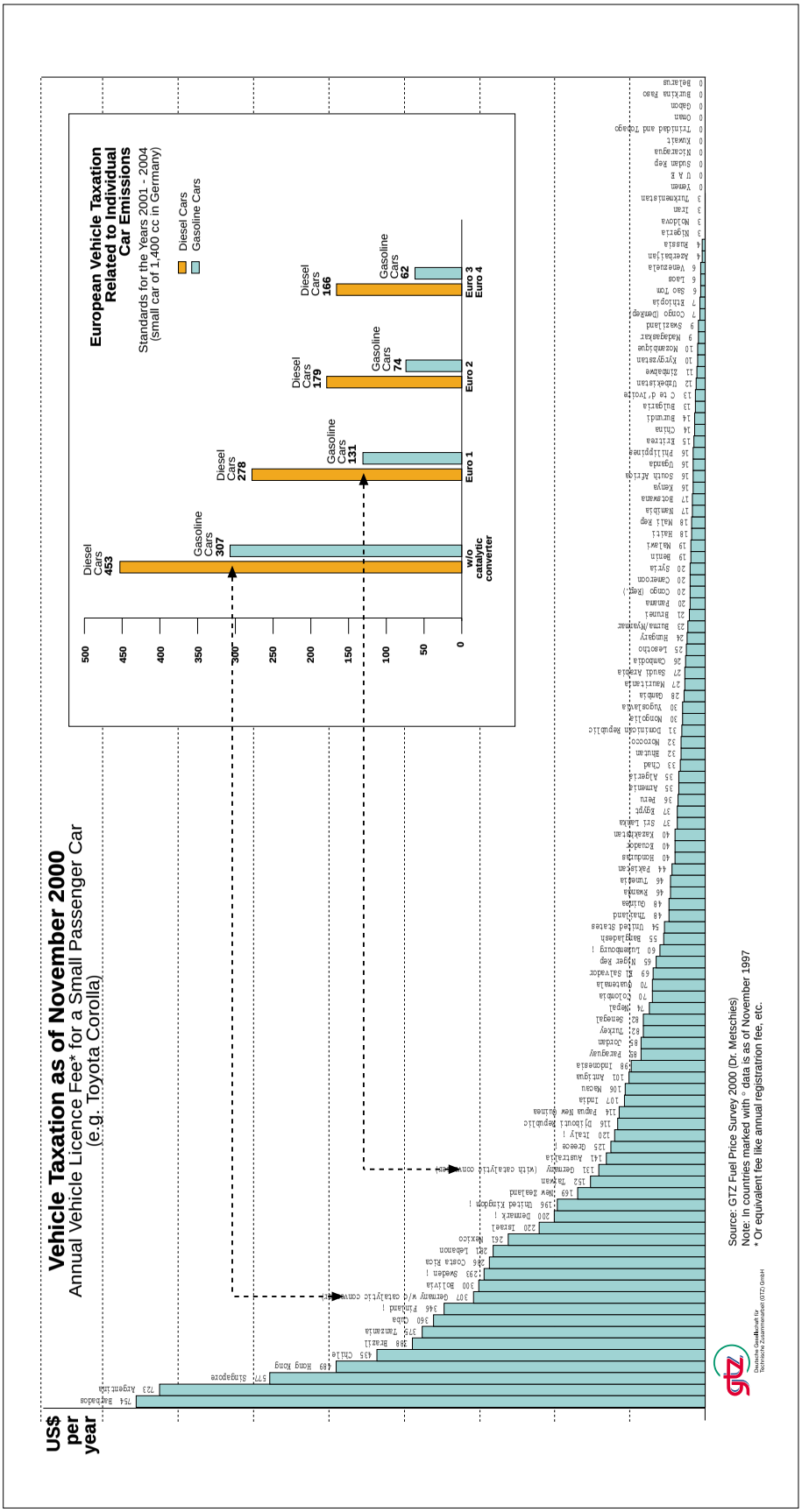


Figure 3.2:
Vehicle taxation for an average passenger car as of November 2000
Source: GTZ, Fuel Price Survey 2000

Best practice case: Vehicle taxation in Germany

Policy background and objectives

Vehicle taxation has always closely followed technical and political developments in transport.

Vehicle ownership has been taxed in Germany since the 17th century. The modern system of vehicle taxation that places a special tax on motorised vehicles was already in place as a state tax in the late 19th century. It has been modified several times in order to meet developments in vehicle technology, transport patterns, revenue and ecological objectives. Today, in Germany, a differentiated system of vehicle taxation offers incentives for drivers to switch to low emission vehicles. This system is applied to both passenger cars and trucks.

Specifications of vehicle taxation

German vehicle tax is differentiated by fuel type and emission level.

Passenger Cars. For passenger cars, engine volume forms the basis of the tax system. The annual tax is levied relative to engine power, i.e. per 100 cc of engine power. The tax is differentiated by both emission levels and fuel types. Diesel engines are generally taxed at higher rates to compensate the lower fuel tax rate on Diesel.

Table 3.2 presents the annual tax levied for a 1,400 cc vehicle per year:

Table 3.2: **Vehicle tax differentiations in Germany** Source: German Federal Ministry of Transport, Building and Housing

Note:
*) The term "3 litre car" refers to a car with an average fuel consumption of less than 90 g CO_2 emission per 100 km.

	Annual vehicle taxaton in Germany Example: 1,400 cc vehicle (e.g. VW Golf, Toyota Corolla, etc.)	
Emission level	Petrol engine	Diesel engine
Euro 4, Euro 3, "3 litre car" *)	65 US$	174 US$
Euro 2	77 US$	187 US$
Euro 1	137 US$	291 US$
reduced emission vehicles (low emission level)	191 US$	345 US$
reduced emission vehicles (medium emission level)	266 US$	419 US$
others	320 US$	473 US$

For environmental reason, the vehicle tax includes an additional incentive to buy low-emission and fuel-efficient cars. For the period of 2000 to 2004 low-emission passenger cars that are registered for the first time get a tax bonus of up to US$ 1,012. The structure of the tax bonus is summarised in Table 3.3.

A tax bonus aims at stimulating the purchase of fuel-efficient and low-emission vehicles.

	Tax Bonus for environmentally friendly cars	
	Petrol engine	Diesel engine
Euro 4, Euro 3, "3 litre car" *)	276 US$	553 US$
"3 litre car"	460 US$	460 US$
Euro 4 and "3 litre car"	736 US$	1,012 US$

Table 3.3:
Tax bonus scheme
Source: German Federal Ministry of Transport, Building and Housing

Note:
*) The term "3 litre car" refers to a car with an average fuel consumption of less than 90 g CO_2 emission per 100 km.

Trucks. The system of differentiated vehicle taxation is also applied to trucks where, again, vehicle classification according to emission and noise levels forms an integral part. All trucks are grouped into one of four categories, and within each category the tax rate is calculated by applying a progressive tax rate to the weight of a truck. Thus the vehicle tax for trucks progressively increases with vehicle weight. This approach is justified as infrastructure requirements are highly dependent on vehicles weight, and the heavier trucks are, the more frequent maintenance will be necessary. However, for each category there is a ceiling which puts an upper limit to vehicle taxation.

Trucks are taxed under a differentiated vehicle taxation scheme as well.

The taxation of trucks (3.5 tonnes and more) is presented in Table 3.4.

	Annual vehicle taxation of trucks in Germany	
Emission and noise classification	minimum tax (for vehicles of 3.5 tonnes)	maximum tax (upper ceiling)
- very low levels	108 US$	600 US$
- low levels	108 US$	921 US$
- medium levels	162 US$	1,381 US$
- high levels	189 US$	1,611 US$

Table 3.4:
Vehicle tax differentiations for trucks in Germany
Source: German Federal Ministry of Transport, Building and Housing

Outcomes and results

Revenues. Vehicle taxation in Germany represents a stable source of national revenues. In 2000, revenues from this tax amounted to roughly US$ 6.4 billion. This represents 1.5 per cent of the national budget.

Conclusions

The German case exhibits important insights:

- It is both technically and economically feasible to raise important contributions to the state budget using fiscal transport measures without compromising the mobility of the population.

- It is possible to implement a vehicle tax system based on ecological considerations and differentiations thereby influencing transport demand shifts to more environmentally friendly transport technologies.

Best practice case: Transition to "Clean Cars" in the Netherlands

Policy background and objectives

The Netherlands used vehicle taxation in order to promote low-emission cars.

European background. Between 1984 and 1993 the European Community gradually introduced more stringent regulations for car exhaust emissions. By 1993 every new car sold in a member state had to comply with standards equivalent to the U.S., including the requirement to use closed-loop catalytic converters. The Dutch government chose to use economic incentive measures in order to implement the EC-directives. Following the different phases of EC regulations, there have been three different stages of incentive measures. These measures often voluntarily exceeded rather lax European minimum requirements.

Specifications of vehicle taxation schemes

The first "Incentive Measure" (1986-88). The first phase of EC discussion was marked by lax regulation. In order to accelerate the introduction of "clean cars" the Dutch government, in 1986, introduced a tax incentive that aimed at approaching U.S. 1983 standards by putting special levies on new cars, only exempting "clean cars", i.e. those cars that complied with EC emission regulation. Differentiated tax reductions were granted to large, medium-sized and small cars whereby different emission standards applied. Due to relatively weak EC emission standards the tax exemptions turned out to be rather generous. Standards could easily be met by many cars – often open-loop converters or slight technical adaptations sufficed – thus the goal of a transition to a closed-loop converters car fleet could not be achieved.

The second "Incentive Measure" (1988-1989). The lenient standards for small cars provided by the EC legislation were only temporary. In 1988 European emission standards were raised. In order to stimulate the sale of cars complying with EC standards the Dutch government revised its incentive measure. Standards for small cars were raised to the level of those for medium-sized ones. For cars complying with the (higher) U.S. standards the maximum tax reduction was granted. For large cars, which already had to conform with these standards under the 1986 provision, this was the only option.

The third "Incentive Measure" (1992-1993). After extensive debate in the EC, a directive was issued stipulating that all new cars were to comply with U.S. standards from 1993 on. The revised Dutch incentive measure came into force in 1992. Revisions were budget-neutral, without changes to the incentive structure.

Outcomes and lessons learned

The examples show that the use of economic instruments in transport policy can effectively induce shifts towards more efficient and environmentally friendly technology.

Lessons learned. The Dutch experience can be summarised in the following remarks:

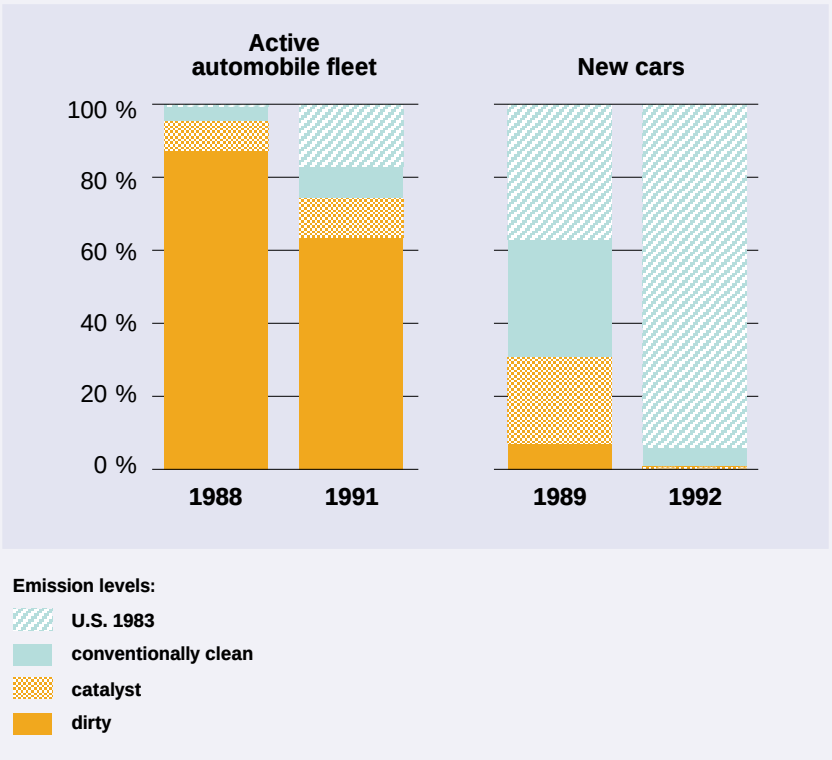
- It is possible to induce major changes in car technology through economic incentive measures. The share of cars complying with U.S. 1983 norms in the active automobile fleet rose spectacularly from 0.6 per cent in 1989 to 17 per cent in 1991. In 1992 94 per cent of all new cars complied with these standards (see Figure 3.3).

- If measures are designed too lax, or standards too lenient, incentives will have no effect. If designed appropriately, transition processes can be fast (the Dutch phase-in of closed-loop converters was accomplished within only 3 years).

- Incentive measures are most effectively introduced when they can be tied to recent or upcoming global technological developments.

- It is feasible to implement incentive measures in a budget-neutral way. Additional cost of converters could be (more than) compensated by tax reductions.

Figure 3.3: **Transition to Clean Cars in the Netherlands: Fleet Composition in the Netherlands**
Data source: Schrama/Klok 1995



Fuel taxation

Fuel taxation as a policy instrument

The basic idea

Recovering variable costs. Fuel consumption can be regarded as a good approximation of road use as it is roughly – though not exactly – related to individual road use. Taxing fuel consumption is the most common form of use charges in road transport. Fuel taxation can effectively be applied to recover variable infrastructure costs. It offers a simple and reliable way of charging the users of transport infrastructure relative to their individual use, and implementation and enforcement is rather easy as the tax can be levied at a few fuel distribution centres.

The variable costs of transport infrastructure should be recovered by fuel taxation.

Improving efficiency. At the level of the individual driver, fuel taxation increases vehicle operation costs. This encourages drivers to make efficient use of their vehicles, and offers a strong incentive to economically use vehicles (and thus infrastructure). In this regard, efficient use of transport goes hand in hand with the efficient provision of transport infrastructure.

Fuel taxation helps make efficient use of transport infrastructure.

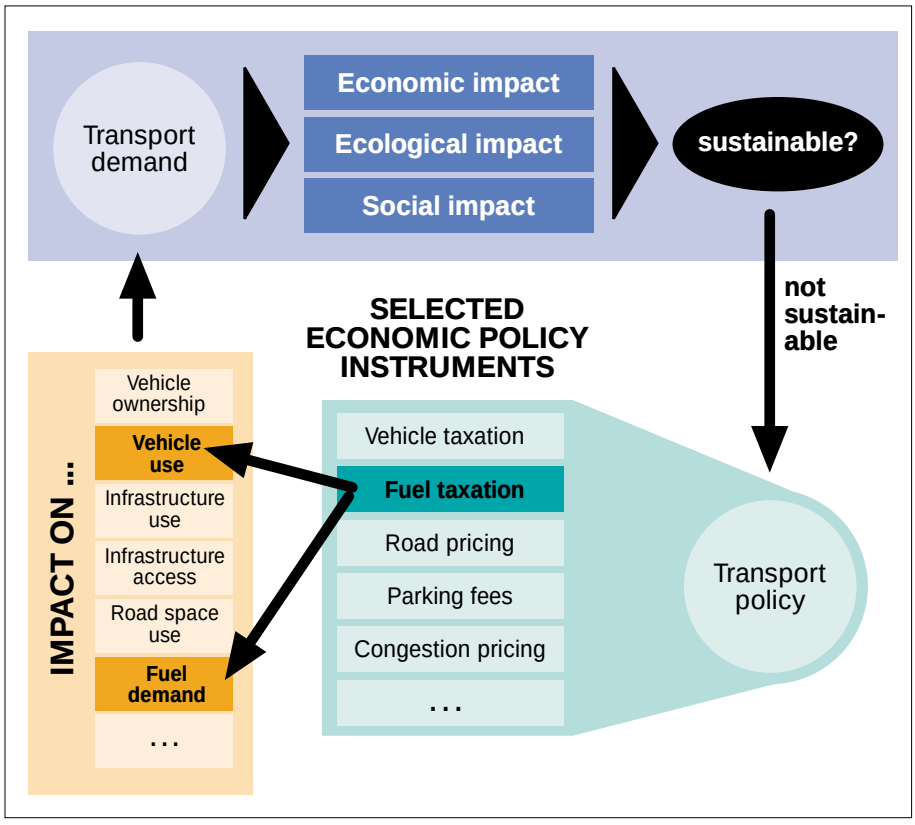


Figure 3.4:
Fuel taxes as part of transport demand management

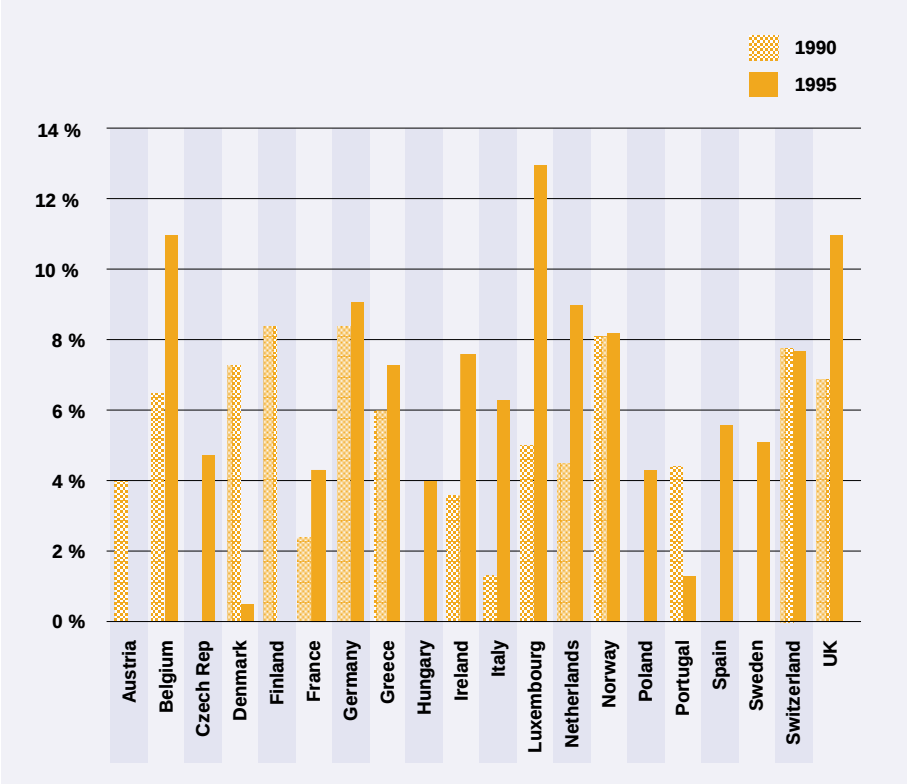
Both the global and the local environment benefits from fuel taxation.

Protecting the environment. Efficiency in the use of transport also serves environmental purposes. With present technology, transport contributes considerably to environmental degradation – both at the local and at the global level. At global level, the burning of fossil fuels like gasoline and Diesel releases high amounts of carbon dioxide which is a major source of global warming. Increasing the price of fossil fuel reduces their use and offers incentives to introduce more fuel-efficient engines or new types of fuels. At local level, emissions of sulphur oxides, nitrogen oxides, hydrocarbons, carbon monoxide, volatile organic compounds (VOCs) and particulates are largely responsible for health impacts like respiratory diseases or even cancer. Imposing a tax on fossil fuels will help shift transport to more environmentally friendly modes like public transport or fuel-efficient vehicles. However, the extent of these shifts is rather uncertain as the reactions of consumers to price increases may be small (so-called small demand elasticities)

Fuel taxation is widely used throughout the world. Regarding the contribution to the state budget, the case of Germany shows that the fuel tax can become one of the three most important sources of revenues.

Figure 3.5:
The price of leaded fuel exceeds the price of unleaded fuel by ... per cent
Sources: OECD

Note:
Germany phased out leaded fuel in 1996.



Optional features

Differentiating by fuel type. In most countries, different tax rates are applied to gasoline as compared to Diesel fuel. In some countries, like Germany, Diesel carries a lower tax burden. The aim is to reduce the burden on commercial vehicles which often run on Diesel fuel.

A differentiation of tax rates may cater for various aspects.

Differentiating by emissions. A differentiated system of fuel taxation, with higher tax rates on high-emission fuels, may induce shifts towards less polluting fuels. In all European countries, for instance, the higher tax levied on leaded fuel significantly contributed to the phase-in of unleaded petrol into the market. Also, in Eastern European countries a mix of tax differentials between leaded and unleaded gasoline and discounted road tax charges for cars equipped with catalytic converters have been successfully applied to phase out leaded gasoline (e.g. in Slovakia). Figure 3.5 gives some examples of price differentials between unleaded and leaded fuels in some European countries. A higher levy may also be applied to fuels with high sulphur content in order to stimulate the use of low-sulphur fuels.

Shortcomings

But there are limitations as well ...

Fuel taxation is only an approximation for road use. Fuel taxation will never exactly relate to the actual variable costs of the use of transport infrastructure. For the time being however, it is the best approximation that can be achieved at reasonable implementation costs. An electronic system to monitor the mileage of each individual car, for example, would provide a much more precise measure for road use – but would also entail significant costs.

... fuel taxation is not exactly related to variable costs.

Fuel taxation cannot be differentiated by location or time of road use. The fuel tax is rather general in its scope as it charges transport in general, i.e. irrespective of where and when transport activities take place. As long as the resulting traffic on roads is evenly distributed, this is no problem at all. But as soon as traffic is concentrated on certain routes (e.g. in urban centres or on express motorways) or at certain peak-times, a general fuel tax is no longer sufficient to efficiently allocate costs to users. On such congested routes the requirements for infrastructure are more demanding and expensive (e.g. more solid roads, additional lanes, etc. are needed) and external costs (such as pollution or time losses due to congestion) are significantly higher. But this is not reflected in the charges resulting from fuel taxation. To cater for the higher costs in congested areas, additional instruments may have to be applied. These issues will be discussed in the subsequent chapters.

... fuel taxation does not address the issue of congestion.

... fuel taxation does not specifically address urban transport issues.

... fuel taxation may face fierce public opposition.

Public opposition on social grounds is possible. It is often argued that low fuel prices are particularly important for low-income groups and that any increase in fuel prices will have unacceptable impacts on the poor. This argument, however, is only partly true. First, in many countries it is the rich that drive cars whereas the poor tend to use public transport. Second, if revenues from fuel taxation are used to improve transport infrastructure, the poor will benefit from this. Third, social concerns are more effectively addressed by separate instruments such as social benefits or family allowances. However, it is true that such instruments are not in place in many developing countries.

... tax revenues do not necessarily go to the country where the driving is done.

Tax evasion is possible. There is one aspect that may be particularly important for small countries and countries with long border lines. If fuel taxation is introduced (or increased) by one country alone, this step will normally result in a price differential between neighbouring countries. This provides incentives for ”refilling abroad” or smuggling of fuels – with the consequence that a significant part of revenues will not go to the country where the driving is done but rather to the neighbouring country. This makes obvious the need for regional co-ordination of transport policy as the incentive for tax evasion can be reduced when a fuel taxation is well co-ordinated with neighbouring countries.

Conclusions

Fuel taxation should be the most important instrument in transport pricing...

The role of fuel taxation in a transport pricing policy. Fuel taxation should be regarded as the predominant economic instrument in the transport sector. It creates revenues, shares the burden among the road users relative to their use, promotes efficiency in both the use of vehicles and transport infrastructure, and contributes to environmental protection.

... but it should never be the only instrument.

On these grounds, there have been discussions in many countries to only levy fuel taxes, and to completely substitute all other transport levies such as vehicle tax by fuel taxation. The reasoning is that such an approach would represent a strong incentive to firmly restrict vehicle use. Empirical studies, however, show that the mere car ownership has large influence on car use. Once a person owns a car, that person is very likely to also use the car. Therefore, the instrument of vehicle taxation plays an important role in discouraging car ownership – with the secondary effect of reducing car use as well.

There should always be a well-balanced mix of instruments that is adequate to the local conditions.

To conclude, fuel taxation is the most important instrument in transport policy. It should form the basis of a comprehensive pricing system aiming at both recovering costs and effectively channelling transport

demand. But depending on the individual national and local conditions it should always be supplemented by other instruments as well. Transport issues are just too complex to be comprehensively addressed by one instrument alone.

Gradual implementation needed. It should be noted that there is always some strong public resistance to fuel taxation. In many cases cheap fuels are regarded by public opinion as a basic right. Opposition to fuel taxation, however, should not be seen as an insurmountable obstacle to the introduction or increase of fuel taxes. It should rather be a reminder that increases should take place gradually (e.g. with no more than 10% increase at a time) and that the building-up of public awareness is very important. In many European countries fuel tax increases follow a foreseeable schedule with small but continuous tax increases. These are announced well in advance in order to reduce public resistance and to allow consumers to take foreseeable medium-term fuel price increases into account when buying a new (and hopefully fuel-efficient) car.

Increases in fuel taxation should be implemented gradually and in a foreseeable manner.

International experience: Fuel taxation in the world

Fuel taxation is one of the Economic Instruments with the highest potential for revenue generation. World-wide comparisons of fuel prices show that fuel price levels vary significantly.

The GTZ Fuel Price Survey 2000 compiled data of fuel prices for Diesel and premium gasoline. The results are summarised in Figure 3.6 for Diesel and in Figure 3.7 for premium gasoline.

According to the these figures it is possible to distinguish four types of fuel price regimes that can be found in developed and developing countries.

Table 3.5:
Fuel price regimes
Source: GTZ Fuel Prices and Taxation, 2001

Fuel price regime	Examples from developed countries	Examples from developing countries	Gasoline prices per liter in 2000 [US cents]
High taxation	EU countries, Hong Kong	Côte d'Ivoire, Bolivia, Burundi	**> 72**
Medium taxation	South Africa, Austalia, Canada	Chile, Cameroon, Malawi	**48 - 72**
Low taxation	USA	Ethiopia, Vietnam, China	**33 - 47**
Subsidised fuel prices	Saudi Arabia	Turkmenistan, Indonesia, Iran	**2 - 32**

Potential for revenue generation. To assess the potential for national revenues from fuel taxation, national fuel consumption has to be multiplied by the envisaged tax rates. As an example, in Table 3.6 potential revenues of an increase of 1 US cent per litre are calculated for selected countries.

Country	Annual fuel consumption 1996 (both Diesel and gasoline [Mio litre]	Potential revenues of an increase of fuel tax of 1 US cents [Mio. US$ p.a]
Burkina Faso	152.1	1.5 Mio US$ p.a.
Kenya	1,092.5	10.9 Mio US$ p.a.
Bolivia	1,013.5	10.1 Mio US$ p.a.
Mexico	40,423.5	404.2 Mio US$ p.a.
Thailand	15,793.7	157.9 Mio US$ p.a.

Table 3.6:
Potential revenues of a 1 US cents fuel tax increase for selected countries
Source: GTZ Fuel Prices and Taxation, 2001

These rough estimates are based on fuel consumption levels as stated in the ”IRF World Road Statistics 2000”.

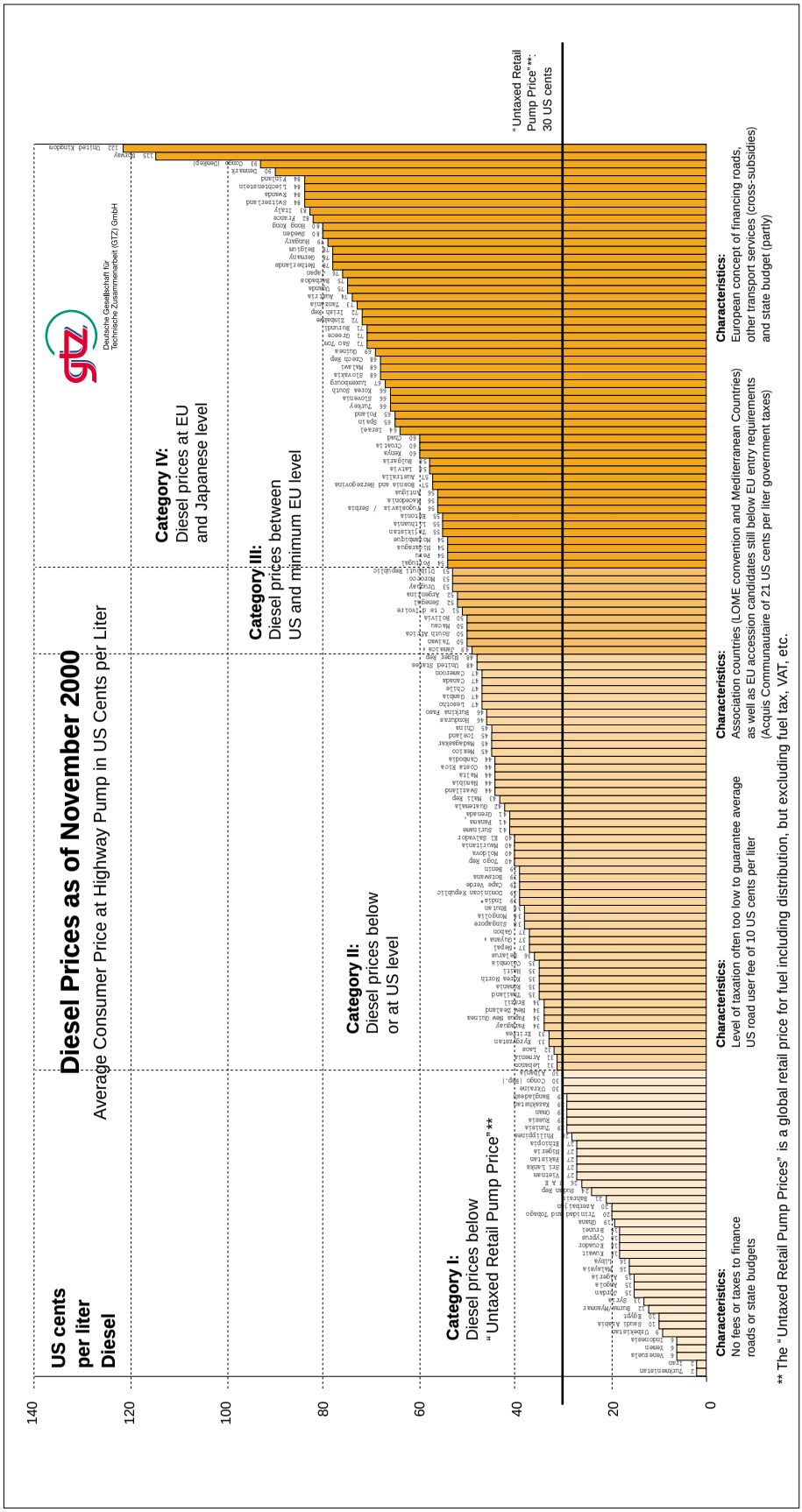


Figure 3.6:
Diesel prices as of November 2000
Source: GTZ, Fuel Prices and Taxation, 2001

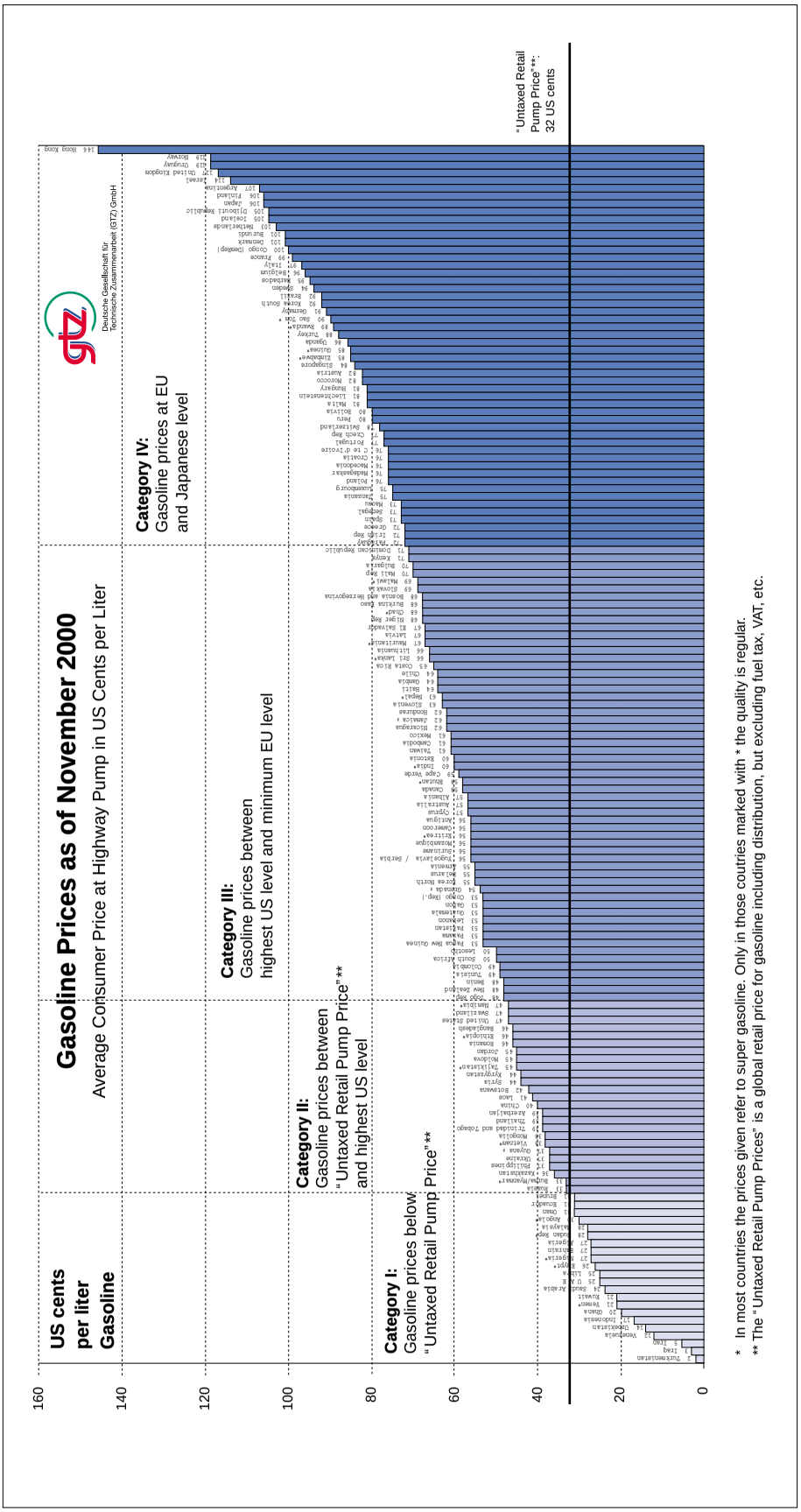


Figure 3.7:
Gasoline prices as of November 2000
Source: GTZ, Fuel Prices and Taxation, 2001

Best practice case: High fuel taxation in Germany

Policy background and objectives

Fuel taxation serves both fiscal and environmental purposes.

Petroleum taxation in Germany dates back to the 19th century. Since then, taxation has been expanded in a step by step manner from petroleum to Diesel, and to several petro-chemical and oil products. As in all other European countries, fuel taxation plays a major role in generating revenues which can be used for the financing of the transport infrastructure. In addition to the mere fiscal aspect, fuel taxation is increasingly used for environmental and energy political objectives. Therefore, in Germany the fuel tax system also includes an environmentally-oriented element, the so-called "Ökosteuer" (eco-tax). The eco-tax element is intended to specifically increase fuel prices in order to create incentives for higher fuel efficiency.

Specifications of the German fuel tax system

The German fuel tax is levied on producers of fuel and oil products. Tax incidence, however, is shared by supply and demand. The tax rates are differentiated by fuel type and, starting in autumn 2001, also by the criterion of sulphur content. As of January 2002, the tax rates on fuels in Germany are as follows:

Table 3.7: **Fuel tax differentiations in Germany**
Source: German Federal Ministry of Transport, Building and Housing

	Fuel taxation in Germany (tax per litre)	
	Gasoline	Diesel
high sulphur content (> 50 mg per kg)	**0.58 US$** (of which 0.11 US$ as eco tax)	**0.42 US$** (of which 0.11 US$ as eco tax)
low sulphur content (≤ 50 mg per kg)	**0.56 US$** (of which 0.09 US$ as eco tax)	**0.40 US$** (of which 0.09 US$ as eco tax)

As fuel should be regarded as any other commercial good, VAT has to be levied on all fuels.

Fuel taxation and VAT. These tax rates amount to more than 50 per cent of the respective retail prices. Fuel is treated as any other good, therefore, an additional value added tax (VAT) of currently 16 per cent is levied as well. This lifts the overall tax element of fuel retail prices to a total of almost 70 per cent of the final pump price.

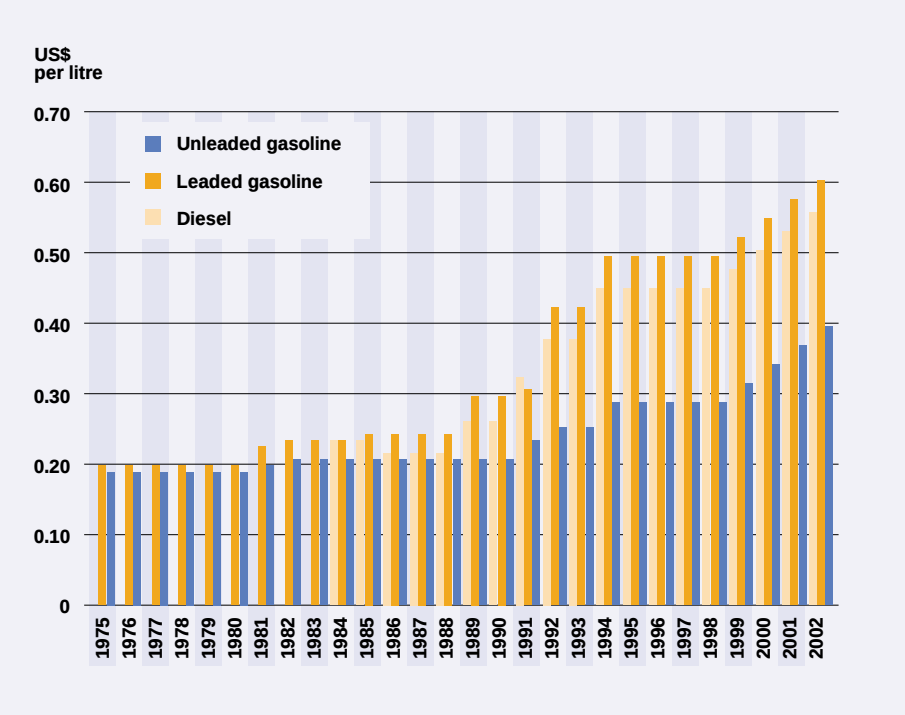


Figure 3.8:
Fuel tax rates in Germany
Sources: German Federal Ministry of Transport, Building and Housing

The eco-tax component of German fuel taxation. The environmentally oriented tax element ("Ökosteuer", eco-tax) was introduced in 1999. The aim was to steadily increase fuel taxation over a period of six years by 0.03 US$ per year. The eco-tax is not only applied to fuels but to energy-use in general, e.g. it is also levied on electricity etc. The intention is to make the use of energy more expensive in order to stimulate fuel efficiency. This direct effect is called the "first dividend" of an eco-tax.

The eco-tax was introduced in a gradual and foreseeable manner.

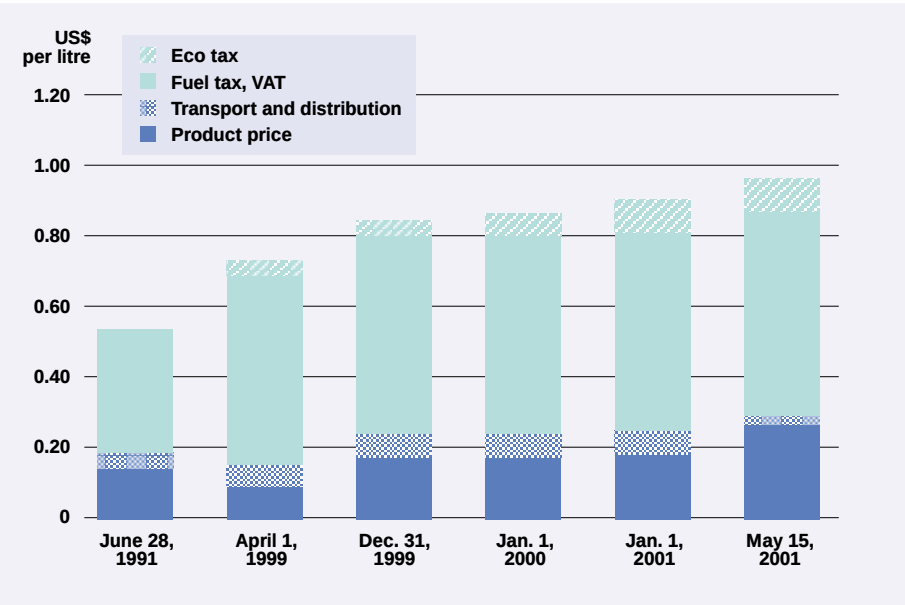


Figure 3.9:
Price of regular gasoline in Germany
Source: Shell

The revenues of the eco-tax are earmarked for the national pension scheme; they directly reduce pension premiums and thus labour costs. This effect makes labour cheaper (relative to energy prices) and offers an incentive to increase labour-intensity (relative to energy intensity). This effect is called the ”second dividend” of an eco-tax.

Outcomes and results

The fuel tax is the third most important tax.

Revenues from fuel taxation. The revenues are part of the general budget, representing the third most important tax in Germany. In 2000 revenues from the fuel tax in the transport sector amounted to about 64 billion DM (US-$ 28 billion) which represents about 7 per cent of the national budget.

Demand and supply side react to incentives to switch to low emission vehicles.

Effects of the eco-tax element. The eco-tax induced fuel tax increase was implemented in a foreseeable manner as the schedule for increases was announced early on. This provided incentives to switch to more fuel-efficient driving patterns in the short-term – and to buy more fuel-efficient cars in the medium- to long-term. Both drivers and the automobile industry have started to react accordingly, and fuel consumption has decreased a little. (However, this effect was also intensified by the significant increases in retail prices due to exploding world market prices for petroleum products.)

Public opinion and public support are crucial.

Nevertheless, it has to be added that the introduction of the eco-tax in Germany led to fierce public opposition that was reinforced by emotionalising media coverage. This, however, was a rather temporary effect that waned after a while. Nevertheless it proved the necessity to create public awareness for environmental issues early on as public support is crucial.

Lessons learned

The German experience with fuel taxation contains a number of useful lessons. These can be summarised as follows:

- The timing of strategies, and long-term implementation and adjustment periods is important. Every fuel tax increase causes intense public discussions and resistance. In order to reduce friction over an adjustment, public acceptance should be built through awareness campaigns and the planning of long and foreseeable adjustment periods.

- It is possible to introduce Economic Instruments that allow both for revenue generation, and for internalisation of external costs.

- It is technically feasible to enforce a fuel tax regime. There are few enforcement problems and low administrative difficulties because fuel tax is collected centrally from a few oil companies.

- Transparent prices can contribute to achieving long-term changes in transport use.

- Fuel taxes can be implemented with significant differentiation.

- It is possible to include economic incentives to promote changes in the use of transport and to foster the technological development of cleaner cars.

- Public acceptance can be raised using taxation schemes based on social and ecological differentiations. In Germany, revenues from the eco-tax were earmarked in order to lower social security contributions. This increased public acceptance as all revenues were redistributed.

Experiences with the Environmental Trust Fund in Mexico

Policy background and objectives

Mexico City has experienced serious environmental problems and health risks from traffic pollution. Continuing increases in population and car ownership magnify these threats. As part of an environmentally oriented response, a combined city-state approach was introduced in 1992. The strategy involves a number of measures aimed at improvement and implementation of alternative energy sources for vehicles. It offers ample and efficient public transportation, the integration of

Mexico City (view of Popocatepetl Volcano) on a day without and with high pollution
Source: http://www.sima.com.mx/sima/df/volcang.html

metropolitan development policies (urban development, transportation and environment), the introduction of economic incentives in transport demand management, the inspection and oversight of fixed and mobile sources, and environmental information, education and public participation.

As part of the strategy focusing on mobile emission sources, two major steps were taken. On a national level fuel taxes were (sur-) charged in order to internalise (part of) the external costs of transport. In addition, the revenue raised until 1998 was dedicated to a so-called "Environmental Trust Fund". Its only purpose was to finance environmental projects in Mexico City.

Specifications of the ETF system

The Mexican ETF system consists of two core elements:

- **Fuel tax increase by 1 US-Cent per litre gasoline** which is levied and received by the central government (Ministry of Finance);
- **Earmarked reallocation of revenues** to ETF-financed projects such as credit schemes for vapour recovery systems at gas stations, rehabilitation of nature to increase absorption capacities for pollutants and particles (e.g. Texcoco lake), purchase of CNG vehicles[1] for police, the financing of environmental public awareness campaigns, etc.

Dedication of ETF resources is decided by the environmental commission of Mexico City, the State of Mexico and the central government.

1 CNG = Compressed Natural Gas

Outcomes and results

Between 1992 and 1998 the ETF received roughly 70 Mio. US$. These funds have been dedicated to the aforementioned projects. Since 1998 however, after a shift in political power, the Mexican Ministry of Finance has stopped payments to the ETF. Despite several initiatives the payment scheme has not been reactivated in its initial form yet.

The initiation of the ETF programmes has contributed to an amelioration of the pollution situation in Mexico City. However, in the last years, due to increasing traffic and a modal change in favour of private car use Mexico City faces again deteriorating health and pollution levels.

Lessons learned

The Mexican experience can be summarised by the following core theses:

- It is possible to design and implement simple mechanisms that will have a large impact in the recovery of external costs and the alleviation of environmental problems.

- Fuel taxation is an administratively easy means to generate revenues for environmental projects, and fuel taxes provide a broad and secure basis for long-term financing of earmarking schemes.

- Fragmented institutional powers pose a risk to a comprehensive and continuously working system. In particular, dependency on political factors increase the risk of failure of programmes.

Further information: A similar fund (”Air Quality Management Fund”) has recently been established in the Philippines. For further information please check http://www.hangin.org/legal/irr/index.html.

Road pricing

Road pricing as a policy instrument

The basic idea

The rationality behind road pricing. Road pricing is an exact and efficient way to charge road users their actual road use. It can be differentiated by vehicle type or time of the day. Road pricing may be applied to the overall road network or to particular roads or bridges. As the implementation of a general road pricing scheme is considered as technically too ambitious, road pricing is normally applied to selected routes only. It is then either implemented in order to recover investment costs for expensive infrastructure such as express motorways and bridges or to impose an extra charge on the use of congested roads. In the latter respect, road pricing is often referred to as congestion pricing: it represents an incentive for drivers to refrain from using these roads.

Road pricing creates revenues for transport infrastructure investment and contributes to congestion management.

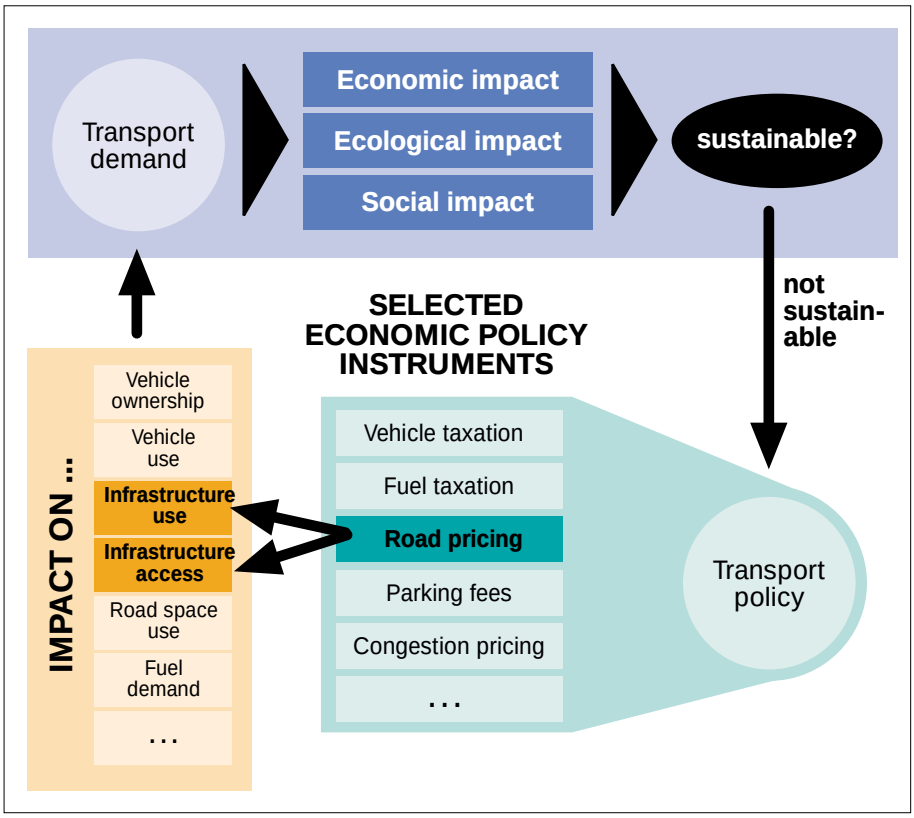
Optional features

Road pricing can take many forms.

Road pricing may take the form of:

- **A general road pricing scheme** for the complete road network (which is often considered as too expensive to implement);
- **Tolls** (which are often used to recover investment and maintenance costs of motorways or bridges);
- **Urban road pricing** can take different forms: **congestion pricing** restricts the use of congested urban roads and reduce the need for network extensions; **area licensing** imposes a charge on the actual road use in cities; and **cordon pricing** is equivalent to an entrance fee into a city.
- **Vignettes schemes** (which can be seen as a fee for temporarily accessing certain road networks, e.g. express motorways);
- **An electronic mileage-tax for Heavy Goods Vehicles** as introduced in Switzerland or under preparation in Germany (in order to effectively tax transit cargo transport).

Figure 3.10:
Road pricing as part of transport demand management



Generating revenues. In an increasing number of cases, toll schemes are implemented to finance infrastructure investment. In many instances private investors are involved on the basis of BOO/BOT models (build, own, operate / build, own, transfer) where the private sector invests in infrastructure and is allowed to recover investment costs by collecting tolls for a certain period of time.

Road pricing is a way to finance the upgrading of expensive infrastructure such as motorways and bridges.

Pricing congestion. In urban areas, tolls (referred to as urban road pricing or congestion pricing) are not necessarily raised for financing purposes but rather as an incentive not to use congested areas. In many densely populated urban areas it is virtually impossible to provide sufficient road capacity to meet peak time demand. Urban road pricing then tries to restrict that demand by increasing travel costs. Urban road pricing may refer to single roads (toll roads), to cordon boundaries (cordon pricing), or to complete areas of a city (e.g. the central business district). Urban road pricing will be discussed in Chapter 4.

Road pricing can reduce congestion and the external costs that are induced by congestion.

Shortcomings

Unwanted traffic diversion is possible. Whenever road pricing is introduced, transport authorities may expect drivers to evade priced roads. If this contributes to levelling off peak travel, it represents the desired effect. In many cases, however, this may be an unwelcome effect when, for example, large shares of traffic divert from motorways to secondary roads going through populated rural areas and villages. In order to keep such diversions within acceptable limits, the actual level of road pricing should not be too high. As long as the price differential between priced and unpriced roads is small, traffic diversion will not be a major problem, as any diversion is always counter-balanced by the burden of additional travel time. The other option in order to avoid traffic diversion is to subject all alternative routes to road pricing as well.

Road pricing may induce unwanted changes of travel routes.

Equity and acceptability issues may cause problems. As any road pricing scheme puts an additional financial burden on car users there are ”winners” and ”losers”. The group of ”winners” clearly includes those who use (improved) public transport. The effects of car users is less straight forward. Some will definitely benefit from reduced congestion, shorter journey time and improved road quality. For other, however, the increased costs of individual car use may make it impossible for them to use their car. They may have to change mode to public transport, if available, and thus benefit from improved public transport. However, if public transport is not available for them, high transport costs may be regarded as an ”isolation tax”.

Road pricing may require additional redistributional measures.

Equity deficits have the potential to reduce public acceptance for road pricing schemes. To resolve these problems it might be necessary to introduce supporting measures for a road pricing strategy such as:

- **direct rebates to low-income groups**, and ”isolation reimbursements”,
- **public transport subsidies** for low-income users (direct transfers),
- **increased supply of public transport**, subsidised public transport fees.

Road pricing requires adequate technical infrastructure.

Implementation is technically demanding. The availability of technical infrastructure for the charging process is a prerequisite for road pricing. It may be done by manual fee collection at tolling stations. This, however, can be a time-consuming process that hinders traffic flows. Automatic electronic pricing may be more convenient but a considerable amount of investment is necessary for such installations.

Conclusions

Road pricing can be a sensible element in a comprehensive pricing policy.

Road pricing can only be a part of a transport pricing policy. As long as road pricing cannot be applied to the overall road network it should never be the paramount instrument to generate revenues for the financing of transport infrastructure. One major reason is that pricing levels would necessarily have to be high and unwanted traffic diversion would thus be considerable. Only when other sources for revenues are available, road pricing can be at moderate levels and diversion effects will be moderate. Therefore, as long as comprehensive road pricing is not feasible, it should mainly be seen as a pricing instrument to finance particularly expensive parts of the road network (e.g. bridges or motorways) or to specifically address road congestion in urban areas (see urban road pricing as discussed in Chapter 4).

Road pricing should be integrated into broader land-use and transport development concepts. There are plenty of cautionary tales that highlight the danger of the isolated and uncoordinated application of road pricing. Even promising project such as the M1 motorway in Hungary ended up in severe financial situations when they were not embedded into comprehensive network concepts. Another example is the second

Tagus bridge in Lisbon/Portugal, where the independently developed pricing scheme for the project failed, upon which an integrated system that also included the first bridge had to be developed.

Public awareness needed. As with all other economic instruments, road pricing will most likely face public criticism. Again it is important to take that resistance seriously and to openly address it. Public awareness of the negative effects of congested roads (such as increase in travel times, noise, pollution, accidents, etc.) should be created early on.

If road pricing is introduced in a predictable and gradual manner, opposition is less severe.

Keep it simple. Whenever road pricing schemes are to be implemented for the first time, the technical design should be kept simple at first. Tolling plazas with manual fee collection will be sufficient in the initial phase (and will even create jobs). Only later on, when road pricing has proven successful, more sophisticated tolling technology may be introduced.

Best practice case: Road pricing of highways, and toll roads in France

Specifications of the French road pricing system

Toll roads are operated by private companies...

Network elements. In France more than 42 per cent of all expressways are tolled roads. A network of more than 7,300 km is operated by a total of 10 motorway companies, covering specific sections of the network (see figure 3.11). Most companies were established in the 1960s. The biggest company is ”Autoroutes du Sud de la France” (ASF), operating a network of about 2,000 km of mostly 2x2- but also 2x3- and 2x4-lane motorways.

...which work on a concession basis...

All companies work on a concession basis: They are responsible for the construction and financing of motorways, as well as for the efficient operation, with particular attention being given to optimal traffic flows and

Figure 3.11:
The toll road system in France
Source:
www.autoroute.fr

road safety. To recover costs, the concessionaires are allowed to charge motorists for the use of motorways. To this end, they operate a large number of tolling plazas throughout their networks.

...under government control.

All companies are set up as private companies, but with capital being held by public entities, either directly or via the governmental agency ”Autoroute de France”. Both the national government, regional bodies (départments) and local authorities (cities and towns) hold shares of the companies. This is also reflected in the composition of the company boards. Sometimes local or regional Chambers of Commerce and Industry hold shares as well.

The only exception from the prevailing public ownership is the concessionaire ”Compagnie financière et industrielle des autoroutes” (Cofiroute). This company is run by private investors with private capital only. It operates a total of about 800 km of motorway in the region south-west of Paris. Major shareholders of Cofiroute are construction companies, a major French bank and a large French insurance company.

Toll differentiations. Tolls are differentiated by both vehicle type and route. On average a toll of 7 US cents per km is charged. An example of tolls for the 770 km route between Paris and Marseille is given in Table 3.8.

Table 3.8:
Toll rates in France
Source:
www.autoroutes.fr

Vehicle categories	Toll for a single trip between Paris and Marseille (approx. 770 km)	
	Total toll for that route	Toll per kilometer for that route
Class 1: Passenger car	39.1 US$	5.0 US cents
Class 2: Passenger car including trailer	51.45 US$	6.7 US cents
Class 3: Truck, up to 3.5 tonnes	82.87 US$	10.8 US cents
Class 4: Truck, more than 3.5 tonnes	114.56 US$	14.9 US cents
Class 5: Motorbike	23.46 US$	3.1 US cents

Outcomes and results

Revenues. In 2000, all companies together had total revenues of approximately 4.86 billion US$ out of which investment of about 1.71 billion US$ was financed. In the late 1990s revenues were mainly allocated to road construction (49 %), tax payments and VAT (31 %), salaries (19 %), and inspection and maintenance of the existing road network (4 %).

Lessons learned

1. It is technically feasible to implement a nation-wide road pricing system.

2. It is institutionally feasible to commercialise implementation and operation of a national road pricing system.

3. It is possible to charge full internal costs of transport according to road use, and it is possible to raise enough revenue for network extension and improvement.

Further Information. English-language information about French toll roads can be found at the website of the ”Association des Sociétés Francaises d’Autoroutes” at http://www.autoroutes.fr. On this website links to all concessionaire companies can be found as well.

Chapter 4

The provincial and urban level: meeting the local needs

Increasingly, cities and regions in developing countries adopt incentive-based transport strategies in order to raise local revenue and alleviate congestion and environmental problems in urban areas. Nevertheless, there is no blue print as to how to successfully manage transport demand on the local level. It should always be borne in mind that sound transport measures based on Economic Instruments:

- **are highly city-specific**, depend on city size, level of development, road networks and transport demand characteristics, cultural and educational factors that determine transport behaviour, flexibility in transport mode choice, public acceptance, institutional capacities to introduce and enforce measures, local institutional and jurisdictional independence from national transport policy frameworks;

- **are most effective if applied as part of a comprehensive transport strategy** as outlined in chapters 1 and 2;

On the regional and local level important Economic Instruments which are implemented in many countries include:

- **Surcharges on national/federal measures** (see section 4.1),

- **Parking fees** (see section 4.2),

- **Urban road and congestion pricing** (see section 4.3).

These measures will be discussed in more detail below.

Surcharges on national/federal measures

Surcharges as a policy instrument

The basic idea

Local charges to better meet the local needs.

Supplementing a national policy. Local conditions are often distinctly different from national conditions. To cater for these differences, in many countries Economic Instruments in transport are set at the national (federal) level to meet the basic national needs, but local governments/authorities are allowed to levy a local/provincial surcharge on these charges.

Local surcharges create local revenues and contribute to local transport demand management.

Creating revenues, managing local transport. Good examples for such surcharges

- are locally differentiated levies on vehicle taxation,
- transport-related surcharges on national/federal income- and company-taxation,
- fuel charges (“pay-at-the-pump charges”) or
- additional local road pricing.

Local surcharges serve two objectives: to create local revenue, and to manage transport demand. Revenues are often fed into the local budget, or they are directly used for new transport investment and maintenance. Often the revenues are assigned to different, well-specified purposes (e.g. maintenance fund, urban roads fund, public transport fund) according to fixed ratios.

Shortcomings

Tax evasion is easier at the local level.

Local surcharges can lead to evasive reactions. If transport users have the opportunity to evade a local surcharge, they will seize it. For example, local surcharges on a national vehicle tax create an incentive for car owners to register their vehicles in the province with the lowest additional levy. Likewise, a surcharge on a national fuel tax creates an incentive to refill in the least expensive province. This evasive action, however, will always involve additional travel, and the risk of evasive behaviour will decrease with the size of a province. Only drivers in the fringe regions may still profit from evasion.

The necessary legal framework is not always in place. To impose local surcharges, the local authorities/governments must have the legal autonomy to levy such charges. National and local legislation does not always provide the legal grounds for such measures.

Local authorities must have the autonomy needed to implement local policy measures.

Conclusions

Local surcharges can help to adapt transport policy more adequately to the needs at the local level. The instrument, however, requires local political autonomy and capacities. It supports but cannot replace purely local transport strategies.

Best practice case: State-surcharges on fuel taxation in the U.S.A.

Policy background and objectives

Fuel taxation in the United States is based on a two-tier approach, with both a national and a local (State) element. Historically, the State fuel tax was introduced in most US States well before a national/federal tax. The initial purpose of the national/federal fuel tax, which was introduced in 1932, was to reduce the federal budgetary imbalance of that time. Only later on, revenue generation for the transport sector became an issue.

Fuel taxation in the U.S. consists of a national base charge and a local (state) surcharge.

Specifications of the U.S. state-surcharges on fuel tax

State surcharges are imposed by the States. There is a lot of variation in State surcharges, with State fuel tax rate ranging from 3.0 to 10.5 US cents per litre gasoline or Diesel (2001 data). Federal, State and final fuel tax rates per litre fuel as of January 2001 are summarised below:

Table 4.1: **Fuel tax surcharges in the U.S.** Source: International Fuel Tax Association (IFTA), and US Department of Transportation

	Federal Fuel Tax [US cents per litre]	State Fuel Tax (range) [US cents per litre]	Final Fuel Tax [US cents per litre]
Gasoline	4.9	3.0 - 10.5	7.9 - 15.4
Diesel	6.4	3.0 - 10.5	9.4 - 16.9

Federal revenues are earmarked and fed into a special fund, the Highway Trust Fund.

The revenue from the federal fuel tax is fed into the federal Highway Trust Fund which was established in 1956. The revenue of the fund (approximately 28 billion US $ in 1999) is mainly used for construction, resurfacing, restoration and rehabilitation of the interstate highway system (from the so-called Highway Account of the Highway Trust Fund) while about 10 per cent of the revenues are dedicated to the Mass Transit Account to finance public transport improvements. Currently the federal fuel tax amounts to 4.9 US cents per litre gasoline and 6.4 US cents per litre Diesel.

Revenues on state-level are used for construction, maintenance, and management of local streets and roads, the State highway system and for State and local public transport. Most States assign revenues to the various expense categories by using a fixed ratio of distribution. For example, the State of California assigns about 64 per cent of its State fuel tax revenues to the State Highway system. 20 per cent of revenues go to the counties and are distributed according to the counties' shares of vehicle registration and road mileage. The remaining 16 per cent are assigned to the cities of the State, basically in proportion to population.

Further Information. A brief but comprehensive summary of fuel taxation in the U.S. can be found in the "Congressional Research Service Issue Brief for Congress", RL30304 by Louis Allen Talley, which is available at www.cnie.org/nle/trans-24.html. For detailed information about tax levels, Trust Fund revenues etc. see, the U.S Federal Highway Administration (www.fhwa.dot.gov) and the website of the International Fuel Tax Association (www.iftach.org).

Parking fees

Parking fees as a policy instrument

The basic idea

Implementing the "user pays principle". In most countries, parking is provided free of charge or at a subsidised rate. Such subsidies are, for example, provided by companies offering parking space free of charge to their employees, or by municipalities that do not charge for on-street parking. Providing parking facilities, however, involves considerable costs that should be passed on to motorists. Estimates for urban areas in the United States show that costs for the provision of one parking space amounts to US$ 1 to US$ 5 per day.

The use of urban parking space has to be charged.

Generating revenues. Parking fees may create considerable revenues for the local municipality. In many developed cities, fees for public parking are in the range of 1 to 2 US$ per hour. In developing mega cities parking fees may be at similar levels. In Buenos Aires/Argentina, for example, parking fees at private car parks amount to about US$ 2 per hour (and US$ 8-10 per day). Although these private car parks also include a guarding component, it shows that a willingness (and ability) to pay for parking exists.

Parking fees can create local revenues.

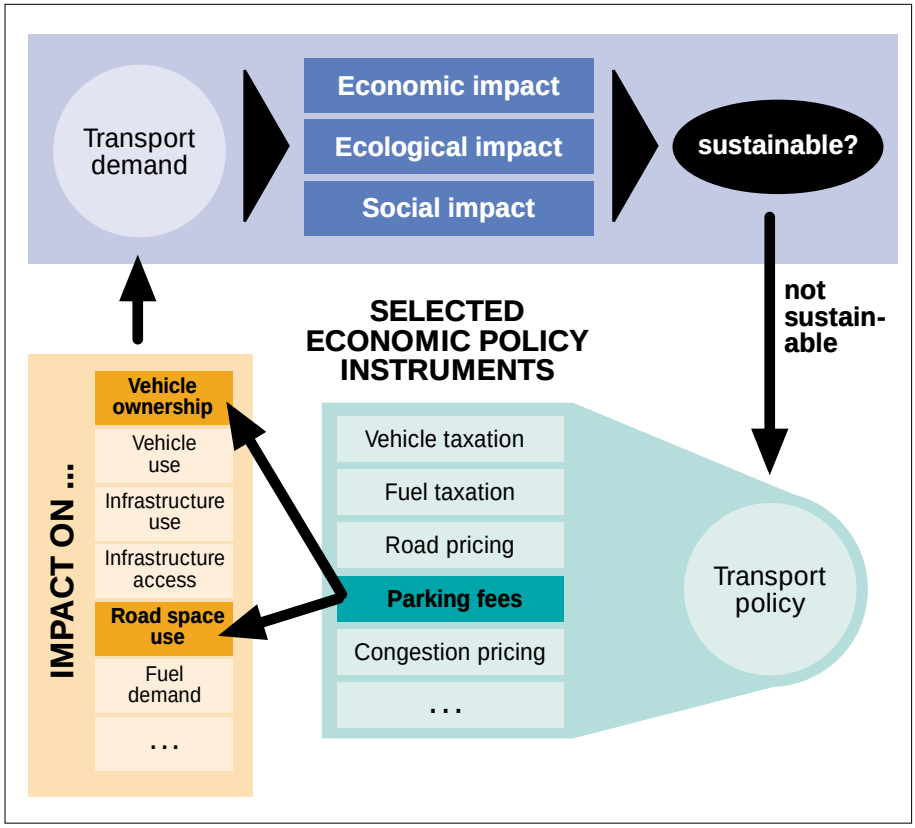
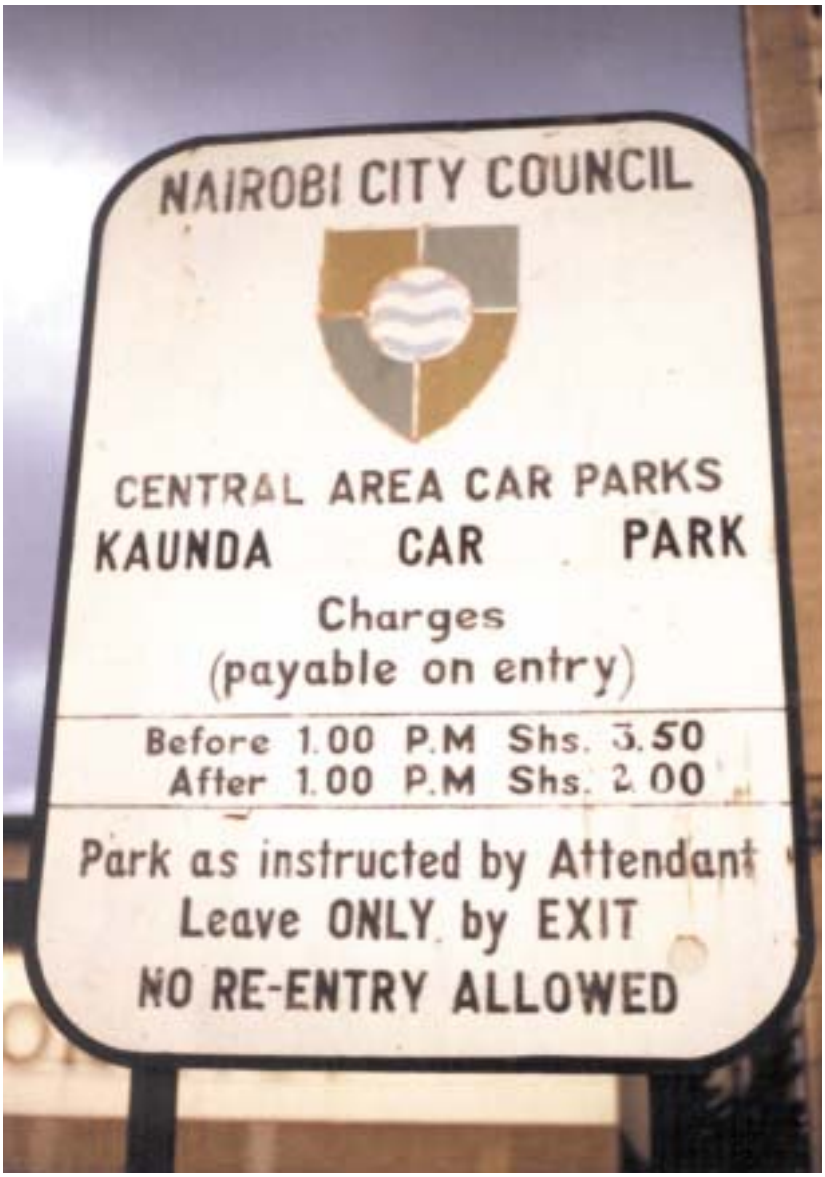


Figure 4.1:
Parking fees as part of transport demand management

A municipality levying parking fees in the range of US$ 4 per day could create annual revenues of about US$ 1 million per 1,000 parking slots under control. Enforcement costs would be significantly below 10 per cent of these revenues so that parking fees may open up a rich financial source for the municipality's budget.

Restricting parking in urban areas helps reduce congestion.

Reducing congestion. By introducing parking fees, car use in urban areas becomes more expensive and thus less attractive to many motorists. This can help reduce inflow traffic and congestion in urban areas. When combined with a consequent policy of limiting parking space, parking fees have also proved successful in stimulating commuters to switch from private cars to the use of public transport. This contributes significantly to the reduction of congestion, as commuting is the main cause of peak time congestion.



A step towards urban road pricing. In many cities, the introduction of parking fees is regarded as a first step towards more sophisticated schemes of pricing urban traffic. Parking fees are rather easy to implement and they gradually make urban road users aware that driving within the city cannot (and will not) be free of charge. It thus helps to create awareness for and acceptance of pricing schemes in general. In the medium- to long-run, road pricing may then be introduced as well, maybe in the form of a cordon around the central business district.

Optional features

Basically, parking fees can be charged on-street (metered on-street parking, ticketed on-street parking), or off-street (public parking space, private car parks). Some criteria for creating differentiation in parking schemes and their corresponding charges are

- area/zone, in order to reduce parking in crowded inner city regions through the use of higher charges;
- time of day, in order to discourage long-term parking by solo commuters through peak parking surcharges;
- calendar day, in order to distinguish between weekday commuter parking and weekends;
- duration of stay, in order to set incentives for short-term parking, and to set incentives for commuters to use certain parking areas designated for long-term parking;
- vehicle type/size, in order to provide disincentives for single-occupant vehicles, etc.

Providing parking space for residents. If residents in the city centres are not provided with adequate parking facilities, there may be an incentive for them to leave the city centres and to seek suburban residential areas. This would create additional commuting traffic. For that reason, parking fee schemes should always include reduced charges for residential use. In many cities, special parking permits are issued to residents.

The needs of residents must not be neglected.

Integrating private parking space into the charging scheme. There is a large share of parking space outside the control of the traffic management authority. These private car parks should be integrated into the public scheme of parking fees. This could, for example, be done by harmonising parking fees with the private sector.

The overall supply of parking space (both public and private) should be integrated into a comprehensive parking policy.

More serious, however, may be the problem of "private non-residential" parking which is offered free of charge by private sector companies to employees and customers. In some developed cities "work place parking levies" have been introduced, with the employer paying a significant charge for each parking lot to the traffic management authority. Ideally, this levy should then be passed on by the employer to the employees in order to make them pay the full costs of their journeys.

Parking charges can also be used to provide incentives for P&R schemes.

Park & Ride Schemes. As part of a comprehensive sustainable transport strategy that aims for a modal split shift toward public transport, parking fees can also be combined with other measures. Restrictive parking regimes in the inner cities with high parking fees and limited parking space can be supplemented by the provision of parking space in the periphery and incentives to access public transport. Park & Ride (P&R) models – as they have been implemented in many OECD countries – combine parking spaces in less congested areas of the periphery and public transport terminals in order to facilitate switching from the vehicle to public transport. P&R schemes provide incentives for modal shifts, however, both their environmental effectiveness and their economic efficiency heavily depend on the specific local circumstances.

Shortcomings

Parking fees may drive motorists out of the cities - with the result of additional traffic.

Parking fees in the central city may stimulate urban sprawl. A restrictive parking policy does only affect trips to the area that is subject to parking control (typically the central cities). This may result in an incentive for business to be set up outside the city. In many developed cities, shopping centres explicitly attract customers with the argument of free-of-charge parking.

Improved traffic flows may attract additional through-traffic in the cities.

Parking fees may increase through-traffic. When trips with a destination within the city centre become less attractive, such trips will decrease in number. However, that will lead to improved traffic flows which may attract additional through-traffic passing through the controlled areas.

Not the complete urban parking is under public control.

Parking space is only partly under public control. When a significant part of urban parking space is owned by the private sector, a restrictive parking policy may be difficult to implement. However, in some cases co-ordination with the private sector may be feasible. Parking fees should be harmonised and the number of car lots provided by private suppliers should be limited. When companies provide free parking for their employees, the introduction of a "work place parking levy" that has to be paid by the company per parking lot can be helpful. It should

be insured, however, that this levy is passed on to the employees, i.e. to the actual road users. Only then will the levy have an effect on the behaviour of road users.

The enforcement of the parking fee scheme is crucial. The traffic management authority has to be able to effectively enforce a restrictive parking policy, to collect parking fees and to fine offenders. In developing cities, any lack of an adequate institutional setting may result in a major obstacle to parking fees.

Parking fees have to be enforced.

The effectiveness of parking fees will generally be limited, when (a) only a low proportion of car users pay to park (enforcement problem), (b) car travel is through travel, (c) employers subsidise or reimburse employees' parking expenses.

Conclusions

The introduction of parking fees is an important aspect of making motorists pay the full costs of their trips. It reduces urban traffic and thus congestion. Unfortunately, parking schemes are more difficult to implement when considerable private parking space is available. In any case, an effective enforcement of the fee scheme is of utmost importance.

Further Information. For a detailed analysis of the role of parking restriction within a urban transport strategy see e.g. Hartmutt H. Topp, The role of parking in traffic calming, available at http://www.agenda21.ee/english/transport/parking_calming.pdf.

International experience with parking policies

Parking policies are in place in most cities all over the world. The following examples shall reflect some of the variety in these policies and approaches. Some more examples can be found in OECD 2001, pp. 105-107.

Parking fees in San Sebastian, Spain

In San Sebastian, as in many other European cities, parking measures are a central element of urban traffic policy and environmental policy. Major objectives have been noise reduction and pollution reduction. In order to reduce motorised transport in the city, several measures have been introduced. Inner city residents have priority access, while commuters are invited to use Park & Ride facilities in the periphery. High inner city parking fees and zero parking fees at P&R hubs give incentives to use P&R schemes.

In many European cities, parking fee schemes have formed the first element of urban traffic management with other measure (e.g. public transport improvements, promotion of non-motorised transport, etc.) following subsequently.

Private parking charges in Buenos Aires, Argentina

In Buenos Aires, private parking places play an important role. They usually charge on a per hour or per day basis. Inner city parking charges are summarised in Table 4.2.

	Per hour [US$]	Per day [US$]
On-street parking	2 - 2.5	7 - 12
Underground parking	3	10

Table 4.2: **Private parking charges in Buenos Aires, Argentina**

Integrated parking management in Bremen, Germany

Parking policy in Bremen follows an integrated approach. It includes measures to raise public awareness, improvements of public transport, parking management, and town planning. Pricing elements in the parking management strategy include (cf. OECD 2001, p. 105):

- Making sure no free or unregulated parking exists in urban centres,
- having the price and quantity of parking lots be determined by the appropriate demand for short-term and long-term parking (highest prices at most attractive locations),
- ensuring that car use plus parking charges in the city should not cost less than the cost of using public transport.

These measures have contributed to changes in urban transport in Bremen. Recent surveys show that 50 % of all trips to the city centre are made by public transport, and roughly 22 % by bike.

Resident parking permit programme in Seoul, Korea

The Resident Parking Permit Programme (RPPP) manages parking space in Seoul's residential areas. A parking lot is assigned to users who buy a parking permit. Permits are differentiated according to the scheme "all-day" (40,000 Won per day, = 36 US$), "daytime only" (30,000 Won), and "night-time only" (20,000 Won). Price levels may vary according to residential area.

The RPPP has not been fully embraced with open arms. Although community members are given priority in buying permits for parking lots near their residences, public acceptance of payments is low. Currently, charged parking accounts for a mere 15 % of all parking lots in Seoul (cf. OECD 2001, p. 105).

Urban road and congestion pricing

Urban road and congestion pricing as a policy instrument

The basic idea

Road and congestion pricing allows for a fair allocation of costs.

Charging internal and external costs. Road and congestion pricing are used as demand management strategies on local roadways. Urban road pricing generally aims at recovering internal and external costs of urban infrastructure and infrastructure use. Like general road pricing schemes, urban road and congestion pricing measures put a levy on the use of specific parts of the road network, thereby charging every road user. They also generate revenues needed to take anti-congestion measures and alleviate environmental problems.

As road users pay regardless of residency status, road and congestion pricing measures are fair. They are particularly useful, if a large share of non-residents causes traffic. Many big cities have a high proportion of the labour force commuting by car from neighbouring residence cities or independent suburbs.

In order to set incentives to implement local road and congestion pricing measures local institutions must be authorised to design, implement and enforce these measures. In short: Decentralisation of institu-

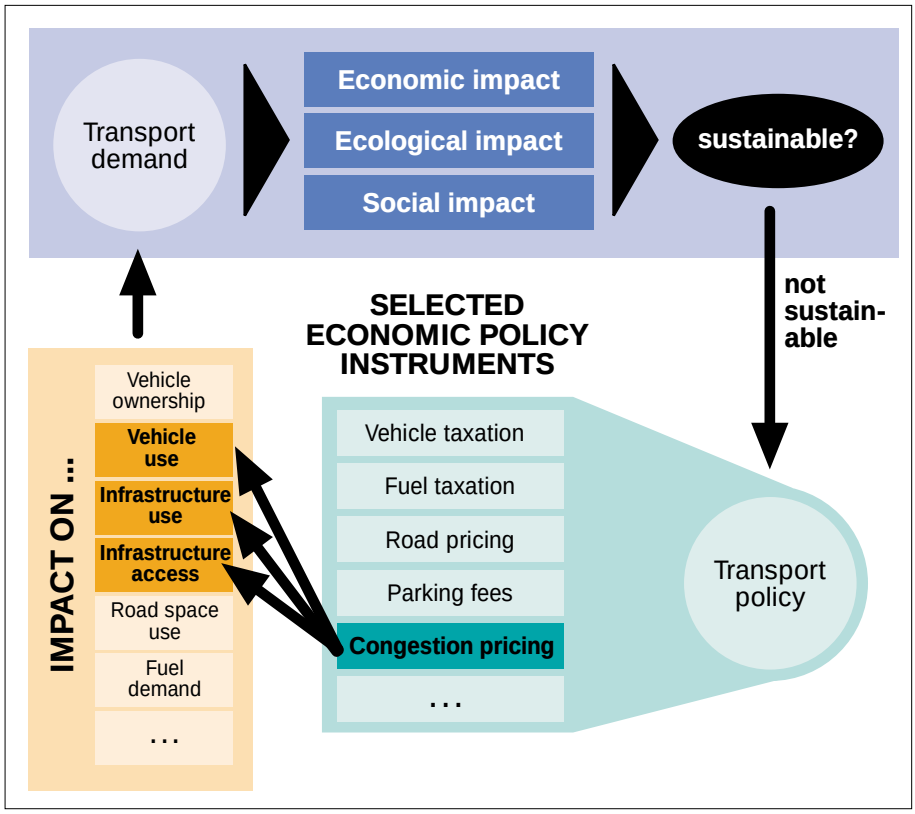


Figure 4.2: **Congestion pricing as part of transport demand management**

tional powers creates incentives for local policy makers to use Economic Instruments, and enables efficient urban road network use.

Congestion pricing specifically addresses the issue of (urban) congestion.

In congestion pricing, the focus for policy-makers is to reduce the overall traffic volume in urban areas in order to reduce or even avoid congestion. When implemented on existing roadways it also reduces the need to add new roadway capacity. The main objectives of road and congestion pricing are thus:

- a **change in the time of travel**: shift of peak to off-peak traffic with a consequent reduction of peak period traffic and a potential reduction of total traffic (e.g. through linked trips: more combination of activities on a single trip);
- a **shift in routes**: to roads without tolls or less tolled roads;
- a **shift towards a more sustainable traffic mode** (transit, carpooling, cycling etc.);
- a **reduction in negative environmental effects**;
- an **improvement in the overall quality of urban life**;
- a **means to generate revenue**.

The implementation of congestion pricing should be gradual.

Success thus is measured in terms of reduced congestion delay, curtailed roadway costs, and other demand management objectives. To actually implement urban congestion pricing the following 4-phase approach may be helpful:

Phase 1: Identification of the need of a local congestion-pricing scheme.

Phase 2: Introduction of a demonstration scheme.

Phase 3: Implementation of a full scheme.

Phase 4: Successive improvements of the congestion-pricing scheme.

According to this approach, congestion pricing should not be too ambitious right from the beginning, as the ideal pricing scheme can hardly be developed right from scratch. Congestion pricing should rather be seen as a gradual process that starts on a pilot scheme basis and then aims at successive extensions and improvements.

There are various options for the actual implementation of road pricing.

The design of road pricing. There are basically two principle forms of road and congestion pricing, namely:

- **Cordon pricing or area licensing**, where motorists are charged for entering a designated area at the defined crossing points of the cordon boundary, or pay a charge for driving within the area that is subject to road pricing;

- **Time-dependent tolling of individual routes**, where motorists are charged for using specific roads or road lanes. In this form, congestion pricing is predominantly applied to major highways or traffic bottlenecks such as tunnels, bridges, etc.

Technically, road and congestion pricing can be implemented in different ways at various levels of technical complexity:

- **Purchase of a paper permit (vignette)**. For each vehicle that is used within the controlled area, a permit has to be purchased and displayed at the windscreen. These permits will then be manually checked. Such permits will normally be valid for a limited period of time, e.g. a day, a week or a month. Such a system is rather inflexible, as it does not allow for time-based differentiation (see below).

- **Manual toll station.** Motorists have to pay a road charge on entering the priced area. Such procedures may be rather time-consuming and may hinder traffic flows. However, toll stations allow the differentiation of charges according to the time of day.

- **Electronic charging systems.** Vehicles are equipped with electronic tags that allow the automatic identification of vehicles at non-stop tolling stations. Charges are then automatically debited against the motorist's account.

Most technological components for congestion pricing have been tested and demonstrated successfully throughout the world. In developing cities, manual toll stations may be the most adequate approach when only a limited number of cordon/area crossing points is needed.

Optional features

Making congestion pricing flexible. In urban road pricing, a flexible system of charges will strengthen the congestion-reducing effect. When charges are higher at peak times (during workdays, at rush hours in the morning or in the evening) and lower at off-peak times (at weekends, mid-day) then drivers may partly shift their travel times to off-peak hours. This levels out peaks and makes the use of transport infrastructure more evenly distributed. With reduced peak-time travel, infrastructure supply – which should cater for peak demand – can be much smaller. In addition, travel may be shifted towards alternative modes such as public transport, thus reducing the overall travel demand as well.

Congestion pricing should be flexible.

Shortcomings

Currently congestion pricing is only an approximation. Ideally, congestion pricing should be based on the actual distance travelled, differentiated by time. At present, however, technical limits only allow a rough approximation; vehicles are only charged on entering a controlled area but the actual amount of driving done within the area is not reflected in the charge.

Congestion pricing does not impose the exact full costs to drivers.

Political opposition can be fierce. The main challenge to the implementation of congestion pricing is opposition from groups who consider themselves worse off once pricing is established. As with other char-

Public opposition may be expected.

ges on transport, congestion pricing may be rather unpopular. Users generally accept congestion pricing on a single lane that was not previously available if other lanes are free. Where all previously free lanes are tolled, there is often opposition because the toll is perceived as double taxation and because of hardship on less affluent people.

One of the key lessons learned from many congestion pricing projects is that the rational behind congestion pricing has to be communicated well to the public in order to ensure the necessary acceptance. When the system of congestion pricing is transparent, and when its advantages are apparent to all road users, then public support may be high.

Congestion pricing requires an adequate legal framework - both at national and local level.

The necessary legal framework is not always in place. To implement congestion pricing in urban areas, municipalities must be in the legal position to directly charge for road use. National and local legislation does not always provide the legal grounds for such measures. In addition, legal procedures must exist for the identification, tracing and fining of offenders.

Strong and competent planning institutions are needed for the implementation of road pricing.

Congestion pricing needs strong planning institutions. Congestion pricing is a rather complex issue that needs the competent backing of a well-organised transport planning authority. That agency needs professional skills to address a wide range of issues such as political issues, public awareness and transparency, transport planning, technical implementation, operational management, financial management and various other aspects. In many developing cities the creation of such an agency may be a major bottleneck to the introduction of road pricing.

Conclusions

Congestion pricing is an efficient way to address urban congestion. Although charges can only be approximations for actual road use and external costs (such as congestion), it is an adequate way to provide incentives for not using the car in congested areas or at congested times. The implementation, however, requires both a strong political commitment and competent planning / regulatory authorities.

Further information on urban road and congestion pricing and additional case studies can be found on www.path.berkeley.edu/~leap/TTM/Demand_Manage/pricing.html and in OECD 2001, chapter 5, and in Cracknell 2000. Congestion charging also is a key element of many recent urban transport proposals, e.g. “The Mayor’s Transport Strategy” for the City of London. For details see www.london.gov.uk/mayor/strategies/transport.

Best practice case: City toll ring in Trondheim, Norway

Policy background and objectives

In quite a few European cities, considerations are under way to introduce urban road pricing schemes. The overall aim is to implement an efficient instrument to reduce urban traffic. In most cases, road pricing constitutes only one element in a more comprehensive strategy for Transport Demand Management (TDM) which in general aims at reducing the total volume of traffic and at promoting shifts to more environmentally sound modes of transport.

In many European Cities road pricing is considered as one important element of Transport Demand Management (TDM).

Seven of these European cities have formed the EUROPRICE Group in order to investigate road pricing policy issues. These cities are: Belfast, Bristol, Edinburgh, Copenhagen, Genoa, Rome and Trondheim. Within the EUROPRICE Group only Trondheim has already introduced a comprehensive road pricing scheme and is currently working on its continuous improvement. All other cities are currently introducing demonstration schemes in order to explore technical, legal and operational issues and, in particular, to gradually stimulate and promote social and political acceptance.

The Case of Trondheim. In 1991 the Trondheim road-pricing scheme was introduced in the form of a toll ring around the city centre. The main objective was to generate revenues for investment regarding the "Trondheim Package", an integrated investment package of infrastructure facilities for car users, public transport, pedestrians, and bike users. Demand management was of secondary importance. However, environmental benefits and increased quality of life were considered as the main long-term benefits.

The City of Trondheim is well advanced in the development of urban road pricing.

Although urban road pricing had been introduced in other Norwegian cities before (Bergen in 1986, Oslo in 1990), the Trondheim scheme was unique in two aspects: first, it was a fully electronic system with non-stop toll lanes at all stations, and, second, charges were time-differentiated. The introduction of the Trondheim toll ring was the result of a six year long process of planning and decision-making. Major decisions that had to be taken included: the principle of road pricing, the design of the toll ring, the design of charges, the use of revenues, and the operational and institutional design. All this was supplemented by comprehensive information campaigns to increase public acceptance.

Specifications of the city toll system

Toll structure. All motorists entering the city centre are charged. The charges are differentiated by time and vehicle type as follows:

Table 4.3:
Tolls in Trondheim

	Average charges per inbound crossing		
	Weekdays, 6.00 a.m. until 10.00 a.m.	Weekdays, 10.00 a.m. until 6.00 p.m.	Weekdays, 6.00 p.m. until 6.00 a.m. and weekends
Passenger cars, light vehicles	1.04 US$	0.86 US$	no charge
Heavy vehicles (3.5+ tonnes)	2.07 US$	1.62 US$	no charge

For heavy vehicles (>3.5 tonnes) twice the charge is levied. Cars are registered with the operator of the pricing scheme and equipped with an electronic tag that enables a detection machine to identify the car when passing a non-stop subscription lane at a tolling plaza.

Zoning. Originally, the Trondheim road-pricing scheme was based on a single cordon around the central business district. Now, however, a further improvement of the scheme is aiming at the development of a zone-based system that will be even more efficient at charging and managing transport demand.

Operating institutions. The road pricing scheme is operated by the "Tøndelong Toll Road Company", owned by public authorities (2/3) and local commercial organisations (1/3). Tolling infrastructure is owned by the Public Road Administration, while electronic tolling tags are issued by the tolling company. The costs of the tolling company amount to about 10 per cent of revenues. The remaining 90 per cent of revenues are fed into the Trondheim Package of infrastructure investment.

Outcomes and results

Prior to implementation, there was concern that road pricing in the city centre may reduce the attractiveness of the central business district and may drive trade and business out of the city. Detailed studies, however, have shown that this has not happened. In fact, trade and commerce were able to keep their growth levels.

Lessons learned

In order to implement local road pricing, adequate national legislation had to be in place. The relevant Norwegian Road Law allows user charges on public roads for the purpose of fund raising. With current legislation, charges are not seen as a demand management device. However, the Road Law is currently under revision to allow for the explicit application of road pricing for demand management purposes.

Further Information. Trondheim's toll ring – as a pioneer case – is widely discussed in the transport literature. See, for instance, an ICLEI-report by C. Erdmenger and S. Schreckenberger (1998). See also the website of the EUROPRICE Group of European cities investigating road pricing issues (www.europrice-network.org).

Best practice case: Congestion pricing in Seoul, Korea

Policy background and objectives

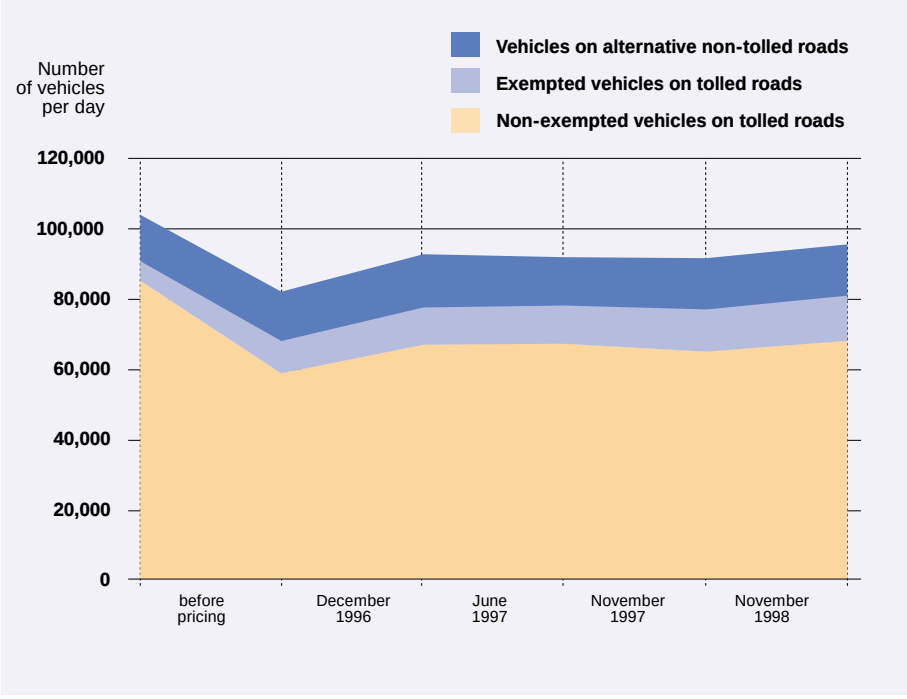
Urban transport policy in Seoul is based on a policy mix including different Economic Instruments.

After several decades of rapid growth in population and car use, Seoul faced increasing traffic congestion problems in the 1980s and 1990s. As part of a push-and-pull-strategy the Seoul City Government has taken several measures to reduce congestion in the inner city and to change the modal split in favour of public transport. These measures are based on a policy mix that also include Economic Instruments (*).

- Expansion of road and railway networks,
- Encouraging public transport demand by
  - Vehicle-related taxation* (local registration and license taxes),
  - Congestion pricing*,
  - Parking fees* and
  - Private car use restraints.

From these measures, congestion pricing plays a major role for controlling traffic volume and speed.

Figure 4.3: **Traffic volume on toll charged and alternative roads**
Data source: Shon 2000



Specifications of Seoul's congestion pricing approach

Congestion pricing measures in Seoul only apply to two major arterial roads linking the southern part of the city to Central Business District. These two corridors had been extremely congested before the system was introduced in 1996, and single occupied cars accounted for the majority of cars. Road pricing charges are levied only on private cars with two or less occupants. Toll booths for cash collection are used.

Charges are 2,000 Won (1.7 USD) for both directions per entry. They are collected between 7:00 am until 9:00 pm during weekdays, and from 7:00 to 3:00 pm on Saturdays. Sundays, national holidays, taxis, public transport, trucks and private cars with three and more people are free of charge.

Outcomes and results

Figure 4.3 depicts the development of traffic volume and speed on toll-charged and alternative routes. All in all, traffic conditions have improved significantly and only slight increases on alternative routes occured. Traffic speeds have increased in the entire system. At the same time use of toll-free vehicles such as bus, taxi, and private cars with more than three occupants has increased significantly.

Lessons learned

The Seoul case allows for several conclusions:

- It is possible to influence transport demand using tolls; they can effectively level off peak demand and induce substitution towards trips in off-periods and other transport modes.
- Despite selective road pricing on few arterial roads it is possible to reduce traffic volumes on the entire road network.
- Using tollbooths to collect tolls does not increase travel time when average traffic speed is increased due to less congestion.
- As part of an integrated transport policy strategy (as outlined above) road tolls do not harm urban economic growth and development.

For further information about the Seoul case see Shon 2000 and the literature cited in that paper.

Best practice case: Mobility concept of the Land Transport Authority in Singapore

Policy background and objectives

In Singapore, a highly restrictive transport policy has been able to keep urban traffic at acceptable levels.

Singapore experienced unprecedented growth in the 1970s and 1980s, which led to a large increase in the vehicle population. To secure future growth prospects, continually attract foreign direct investment, and avoid widespread vehicular congestion and pollution, as can be experienced in other cities of the region, Singapore proactively implemented Economic Instruments for demand side transport management. Demand

Traffic congestion is believed to be bad for business
Source: http://news6.thdo.bbc.co.uk/hi/english/world/asia-pacific/ new-sid_78000/78172.stm

side measures, including Economic Instruments, have been in effect since the 1970s. In 1995, however, the Land Transport Authority was formed to establish a comprehensive transport system that guarantees, controls and manages mobility in the city-state. Since then, Singapore has provided a best-practice example of how Economic Instruments can be implemented as part of a comprehensive management and planning strategy in urban transport.

Singapore's transport policy approach, as outlined by the Land Transport Authority (LTA), since 1995 has followed three basic tenets:

- to deliver an effective land transport network that is integrated, efficient, cost-effective and sustainable;
- to plan, develop and manage Singapore's land transport system to meet the nation's needs, i.e. enable growth, inclusion of the poor, etc.;

- to develop and implement policies to encourage commuters to choose the most appropriate mode of transport.

The basic idea behind these goals is to establish an approach that integrates supply and demand side management strategies and delivers a "World-Class Land Transport System". This top-down approach guarantees that all relevant aspects of transportation are considered, that synergies of supply and demand side measures can be reaped, and that long-term planning is facilitated. Therefore, the goals are broken down into the main strategy elements:

- Integrate land use, town, and transport planning by forming the Land Transport Authority as through the merger of four public sector entities: registry of vehicles, Mass Rapid Transit Corporation, Roads and Transport Division of the Public Works Department, and the Land Transport Division of the then Ministry of Communications;

- develop a comprehensive and efficient road network;

- improve public transport through rapid transit projects, commuter and traffic facilities;

- manage the demand for road space through vehicle ownership and usage measures; these include electronic road pricing schemes, vehicle registration and licensing, differentiated vehicle taxation, vehicle entry permits and toll payments.

Among these key elements of the Singaporean transport strategy, Economic Instruments play a central role in demand side management. Basically, there are three major instruments: Electronic Road Pricing (ERP), Vehicle Quota System (VQS), and Vehicle Entry Permits and Tolls. Additionally, Singapore has levied an annual vehicle tax. It is differentiated according to engine capacity, fuel type and type of vehicle (car, motorcycle).

Specifications of ERP and VQS measures in Singapore's mobility concept

Electronic Road Pricing (ERP) is aimed at managing transport demand through road pricing. The ERP system was introduced in 1998 after extensive trials and preparations. It replaced the Area Licensing Scheme, introduced in the mid-1970s, which required cars entering a designated

Electronic road pricing is one of the key elements in Singapore.

area in Central Area to display an area license. This road-pricing scheme had already been rather effective.

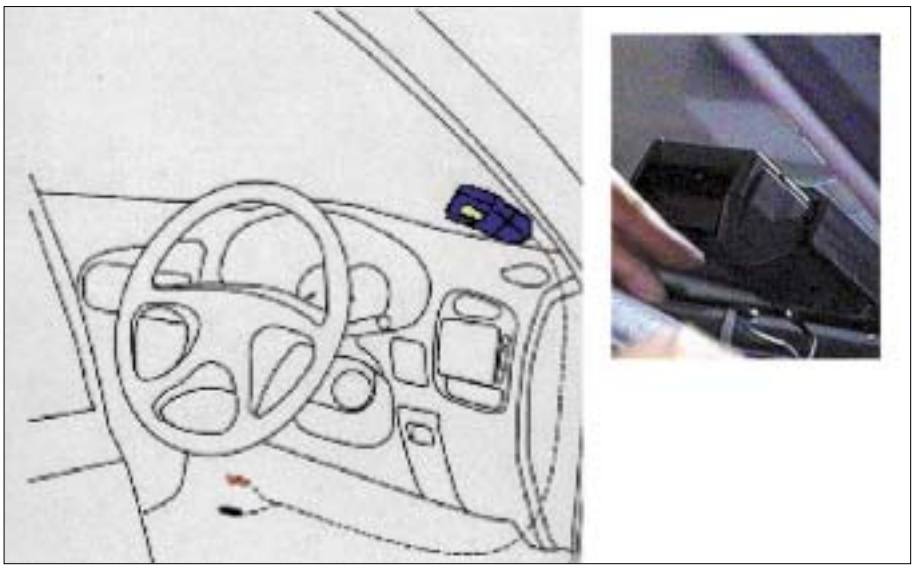


Figure 4.4:
In-vehicle Unit of Singapore's ERP system
Sources: http://its-hongkong.com (left) and http://news6.thdo.bbc. o.uk (right)

ERP, however, allows for more fine tuning. Today, major city axes, arterial roads and expressways use ERP to regulate traffic flow and congestion through differentiated pricing measures. In order to maintain traffic flow, there are neither toll booths or lane dividers, nor is there a need to slow down for detection. The ERP systems consists of two elements that allow for automated payment: Every car is equipped with an ERP in-vehicle unit (IU, see Figure 4.4), i.e. an electronic device installed in the vehicle that accepts a stored value cash-card (their value can be topped up at the automatic teller machines available at most banks, post offices and petrol stations). Vehicles simply pass under gantries and the system automatically identifies the vehicle and deducts the appropriate amount from the user (see Figure 4.5). Enforcement is by way of cameras installed on the same ERP gantries.

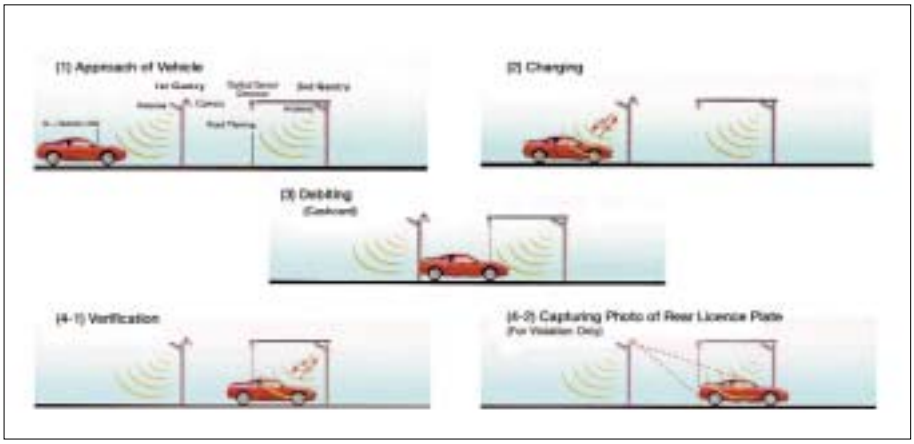


Figure 4.5:
ERP system procedure in Singapore
Source: http://itshongkong.com

Prior to the launch of the ERP system, two important programmes were initiated: the 10-month long IU fitting programme and the ERP publicity programme. With ERP, motorists shall be more aware of the true costs of driving. With ERP the LTA wants to encourage motorists to choose when to drive, where to drive, or whether to drive or seek other modes of transport, e.g. car-pools or use public transport.

Charges are levied on a per-pass basis (pay-when-you-use principle), and they are differentiated according to

- day, time of the day (rush hours are 2 or 3 times more expensive),

- type and size of vehicle (basically the categories consist of taxis and passenger cars < 1,600 cc, cars > 1,600 cc, goods vehicles & buses, motorcycles, other),

Tolls for passenger cars in Singapore $ per pass Monday to Friday	7.30 a.m. - 8.00 a.m.	8.00 a.m. - 8.30 a.m.	8.30 a.m. - 9.00 a.m.	9.00 a.m. - 9.30 a.m.	9.30 a.m. - 10.00 a.m.	10.00 a.m. - 12.00 p.m.	12.00 p.m. - 12.30 p.m.	12.30 p.m. - 5.30 p.m.	5.30 p.m. - 6.00 p.m.
Expressways									
- AYE between Portsdown Road and Alexandra Road		0.50	2.00	0.50					
- CTE after Braddell Road, Serangoon Road and Balestier slip Road	1.00	2.50	3.00	0.50					
- CTE between Ang Mo Kio Ave 1 and Braddell Road	1.00	1.00	0.50	0.50					
- ECP after Tanjong Rhu Flyover		1.50	2.00	0.50					
- ECP from Ophir Road		1.00	1.50						
- PIE after Kallang Bahru exit	0.50	1.50	1.00						
- PIE eastbound and Mount Pleasant slip road into the eastbound PIE	0.50	1.50	1.00	0.50					
- PIE slip road into CTE	1.50	2.00	2.50	1.00					
Arterial Roads									
- Bendemeer Road southbound after Woodsville Interchange	0.50	0.50	0.50	0.50					
- Kallang Road westbound after Kallang River	0.00	0.50	0.50	0.50					
- Thomson Road southbound after Toa Payoh Rise	0.50	1.00	1.00	0.50					
- Restricted Zone (Nicoll Highway)	0.50	2.50	2.50	2.00	1.00		0.50	1.00	1.50
- Restricted Zone (All other gantries)		2.00	2.50	2.00	1.00		0.50	1.00	1.50

Table 4.4:
ERP differentiations for passenger cars
Source: LTA Singapore

- congestion level (at present, prices do not fluctuate directly with actual traffic volumes, but they are readjusted quarterly according to the evolving traffic conditions),
- road and place of gantry.

These differentiations allow for flexible road pricing. Table 4.4 provides an example of differentiations for passenger cars.

The number of vehicles is restricted by a quota system in conjunction with a regular auctioning of vehicle licences.

The Vehicle Quota System (VQS) is aimed at directly restricting vehicle ownership in the territory. Vehicle quotas have been in effect since 1990. They have replaced earlier attempts to regulate car ownership indirectly through taxes and charges. Under the VQS, car licenses (COE, "certificates of entitlement") are sold through auctions. Under this scheme, the government decides upon the number of vehicles and an acceptable growth rate of the vehicle population and then auctions a corresponding number of additional certificates.

The certificates of entitlement are valid for a 10-year period. In a monthly tendering process, applicants are allowed to make a bid in order to receive a COE. After the bidding, all bids are ranked in descending order, and the highest bids are awarded a COE as long as the upper limit of the COE to be allocated (the "quota") is reached. The last bid to be accepted eventually determines the prices of all other bids, as the COE price offered in this bid (the so-called quota premium") is applied to all bids.

In the beginning of the 1990s quota premiums were modest. Increasing demand for car ownership, however, has increased premiums for

Table 4.5:
Tendering results for Certificates of Entitlement in Singapore
Source: Land Transport Authority Singapore (ww.lta.gov.sg)

	Category A Cars up to 1,600 cc	Category B Cars, more than 1,600 cc	Category C Goods Vehicles, Buses	Category D Motor cycles
Quota	2,936	1,083	333	613
Quota premium	16,092 US$	15,862 US$	13,795 US$	478 US$
Total bids received	8,350	5,081	1,842	1,312
As % of quota	284 %	469 %	553 %	214 %

medium-sized cars to above Singapore-$ 40,000 (US$ 22,000) in 1994. Since quotas were increased in the mid-1990s, premiums for a medium-sized passenger car have fallen to Singapore-$ 28,000 (US$ 16,000) in 2001.

The results of the tender for various vehicle types in September 2001 are summarised in Table 4.5.

Outcomes and results

All in all, Singapore managed to reduce congestion and pollution resulting from car usage while maintaining high mobility in the city and between the central areas and the periphery. At the same time, the country continually attracted foreign investment and maintained high economic growth rates.

Less congestion due to ERP. Several survey results show that the ERP system is working well. Traffic volumes in the Central Business District during the ERP period have been reduced significantly. There was a

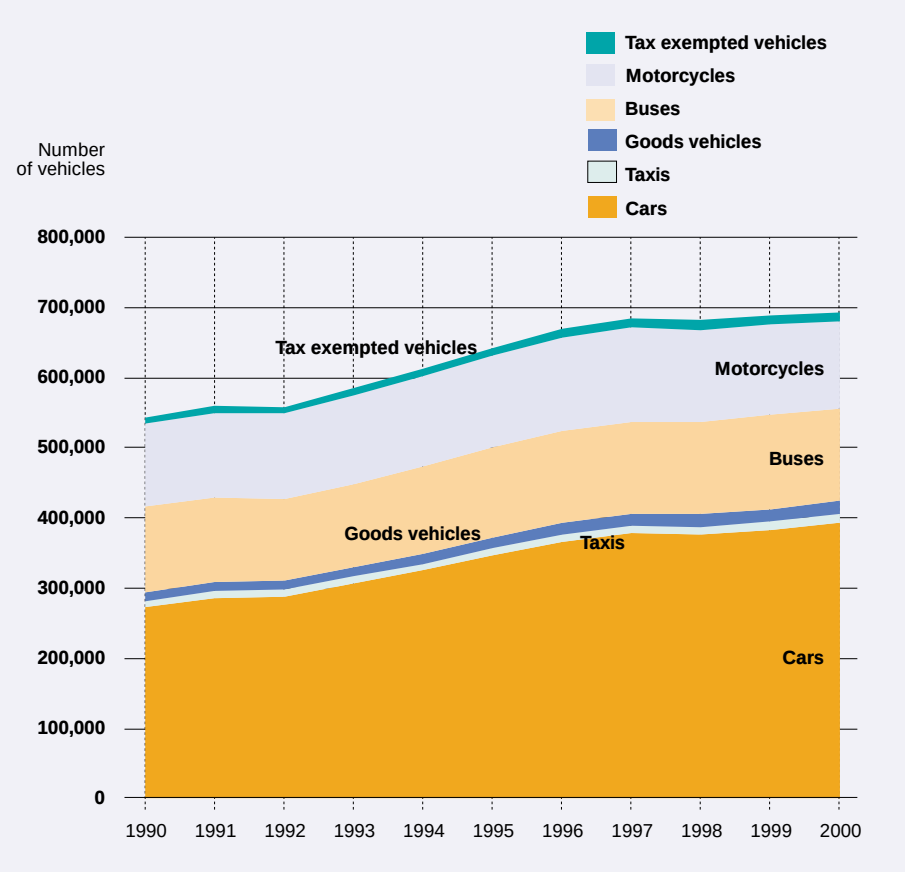


Figure 4.6:
Motor Vehicle population in Singapore, by vehicle type (1990-2000)
Source: Land Transport Authority Singapore (ww.lta.gov.sg)

slight spreading of the peak hour traffic as some vehicles took advantage of the lower charges between 7.30 am – 8.00 am and 9.00 am – 9.30 am.

Controlled vehicle population due to VQS. The vehicle quota system has been rather successful in stabilising the number of vehicles in Singapore. Figure 4.6 shows the development of the vehicle population between 1990 and 2000.

Lessons learned

Quite a few factor influenced the success of the Singapore transport policy.

Key factors to the success of the LTA's transport strategy include:

- **Centralised management and control.** The LTA was formed through the merger of formerly separate regulatory authorities. As part of a transport strategy for demand side management, e.g. to give incentives for a switch to public transport, push and pull factors have to be set comprehensively and in a proper schedule. The best timing and matching can be achieved through close cooperation, or centralised planning. Experience from other cities suggests that policy coordination problems are a major source for disjointed strategies that fail to induce modal changes.

- **High public acceptance.** The pricing schemes are generally considered as fair because they charge on a per-pass basis and pricing structures are time- and congestion-sensitive. Automatisation increased reliability, effectiveness and convenience. Furthermore, the integration of push factors (congestion pricing) and pull factors (cheap, convenient and ubiquitous public transport) allows for substitution and effective modal split changes. Embedding the use of Economic Instruments in a wider strategy raised public acceptance for Economic Instruments measures. A high proportion of commuting trips are now made by public transport.

- **Use of funds raised through ERP and VQS auctions for public transport projects.** Singapore has been able to attain a revenue that significantly exceeds the annual capital and operating cost of the road network, thus enabling it to meet the expenditure requirements of public transport.

The Singapore case has a couple of caveats. Several lessons can be learned:

- Win-win solutions are possible. The Singapore case shows that the goals of revenue generation and pollution mitigation are compatible and can be jointly pursued with the use of Economic Instruments. As a consequence, improvements in urban living conditions go hand in hand with satisfying increasing demand for mobility.

- It is technically feasible to charge road and congestion taxes, and it is possible to collect revenues electronically using automated systems.

- Road pricing and congestion pricing structures can be run with significant differentiation.

- It is possible and technically feasible to implement pricing structures that aim at optimising (peak) traffic flows.

- It is possible to influence transport demand using Economic Instruments; in particular, congestion pricing can effectively level off peak demand and induce substitution towards trips in off-periods and other transport modes.

Further Information. The Singapore case has been subject to extensive studies in the past years. For more information about the LTA's approach visit their websites at www.lta.gov.sg and www.onemotoring.com.sg. Also see the analyses in UN ESCAP (2000, pp. 187-192), and the World Bank Discussion Paper by C. Willloughby (2000b).

Chapter 5

Conclusions and general recommendations

Economic Instruments have a long history – both in developed and developing countries. Transport has always been used to generate state revenues. Many instruments that have been discussed in this book, in fact, can be found in various forms of horse ownership charges, and road and bridge tolls in many countries' economic histories. Many of these roots, however, have been neglected and forgotten in the recent debate about sustainable transport policy. By 1776, Adam Smith, in "The Wealth of Nations," had already outlined the basic principles of a sound transport policy. These included most of the aforementioned principles and recommendations for taxation and financing schemes.[1] Economic Instruments thus are not new transport policy "tools." But these tools have too long been idle. It is time to relearn their use, and to use them wisely in order to meet the economic, social and ecological challenges that occur today.

1 An excellent modern outline of the principles formulated by Adam Smith can be found in Metschies 2001.

Chapter 5 | Conclusions and general recommendations

Eight basic insights toward a wise use of Economic Instruments.

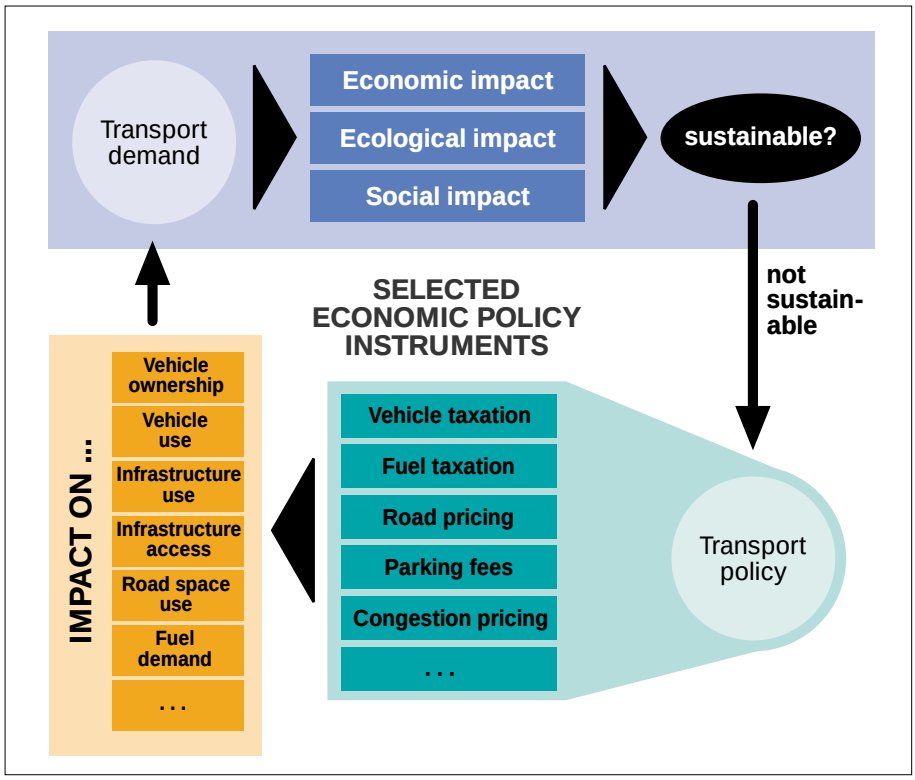
In the face of diminishing public budgets but increasing internal and external costs of infrastructure and environmental damage a rethinking of transport policy is needed. In this rethinking, Economic Instruments should play an important role. The existing experience with the use of Economic Instruments, as presented in this book, lead to a number of conclusions. These can be summarised as follows:

1. There is a diverse toolbox of Economic Instruments that can be used to address economic, ecological and social goals with tailor-made measures based on economic incentives. Various transport demand aspects can serve as a starting point for Economic Instruments (e.g. vehicle ownership, vehicle use, etc., see Figure 5.1).

2. Economic Instruments are crucial in making efficient use of transport infrastructure. They assign costs according to the "user pays" principle and thus contribute to an efficient management of transport demand. Road users must pay in accordance with the magintude of the road and external damages they cause.

3. In most cases, Economic Instruments offer the flexibility needed to adapt to specific technical and institutional environments. For instance, road pricing schemes can be introduced using high-tech solutions (as in Singapore), or simply by collecting fees manually (e.g. toll booths).

Figure 5.1: **Overview of Economic Instruments in transport demand management**



4. Economic Instruments are fully compatible with market economies. By using market-based incentive mechanisms, policy objectives can be achieved without unduly interfering with existing market processes.

5. Economic Instruments are most effective when they are embedded in a comprehensive transport policy approach as outlined in Chapter 1. One example could be a “push and pull” strategy that combines fuel taxation (Economic Instrument as push factor) with improvements of public transport (pull factor).

6. The implementation of Economic Instruments in many cases is rather simple and straightforward. However, a strong political commitment, certain minimum institutional capacities and a clear and transparent assignment of competencies within political institutions are important prerequisites. In addition, Economic Instruments should always be implemented as part of medium- to long-term transport policy strategies.

7. Economic Instruments can serve as an important source of state revenues. In particular, the "transport finances transport" principle should be applied. The transport sector in an economy is too large to be subsidised by other sectors. Thereby, earmarking of revenues is important, because the miscellaneous financial requirements of governments might erode the financial basis for sound transport financing.

8. To avoid public opposition, Economic Instruments should never be perceived as an additional burden. Therefore, it is important that all stakeholders are involved in the process of design, set-up and implementation of Economic Instruments. All steps must be transparent, accompanied by public awareness campaigns, and possibly designed in a manner that guarantees social fairness and a wise use of the revenues created (e.g. for social and ecological projects).

Table 5.1: **Survey of basic Economic Instruments**

Instrument	Affected transport demand group	Institutional bodies involved	Policy objective	Incentive mechanism	Shortcomings	Selected supplementary measures
Vehicle taxation (chapter 3.1)	- Motorised vehicle owners (vehicle tax on cars, motorised two-wheelers, etc.) - Non-motorised vehicle owners (vehicle tax on carriages, horses, etc.)	- vehicle registration office - (national) fiscal office	- tapping stable source of revenue - recovering infrastructure costs - congestion reduction - restricting vehicle ownership	- discourage vehicle ownership - discourage ownership of selected types of vehicles / technologies (through tax differentiation) - encourage use of public transport	- administrational requirements for vehicle registration - high information requirements on vehicle types, engine types, emission levels - tax is independent from actual infrastructure use (no incentive for efficient road use) - rural areas disadvantaged	- fuel taxation - set-up of vehicle registration office and control procedures - traffic police for registration control - public transport subsidies
Fuel taxation (chapter 3.2)	- motorised vehicle users	- (national) fiscal office	- tapping stable source of revenue - recovering variable infrastructure costs - efficient infrastructure use - reduce emissions from mobile sources	- discourage vehicle use - encourage use of public transport - encourage fuel-efficient technologies - encourage low-emission technologies	- influence on vehi-cle use limited if ownership is unregulated - not differentiable for time and location of infrastructure use - low public accep-tance if not imple-mented gradually - evasion possible	- vehicle taxation - subsidies for technology improvement - public awareness campaigns - direct transfers to low-income groups - public transport subsidies

Table 5.1: **Survey of basic Economic Instruments** (continued)

Instrument	Affected transport demand group	Institutional bodies involved	Policy objective	Incentive mechanism	Shortcomings	Selected supplementary measures
Road pricing (chapter 3.3)	- national infrastructure users (road network)	- (national) transport office - private entities (if commercialised) - traffic police - road inspection and maintenance bodies	- recovering fixed and variable infrastructure costs - efficient infrastructure use - reduce congestion	- discourage use of selected roads - encourage travel time optimisation - discouraging road transport - encourage use of public transport	- unwanted traffic diversion possible - equity and acceptability problems - demanding technical implementation - many institutions involved, organisational programmes required - rural areas disadvantaged	- "isolation reimbursements" to rural areas - public transport subsidies - public awareness campaigns - direct transfers to low-income groups - private sector participation
Surcharges on instruments (chapter 3.1 - 3.3; chapter 4.1)	- depends on underlying national instrument	- local fiscal office - local transport office	- create local revenues - raise revenues for local infrastructure - reduce externalities	- increase incentives set by national instrument	- depends on national instrument - surcharge evasion - lack of local institutional and legal autonomy	- national instrument fully implemented - local public transportation improvement - public transport subsidies - increase local regulatory power

Table 5.1: **Survey of basic Economic Instruments** (continued)

Instrument	Affected transport demand group	Institutional bodies involved	Policy objective	Incentive mechanism	Shortcomings	Selected supplementary measures
Parking fees (chapter 4.2)	- inner city road space users	- local fiscal office - local transport office - urban traffic police	- create local revenues - reduce congestion	- discourage car use in inner cities - encourage use of public transport - discourage parking in selected areas	- city residents disadvantaged (if not exempted from parking fees) - urban sprawl - increased through-traffic - evasion toward private parking suppliers - enforcement deficits due to limited institutional capacities	- Park&Ride schemes - improved public transport - free residents parking - parking space limitation
Urban road pricing, congestion pricing (chapter 4.3)	- urban infrastructure users (road network, bridges, city access)	- (local) transport and city planning offices - private entities (if commercialised) - urban traffic police - road inspection and maintenance bodies	- emission reduction - congestion reduction - recover fixed and variable costs of local infrastructure - efficient use of urban infrastructure	- discourage use of selected roads - encourage travel time optimisation - discourage urban road transport - encourage use of public transport	- unwanted traffic diversion possible - equity and acceptability problems - demanding technical implementation - many institutions involved, organisational	- integrated land use planning - public transport improvement - public transport subsidies - private sector participation

References

Allport, R. (1996): Transport Management: Private Demands and Public Needs, in: Stubbs, J. / Clarke, G. (ed.), Megacity Management In the Asian and Pacific Region, Vol. I, ADB et al., Manila, pp. 177-226.

Cracknell, J.A. (2000): World Bank Urban Transport Strategy Review – Background Paper: Experience in Urban Traffic Management and Demand Management in Developing Countries, Washington D.C.; available at www.worldbank.org/transport.

European Conference of Ministers of Transport , ECMT (1998): Efficient Transport for Europe, Policies for Internalisation of External Costs, Paris.

European Conference of Ministers of Transport , ECMT (2000): Economic Objectives of Introducing Tolls on Intercity Road Transport Infrastructure, Conclusions of Round Table 118, Paris, November 30-December 1, 2000.

European Commission (1998): Fair Payment for Infrastructure Use, White Paper, presented by the Comission; available at: www. europa.int/comm/transport/infr-charging/library/charging-en.html.

European Commission (1999a): High Level Goup on Transport Infrastructure Charging, Final Report on Estimating Transport Costs, May 1999; available at: www.europa.int/comm/transport /infr-charging/library/charging-en.html.

European Commission (1999b): Calculating Transport Infrastructure Costs, Final Report of the Expert Advisors to the h Level Goup on Transport Infrastructure Charging, April 1999; available at: www.europa.int/comm/transport/infr-charging/library/charging-en.html.

European Commission (1999c): Calculating Transport Congestion and Scarcity Costs, Final Report of the Expert Advisors to the h Level Goup on Transport Infrastructure Charging, May 1999; available at: www.europa.int/comm/transport/infr-charging/library/charging-en.html.

European Commission (1999d): Calculating Transport Environmetal Costs, Final Report of the Expert Advisors to the h Level Goup on Transport Infrastructure Charging, April 1999; available at: www.europa.int/comm/transport/infr-charging/library/charging-en.html.

European Commission (1999e): Calculating Transport Accident Costs, Final Report of the Expert Advisors to the h Level Goup on Transport Infrastructure Charging, April 1999; available at: www.europa.int /comm/transport/infr-charging/library/charging-en.html.

Erdmenger, C. / Schreckenberger, S. (1998): First Mover Advantage by Eco-efficiency - local incentives for environment and employment, Guide on economic instruments for local and regional authorities, ICLEI “Policy & Practice Series”, ICLEI, Freiburg.

References

Farrington, J. / Gray, D. / Martin, S. (1997): Rural car dependence and the rising costs of car use, in: Town & Country Planning, July/August, pp. 214-216.

German Technical Cooperation / GTZ (1998): Fuel Prices and Taxation, by G. Metschies; available at: www.worldbank.org/transport /urbtrans/other.htm.

German Technical Cooperation / GTZ (2000): Surveys on Economic Instruments in Surabaya/Indonesia.

German Technical Cooperation / GTZ (2000): Surveys on Economic Instruments in Buenos Aires/Argentina.

German Technical Cooperation / GTZ (2000): Economic and Fiscal Policy Instruments, Presentation at the International Conference on Sustainable Transportation and Clean Air, Jakarta, May 29 – 30, 2000, held by M. Breithaupt; available at: www.sutp.org/docs/eislides.pdf.

German Technical Cooperation / GTZ (2001): The World Bank Urban Transport Strategy Review, Experience from Germany and Zurich; available at www.worldbank.org/transport/utsr.nsf.

German Technical Cooperation / GTZ (2001): Transport Demand Management: Towards an Integrated Approach, Presentation at the European Investment Bank (EIB), June 6, 2001, held by M. Breithaupt; available at: www.sutp.org/docs/eib-tdm.pdf.

German Technical Cooperation / GTZ (2001): Fuel Prices and Vehicle Taxation, Second Edition September 2001, by G. Metschies, GTZ: Eschborn.

Gilbert, R. (2000): Sustainable Mobility in the City, Presentation to URBAN 21, Global Conference on the Urban Future, Berlin, Germany, July 4-6, 2000; available at: http://www.cremtl.qc.ca/PDF /sustainable%20transportation.pdf.

Gwilliam, K.M. / Shalizi, Z. (1997): Road Funds, User Charges and Taxes, World Bank Discussion Paper TWU-26, Washington D.C.; available at: available at: http://www.worldbank.org/transport/publicat /twu_42.pdf.

International Council for Local Environmental Initiatives / ICLEI (2000): Changing the Price Signal: How Local Governments Can Use Economic Instruments to Cut Traffic and Pollution, Toronto.

International Road Federation / IRF (1999): IRF World Road Statistics 1999, Geneva.

Metschies, G. P. (2001): Adam Smith and the Principles of a Sustainable Road Policy, International Road Federation, Vernier.

Organisation for Economic Co-operation and Development / OECD (2001): Influencing Road Travel Demand – You can't reach Tokyo by car. Expert Group on Influencing Road Traffic Demand (MM2), DSTI/DOT/RTR/MM2(2001)1, by M. Micozzi, forthcoming.

Oum, T. H. / Waters, W.G. / Jong, S. Y. (1990): A Survey of Recent Estimates of Price Elasticities of Demand for Transport, World Bank Working Paper, WPS 359.

Schrama, G.J.I. / Klok, P.-J. (1995): The Swift Introduction of "Clean Cars" in the Netherlands, 1986-1992. The Origin and Effect of Incentive Measures, in: Jänicke, M. / Weidner, H. (eds.), Successful environmental policy: a critical evaluation of 24 cases, Berlin: edition sigma, pp. 203-222.

Shon, E.-Y. (2000): Developments in Road Pricing and Traffic Restraint, Seoul Case, World Bank's Urban Transport Strategy Review, Asian Consultation Workshop, University of Seoul.

Topp, H.H. (1995): The role of parking in traffic calming, World Transport Policy & Practice, Vol. 1, No. 3, pp. 17-22; available at http://www.agenda21.ee/english/transport/parking_calming.pdf.

United Nations Economic and Social Commission for Asia and Pacific / UN ESCAP (1999): Guidelines on Road Safety Action Plans and Programmes; UN.

United Nations Economic and Social Commission for Asia and Pacific / UN ESCAP (2001): Sustainable Transport Pricing and Charges – Principles and Issues; UN.

U.S. Environmental Protection Agency / EPA (1997): Opportunities to Improve Air Quality through Transportation Pricing Programs, Report for the Regional and State Programs Division, Office of Mobile Sources, U.S. Environmental Protection Agency, September; available at: http://www.epa.gov/omswww/market.htm.

Vougioukas, M. (1999): Implementing Fair and Efficient Pricing and Subsidy Policies in Urban Transport, Paper prepared for the ECMT/OECD Workshop on Implementing Strategies to Improve Public Transport for Sustainable Urban Travel, Athens, Greece, June 3-4, 1999.

World Commission on Environment and Development / WCED (1987): Our Common Future, Oxford University Press.

Willoughby, C. (2000a): Managing Motorization, Discussion Paper TWU-42, Wahington: The World Bank; available at: http://www.world-bank.org/transport/publicat/twu_42.pdf.

Willoughby, C. (2000b): Singapore's Experience in Managing Motorization, and its Relevance to Other Countries, Discussion Paper TWU-43, Washington: The World Bank; available at: http://www.worldbank.org/transport/publicat/twu_43.pdf.

World Bank (2001): Urban Transport Strategy Review, latest update; available at http://wbln0018.worldbank.org/transport/utsr.nsf.

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