Appendix 4.4 –Deliverable D4

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CO	Confidential, only for members of the consortium (including the Commission Services)	R

Content

1. Introduction

- Innovation and environment
- The importance of clean technologies in the transport sector
- The ETAP and Popa-CTDA project
- The methodology for the background study

- The transport sector was responsible for 28% of total CO2 emissions in Europe in 2000. These emissions are expected to grow with 50% in the next 10 years.
- Road transport is responsible for around 84% of CO2 emissions of the transport sector.
- Freight transport modal shares: In western, central and eastern European counties road transport comprises 65-75% of tonne-kilometers made. Rail transport comprises around 30% in Central and Eastern Europe, against around 18% in Western Europe. In share of road transport is gaining rapidly though in Central and Western Europe, at the expense of rail.
- Transport volumes grew in the 1990's at a fast rate in Western-Europe; they fell in Central and Eastern Europe (CEE) and Eastern Europe, Caucasus, and Central Asia (EECCA) in the first part of the decade, but has reached its 1990 level already in CEE and growing rapidly as well as in EECCA (still at a lower level).
- At the same time transport volumes shifted away from the more environmentally friendly modes, towards road and aviation. Freight transport on rail or inland shipping did not grow in the last decades, or even declined. Freight over the road grew, and is expected to grow till 2010 with 50%, with respect to 1998.

2. Policy developments

This section is intended to analyse critically review and of recent and current technology and environmental policy developments and initiatives with regard to cleaner technologies for the transport sector in the EU (e.g., EU Action Plan in Cleaner Technologies). First it looks at the EU policy level describing its main traits and prospects. Then, the analysis turns to the Dutch context as an example of national policy.

2.1 European level

EU has acknowledged (EEA, 2003 & White Paper, 2001) that the answer to the growth of transport cannot be just to build new infrastructures. (…) It has to meet the demands of (…) sustainable development. A modern transport system must be sustainable from an economic and social, as well as an environmental viewpoint.

EU experience shows that vehicle technology and fuel improvements can, through environmental regulation, help to reduce certain impacts per unit of transport significantly, particularly air pollution. But such gains in eco-efficiency seem not to have been sufficient to mitigate the impacts of the rapid growth of transport and infrastructure volumes on greenhouse gas emissions, noise and habitat fragmentation. In addition to technological solutions, better integrated transport and environmental strategies are needed to restrain traffic growth and promote the use of more environmentally friendly modes – two of the key objectives of the EU sustainable development strategy.

Table 1. *EU Mobility Sustainable Development Strategy*

Goals

- Restrain traffic growth
- Promote the use of more environmentally friendly mobility modes

Means

- Technological solutions
- Better integrated transport & environmental strategies

Source:

With respect to the EU transport sustainable strategy an number of researchers comment that it is quite strange that EU still (in 2003) has the goal 'to restrain traffic growth' (Refs….). An example of public policy moving away from such a strategy is given by The Netherlands. The Dutch ministry of transport changed that same goal in the nineties into 'to facilitating growth in transport as good (or sustainable) as possible' (Ref…). This new aim contains much more realism (i.e., accepting growth). It is not realistic to limit growth in transport, when your population is still growing, policies promoting economic growth are in full swing and freedom of transport is so highly valued by consumers.

Despite regular increases in tax, fuel for road transport remains cheaper in real terms than it was 20 years ago. The EU Commission recognizes the need to internalize the shadow costs of transport on society in its common transport policy. Some Member States have begun to introduce instruments to achieve this (see below), but a number of barriers to implementation remain. There is little evidence of similar measures being developed or introduced in other parts of Europe.

Investment in infrastructure remains a priority of EU transport policy. Investment in western Europe has focused on extending the infrastructure, particularly roads, and investment in the accession countries is moving in the same direction. The multi-modal trans-European transport network and its extension to the east constitute a major pillar of the common transport policy. Although trans-European transport network investments were originally targeted to have a dominant rail share, road network development is currently ahead of the railway network.

EU policy prospects

The EU Transport White Paper is based on an approach that comprises a series of measures ranging from pricing to revitalizing alternative modes of transport to road and targeted investment in the trans-European network. This integrated approach aims to facilitate and allow the market shares of the other modes to return to their 1998 levels, and thus make a shift of balance from 2010 onwards (reference…).

The most important policy prospects are cleaner vehicles and fuels, investments in infrastructures, fuel taxes, internalization of shadow costs, the promotion of voluntary agreements, and Strategic environmental assessment and monitoring. These developments are described in more in detail below:

Cleaner vehicles and fuels

Regulation has effectively reduced air pollution per unit transport (e.g., phasing out leaded petrol) in the last decade. In order to step this process up the EU has taken several measures aiming to reduce the sulfur content of road fuels to almost zero (by 2009). This increases the possibility of using the highly effective $DeNO_x$ catalysts and particle filters, which aim to further reduce air pollution and enable the fuel efficiency of vehicle engines to be optimized. As a result, emissions of NO_x, HC and PM10 (particulate matter with a diameter smaller than 10μm) from the newest generation of vehicles will be only a few per cent of those from the vehicles of the 1980s.

These type of improvements are also needed for other transport modes, but pollutant emissions standards for rail, aviation and shipping are generally less regulated or lacking. For CEE and EECCA, the most important measures needed in the short term are the phase out of leaded petrol (for direct health benefits and to avoid catalysts poisoning), the adoption of stricter standards for new vehicles (sometimes difficult because of the outdated technological level of domestic vehicle production) and an effective inspection and maintenance regime for the existing fleet (particularly important as old vehicles often have very high emissions).

The average age of the passenger car fleet is currently 7.3 years in the EU and 11.5 in the new member countries. Most of the new members have already introduced higher taxes on leaded petrol or banned it completely. They are in the process of adopting the strict EU environmental standards and inspection regimes. Non-accession countries do not feel the pressure of the EU body of legislation and therefore generally lag behind.

Despite efforts at the EU level to promote alternative and renewable transport energy sources, such as natural gas, biofuels or electricity, their use and penetration remains low. The Commission proposes that 5.75% of fossil-based should be replaced with biofuel substitutes by 2010. The environmental impact of this is highly dependent on how and where such fuels are produced and any resulting emissions from the production plant vehicles. There is a tax reduction on bio-fuels.

Infrastructure investments

Infrastructure investment is another longstanding priority of transport policy. A good quality transportation network is an essential backbone for society and the economy. Transport investment policies in the EU have traditionally focused on extending infrastructure, particularly roads, as a response to increasing traffic demand. Better road network, in turn, have further boosted road transport. The share of rail in the building of a trans-European transport network (TEN-T) is far behind on its schedule.

Fuel taxes

Fuel taxation is an important policy tool that provides a direct incentive to improve the energy efficiency of transport and thereby reduce greenhouse gas emissions. Fuel tax can also serve as a tool for payment of the costs of infrastructure, congestion, accident risks, air pollution and noise, but a differentiated kilometer charge is generally considered a more effective tool for internalizing and reducing these costs (see also next point). Despite this potential reality has demonstrated that normally national governments do not channel the tax revenues to the improvement of transport or environmental infrastructures. In the case of shipping and aviation fuels are not taxed at all. Railway diesel and electricity are either not taxed or relatively mildly taxed. The untaxed sectors face no extra incentive to reduce their greenhouse gas emissions.

Internalization of shadow costs

A restructuring (and in many case increase) of transport taxes and charges could contribute to making individual users pay the true costs imposed on society. With such internalization of external costs, users would have incentives to drive cleaner and safer vehicles and avoid peak hours, and accidents and congestion should decrease. Switzerland is the only country to have introduced a kilometer-dependent transport charge in its whole territory. For example, charges for heavy goods vehicles (HGV) are dependent on distance driven, truck size and the environment class of the engine. Germany planned the introduction of such charges by mid 2004 (but is cancelled now, due to technical problems). London has introduced a congestion charge of around 8 euro for its center, starting on February 2003, the first results show a 20-25% decrease in congestion in London). The European Commission intends to publish a framework directive on infrastructure charging which aims to coordinate at the EU level the principles on which transport pricing should be based.

Voluntary agreements

The EU focuses its policy efforts mainly on the Community strategy to reduce CO2 from passenger cars, which included three pillars: the voluntary agreement with the European car manufacturers (= agreed target of 140g CO2/km by 2008; they are on track; trucks and vans are not yet included in the agreement; is under EU study to be), car labeling and fiscal measures for new passenger cars. The other transport modes (air & rail transport) are as yet much less addressed by EU policies, or voluntary agreements.

Strategic environmental assessment and monitoring

Strategic environmental assessment is a useful tool to help integrate environmental concerns at various policy and planning levels. A recent EU directive requires that transport plans and programs be subject to environmental assessment prior to their adoption as from mid-2004. Large variations exist across the EU; some countries have an established history of strategic environmental assessment of transport plans or policies and others are moving towards systematic strategic environmental assessment of transport. Some accession countries are considering strategic environmental assessment of national transport plans, but these are either non existent or still optional in others.

The EU has established the transport and environment reporting mechanism (TERM), in which indicators are used to track progress in various policy areas. TERM's aim is to build up a policy-oriented system of data generation, integration and interpretation.

2.2 National level: the Netherlands

Since transport policy is by a large extend developed and implemented by national governments, this section will describe the policy development of one of the member states, the Netherlands. Three factors have forced the Dutch government to work on transport policies for decades: High population density in the Netherlands, relatively high economic growth and welfare. In this regard, Rotmans (2003) mentions that development in Dutch transport policy in the last 15 years went from 'restraining mobility growth' (1988) to 'facilitating mobility growth as good as possible'. This has been considered as a 'new policy paradigm' in transport policy. Rotmans argues that currently there is mainly a focus on instrumental aspects of transport policy, while focus had better been directed towards new way of dealing with mobility partners (by government): a more evolutionary policy approach.

The most important transport national policy document is the National Traffic and Transport Plan (NVVP). Its main philosophy is that everybody needs to 'cooperate for easy reach' of their destinations. It has two main aims, to maximize the usage of current infrastructures and influence mobility demand.

- With respect to the first aim two means have been in place: 1) Invest in current infrastructure until 2010 aiming to solve specific problems in the road-web and improvement of public transport. Often projects are done as public-private partnerships; 2) Search for coherence in measures to better utilize existing infrastructure, for example linking 'toeritdoseerinstallaties' (=installations to control input of cars to the motorway), research on dynamic road marking, and remarking of existing road surface. There is also research to better use existing rail infrastructure.
- With respect to influencing mobility demand this has been done with initiatives like: carpooling, traffic management, and car sharing. These initiatives often are done together with other governmental organizations and companies. A kilometer dependent transport charge for private cars ('rekeningrijden') is an initiative that is currently under study. It aims to decrease traffic demand, as well as better utilization of existing infrastructure. Kilometer charge is an example of making car cost variable ('paying for using'). In addition, flexible- and tele-working are stimulated (NVVP, 2004).

The center of responsibility and activity (with respect to traffic management) will be decentralized from the ministry in The Hague, to local governments. In this context, items like emission and noise pollution are often neglected in the policy papers of the ministry of Transport. There seems to be little collaboration with the ministry of Environment on this.

As a vision of the future the policy document NVVP mentions 'chain mobility'. Chain mobility is a mobility concept where the user should be able to compose his/her own journey according to his wishes, from combinations of bike, car, rent-car, taxi, public transport. Currently experiments are done to see whether the theme is picked up by actors, and result in new forms of mobility products and services. To stimulate ventures in chain mobility, the ministry of transport runs a funding program since 1999 (for 4 years). See also further below: 'Selection of technologies and case-studies.

In a similar line promoting change in transport behaviour, the law ‘Personenvervoer’ (transport of people) 2000 arranged an increase in market working in regional and city transport. Many transport organization (e.g. bus-companies) were privatized. This law / bill did not touch upon regional rail transport. With respect to rail it is examined, especially in less populated areas, whether phased privatization (by contract work / tender) is possible. In the North of the Netherlands, between Groningen and Leeuwarden, another rail company than Dutch Railways (NS) had been running for a few years now. The idea is that a more customer focused approach will come up in the decentralized transport companies. With respect to the Taxi transport sector, it has gone through a major deregulation, which has made it much easier to start a taxi-service company as there is no need to request license for a certain area.

The increase in decentralization and privatizing of (public) transport companies is monitored by the program VEMOS (Vervoerkundig Monitoring Systeem). It allows for comparing regions on quality and cost.

The Dutch government also studies a new way of pricing private car use. Some of the possible features that an scheme like this may have include:

- A fixed charge (tax for road-building of approximately 25% of current road-tax)
- A variable charge (a) kilometer charge (tax for maintenance, environment and safety), (b) route charge (tax for congestion)

The future/practice of this scheme will have to show whether this plan results in the intended spread of road use (and less kilometers), hence whether congestion will solve, or that congestion will stay, but now extra charged.

3. Environmental issues

This section aims to describe the most pressing environmental issues arising from the use of transport in the EU. The effects of transport upon the environment have been widely studied for the last three decades (refs…). The most common problems include safety, noise, use and fragmentation of land, congestion, emissions of polluting gasses and acidification and use of non-renewable materials and fuels. These problems relate to the building of transport infrastructures and use of transport technology. Additional environmental problems not mentioned here are generated in the production of the means of mobility (i.e., manufacturing of cars, planes, ships, railways, etc.). Rotmans (2003) mentions environmental as well as non-environmental negative effects of the current mobility system (in other words: symptoms of unsustainability):

S*afety and noise*

Road transport accidents are now the largest cause of death for people under 45 in Europe. Accidents in traffic caused more than 100 thousand people to die in Europe in 2000 and almost 2 million people was reported injured in the EU alone, but there are signs that the latter figure is largely underestimated. The number is slowly decreasing. 30% of citizens are exposed to road noise levels (> 55Ldn dB), around 10% to rail noise level.

Land-use and habitat fragmentation

Every day 10 hectares of land are taken to build new roads. The length of the road network increased with 70% since 1980, while total length of rail network and inland waterways decreased with 9% in the same period. While the New Member States have much lower road density the length of motorways has almost doubled between 1990-1999 and continue to grow rapidly (supporting the concept that transport infrastructure will drive economic development by national governments) causing serious threat on their territory with relatively high biodiversity by habitat fragmentation. The length of railways has been decreasing in the New Member States as well. Although trans-European transport network investments were originally targeted to have a dominant rail share, road network development is currently ahead of the railway network.

Congestion

10 % of the European road network (around 7500km) faces daily congestion. Sixteen of the most important European airports face more than a quarter of an hour delay on more than 30% of the flights. Congestion on road, rail and in the air causes an extra use of 1.9 billion litre fuel, around 6% of yearly use.

E*missions of polluting gasses and acidification*

The transport sector was in 2000 responsible for +/- 28% of total CO_2 emissions in Europe. These CO_2 emissions by the transport sector are expected to increase by 50% in the next 10 years. Road transport produces +/- 84% of CO_2 emissions in the transport sector.

Use of non-renewable materials and fuels

In 1995 around 11.3 million cars ended at the scrap yard; in 2015 this is expected to be around 17 million. The transport sector depends for 98% on oil. The dramatic increase in transport demand, in particular for road transport and aviation, has made the transport sector a major contributor to several health and environmental problems in Europe (EEA, 2003). Western European transport systems comply with stricter environmental and safety standards than those in central and eastern Europe and certainly those in the 12 countries in Eastern Europe, the Caucasus and central Asia (EECCA). However, western European citizens use about three times as much transport fuel and face approximately the same probability of a fatal accident in transport as those in the east.

The European Environmental Agency mentions as environmental impacts of the transport sector (EEA, 2003):

Table 3: *Environmental impacts of the transport sector, according to EEA.*

Impacts:	*Current situation:*
Greenhouse gas emissions → climate change	These emissions are still growing, because transport energy consumption still rises 2 – 3 % a year (mainly because of growth in road and aviation transport). The difference in energy use per person between regions (e.g. western and eastern Europe) is huge (about 840kg of transport fuel in WE, 240kg in CEE and 360kg in EECCA).
	Aviation requires special attention. It is the fastest growing energy user in the sector, and the impact on the climate of all aviation emissions is estimated at two of four times that of the CO_2 alone.
Habitat disruption / land take → loss of biodiversity	Road density is still increasing: at a high speed in CEE (length doubled from 1990-99), but also in WE (+25% from 1990-99). The expansion of transport infrastructure networks – in WE as well as CEE – leads to increasing land take and fragmentation, and increases the pressure on designated nature conservation sites.
Accidents, loss of air quality, noise production → all kinds of effects on human health and well being	Because of regulations, emissions decreasing local air quality have been strongly reduced. In eastern Europe there's still a lot to gain in this though. In western Europe, the gain in emission per unit, is being offset by the large increase in transport volumes, keeping the air quality of European cities poor
	W.r.t. noise: more than 30% of citizens are exposed to road noise levels (> 55Ldn dB), around 10% to rail noise level. Around 10% may be highly disturbed by air transport noise. Also here: noise level per aircraft is decreasing, but because of growth in volumes, air noise pollution still grows
	Road transport accidents are now the largest cause of death for people under 45 in Europe. Level of fatalities is more or less stable or slightly decreasing

Source:

The most important short-term challenges for the Balkan countries and the countries of EECCA are to phase out leaded petrol (most countries), abolish fuel subsidies (three countries only), introduce self-financing of the transport system via fuel taxes, and move towards cleaner vehicles and better inspection and maintenance regimes. For the new EU member countries, the main short-term challenge is complying with the complex and extensive EU environment and transport legislation. The upgrading of their infrastructure networks – while at the same time maintaining their high share of rail transport – is another major challenge. In the case of the western European countries the challenge lies on 'striking a balance between the economic and social benefits of transport and its negative impacts on society and the environment' (refs).

4. Selection of (clusters of) technologies and case studies

Cleaner technologies or cleaner practices are essential to reduce the environmental burden of the transport sector. This section provides an overview of current initiatives and developments in transport technologies that point towards a cleaner direction. Out of the pool of technologies surveyed two promising technologies or practices will be selected to undergo further study in the POPA-DACT project. Te section is structures as follows: Firts, four categories of technologies-practices are described in more detail (i.e., environmentally improved internal combustion engine cars, alternative propulsion / clean vehicles, collective use of private car and integration of public transport modes / chain mobility, and other technology niches). Second, a list of promising technologies and their state of development is presented. Third, a selection and justification of two technologies-practices is done. Last, a description of the case study is give.

4.1 Four categories of technologies

Promising technologies in the transport sectors can be clustered in four identifiable themes or practices: environmentally improved internal combustion engine cars; alternative propulsion vehicles; collective use of car; integration of public transport mode – mobility chains. These clusters are defined below, in addition other interesting niche developments in transport are mentioned.

Environmentally improved internal combustion engine cars

Over the past decades, under pressure of government regulation and rising energy prices, the car and truck industry has significantly upgraded the environmental performance and energy efficiency of its products. Still, this trend has not led to vehicles that are clean enough to reduce the environmental burden of road transport as a whole.

Alternative propulsion / clean vehicles

From in and out of the group of current major car and truck manufacturers, research has been done to alternative propulsion systems. These has led to the following results:

- electrical vehicles. These include battery-powered vehicles (BEVs), hybrid-electric vehicles, and fuel-cell vehicles. These vehicles have different energy sources, but share the same drive system technology. Hybrid cars combine a small combustion engine with an electric motor and battery. In a fuel cell a hydrogen-oxygen chemical reaction produces electricity, which powers an electric motor.

- Bio-fuels & natural gas. Compared to gasoline cars, both LPG and Compressed Natural Gas cut carbon monoxide emissions by 70-80%, hydrocarbon emissions by 70-80% and CO2 emission by 15-20%. (the highest obstacle to wider adoption of these 2 is the higher storage cost of the compressed gas in the vehicle, along with lack of widespread fuel supply infrastructure).

The EU has the following vision of the future with respect to these '*promising alternative energy*' sources (White Paper, 2003):

- -short & mid term: bio-fuels
- -medium and long run: natural gas
- -very long term: hydrogen

The objective is to replace 20% of conventional fuel by substitute in 2020.
Means to achieve this:
1) Members are obliged to increase the use of biofuel to 2% in the coming years; by 2010 it should be 6%
2) Tax reduction on biofuels

> Several European cities (Paris, Florence, Stockholm,& Luxemburg) are already using buses which run on natural gas, bio-diesel or zero-sulfur diesel. Also, Hybrid cars (e.g. Toyota Prius) have a large tax discount in many countries, which makes the new propulsion cars very competitively priced.

Collective use of private car: car-sharing

Organized car-sharing exists in market-niches in several countries, in particular Switzerland, Germany, Austria and the Netherlands. The main aim of organized car-sharing is to decouple ownership and use of cars. Users subscribe to an organization, which owns and operates a pool of cars. Access to these cars is regulated by explicit rules and trips are billed in proportion to the actual use of the system. Organized car-sharing differs from private forms (among friends and relatives) as it regulates access to the car, duties, services and rates in an explicit and professional manner.
In 1998, over 70,000 people were members of car-sharing organizations in these countries, and annual growth rates were relatively high in all countries.

Integration of public transport modes / chain mobility

Connections between different means of public transport are often cumbersome. Chain mobility is a mobility concept where the user should be able to compose his or her journey according to his wishes, from combinations of bike cars, rent-car, taxi, public transport. Increasing integration can be achieved by providing more physically accessible connection nodes (stations with trains, buses, trams, bicycle hire), by providing better information about public transport services before and during a trip (travel information systems), and by using single systems of swift payment (e.g. by smartcards). Hoogma et al. (2002) state there is a small potential for a regime shift in this initiative, because the innovations could lead to a fusion of the regimes of individual car-based transport and public transport into a new regime.

> The Dutch ministry of transport runs the program ‘chain mobility’ since 1999, aiming at stimulation innovations in chain mobility. There are 87 subsidized programs. Examples are:
> - ‘the transfer from bike to public transport’
> - car sharing-project, called ‘Pointer’ (similar to the white-bike-project in the seventies in Amsterdam)
> - ‘Chip and Tariff’: the development and testing of a National Chipcard for use in all public transport (train and bus) in the Netherlands. MOBIS (market sector organization) leads this project. Three different testing project have been done (1: in Groningen, Tripperpas; 2.: Organization for city transport companies; 3. European DISTINCT-project.
>
> Study of the application of ICT in traffic management. A research by TNO-stb & Novem (Butter, Ellen, Hartkamp) on potential consequences of ICT on mobility and environment concludes that there is a big potential for a positive effect (see also: Rotmans, 2003).

Though some initiatives are promising, many projects still seem feasibility studies. The experiments will first have to be done in a (protected) market situation (i.e. offered to the public, hence indicating the size of demand for it). That will show how the business case for the different projects is.

Other niche developments in the transport sector

- Light rail. This concept replaces (heavy) trains by vehicles that are more like a metro or tram vehicle. The frequency of departure could be increased, hence the attractiveness for the traveler.

- Dial-a-ride services. Dial-a-ride services provided by bus-companies are another intermediate step between individual and collective transport. Passengers are picked up from home or a meeting point by mini-buses and driven to their destination or to a transport node. Dial-a-ride services give further flexibility and efficiency to bus operations and prove feasible thanks to advances in information and telecommunications technology. Niches for such services exist in many cities in the UK, Germany and the Netherlands. The ASTI experiment in London is a good example of combining a dial-a- ride service with alternative fuel technologies.

- 'Wegen naar de toekomst' (=’Roads to the future’) is an innovation program of the Dutch Rijkswaterstaat. Since1998 this program delivers different innovative perspectives and experiments, like Automatic Vehicle Control, Dynamic lane marking, prefab road surface, new possibilities of noise reduction, design for high way habitation, and different voluntary agreements between government and business about freight transport

- priority lanes for public transport in the inner city (e.g. Utrecht)

- free public transport (e.g. Hasselt, Belgium)

- Switzerland is the only country to have introduced a kilometer-dependent transport charge in its whole territory. A heavy goods vehicle (HGV) charge is dependent on distance driven in Switzerland, size of truck and the environment class of the engine. Germany has planned for the introduction of such charges in mid 2004 (but seems to be cancelled now due to technical problems). London has introduced a congestion charge for its center, started February 2003, of around 8 euro. (first results: 20-25% less congestion in London)

Weber and Van Zuylen (2000) have made a list of the latest, ‘most promising’ innovations in the transport sector.

Table 4: *Promising innovations in the transport sector and their age*

Category	**Technology**	**Innovation phase**
Multi-modal technologies	Multi modal travel information	2,3
	Multi-modal trip planning information	2,3
	Inter-modal trans-shipment terminals	3,4
	Inter-modal passenger terminals	2,3
	Multi-modal transport services	2,3
	Reservation system for transport modes	2
	Information system for the co-ordination of modes	2
	Information system to identify travel preferences and habits	1
Information Technology	Smart payment systems	3,4
	Smart Card	3,4
	Authentication systems	2,3
	Mobile access to internet	4
	Tele-activities	4
Road, *generic*	Advanced propulsion systems	2,3,4
	Electric and hybrid traction	3,4
	Fuel cell	2,3
	Electric urban car	3
	Dynamic route planning	3
	In-vehicle traffic information	4
	Electronic trolling	4
	Navigation systems	4
	Traffic control systems	4
	Parking management systems	4
	Automated guided vehicles	2,3
	Driver support systems	2,3,4
	Drive-by-wire	2
Road, *passenger*	Human powered vehicles	4
	New systems for personal rapid transit	2,3
	Ride sharing	4
	Car sharing	4
Road, freight	Road trains	4
	Freight telematics	3,4
	Systems to build underground infrastructure	2,3

Note: 1= invention phase; 2 = test phase; 3 = first practical application; 4 = market introduction; 5 = maturity; 6 = decline or take over by a new technology.

It would make much sense to choose technologies (or practices) for POPA-DACT that lie on the path towards a sustainable transport system (and not on a path towards a new lock-inn in an unsustainable state) (Kemp & Rotmans, 2003). According to the Dutch ministry of transport, a sustainable transport system has the following characteristics: relatively easy reach of one's destination, safe (internally: low # accidents, externally: no danger for surroundings), zero emission level, high spatial quality, certainty of deliverance of energy (V&W, 2002).

As criteria for the choice of two case studies for POPA-DACT will be regarded:
- problem solving potential (corresponding to groups A&B of the ISI list)
- potential for diffusion and networking (socio-techno-economic conditions) (corresponding to group C&D&E of ISI list)

- potential to contribute regime change (into a sustainable state) (based on Elzen et al, 1998)

Using this set of criteria, TNO proposes the following 2 case-studies:
- private transport: clean propulsion systems in passenger and freight vehicles
- public transport: urban chain mobility. Practices to cleaner urban transportation

The following considerations led to the choice for these two case studies:

- (case 1) individual transport vehicles (for passengers and freight) are an essential element of mobility, and it is highly unlikely that this icon of individuality and flexibility will loose much ground in the coming decennia. The expected growth in population and welfare in Europe will only increase the number of transport vehicles, and hence of its cumulated emissions. To break with the trend of growing emissions, a radical new vehicle-propulsion seems more and more a necessity . It is important to make this transition smoothly (prevent too big impact on current regime players), effectively (prevent lock-inn in new unsustainable situation), and soon (the sooner the better). It should be said that clean vehicles do not solve the congestion problem however.

- (case 2) In areas with a high-density population, urban areas, use if individual vehicles leads to major congestion (long travel times), poor air quality in the city, and spilling of petrol. With regard to the expected growth of vehicles (cars and trucks) this will increasingly lead to problematic situations. Many cities experiment with alternatives to car en truck transport in their urban areas. It is likely that a solution for this unsustainable situation is to be found in (a) different mode(s) of transport in urban areas. Urban chain mobility is a general term for initiatives in this direction.

Why not the others?

Car-sharing is promising in theory: it could seriously reduce the number of cars, and hence parking spaces required. Experience also showed that total emissions of the population will decrease. It could be a big change in the regime from individually owned vehicles to collectively owned vehicles. However, research shows (Rijkswaterstaat, 2003) that sharing cars is perceived attractive by a small sub-set of the population only. Despite active stimulation of the government, the growth of users has stagnated over the last years. It doesn't seem likely that it will grow in the near future.

Dial-a-ride services seen attractive as an addition service between taxi and bus transport. However, is does not seem powerful enough to keep people from using their cars.

Traffic control systems are valuable in support to optimise transport streams. It can be used both to optimise the current regime of car and truck transport on the current infrastructure, and also to serve as a tool in chain mobility. In the first respect it will show to be worthwhile until the moment that traffic streams have grown thicker again, leading to congestion with traffic control systems as well. In the second respect, traffic control system can be a supporting tool in chain mobility systems, advising travellers to use certain transport modes. In this second respect, this innovation will be taken into account in the second case study.

In table form:

	Clean vehicles	Car sharing	Urban chain mobility	Dial-a-ride service	Traffic control systems
Problem solving potential	xxx	xxx	xxxx	xxx	x
Potential for diffusion and networking	xxxx	x	xxx	x	xxx
Potential to contribute to regime change	xxxx	xxxx	xxxx	xx	xx

The two chosen cases will be further worked out now.

4.2 Description of the two case studies

Case 1: Clean Vehicles

This case will map, measure and prioritize the barriers hampering and drivers fostering the development and use of (radically) clean vehicles in the transport sector.
Radically cleaner vehicles are necessary to move towards a sustainable transport system. This means vehicles with emission levels 50% or more below current average vehicles.

Many initiatives are currently undertaken to develop and produce such vehicles. Examples are:

- Hybrid-electric vehicles
- Hydrogen (fuel cell) vehicles
- Battery-powered vehicles (full electric)

Still, it is clear that the current vehicle-regime is fully focused on petrol / gasoline engines. The niches of clean vehicles thus have to compete against a strong existing regime. This case study studies what the chances of the current niches are, and how their growth can be stimulated (through government actions).

The actors involved
This case study will study the beliefs of the relevant actors, potential users and potential developers that influence this development / transformation process.
As the relevant actors for this case study are seen:

- current car manufactures (heads of product development organizations)
- current car dealers (the local selling people)
- oil industry (also likely being the producer of hydrogen)
- individual users
- fleet owners
    - private (company cars)
    - public (semi –government organizations)

Mapping beliefs; signs of receptiveness
By means of a questionnaire, insight will be gathered into:

- the beliefs of the actors with respect to clean vehicles (willingness to develop, willingness to use).
- the actual behavior with respect to clean vehicles
- Under what circumstances would there be more willingness / receptiveness

Case 2: Urban Chain Mobility (park and ride)

This case will map, measure and prioritize the barriers hampering and drivers fostering the development and adoption of chain mobility practices in the transport sector in the city. Large and medium cities around Europe are burdened with huge volumes of road vehicles in and around the city centers. This results in major congestion (long travel times), poor air quality in the city, and spilling of petrol .

Currently, in general, people seem to prefer to drive with their car into the city center as far as possible. Many initiatives are undertaken to change this behavior. Chain mobility is a general term for initiatives that aim to create seamless connections between train, metro, buses, bicycle hire, taxi, and to keep cars away from the city center. Changing people's behavior is a hard thing to do. City councils are balancing to appreciate the freedom of the individual traveler, with the care for the quality of the city center as a whole in many aspects (ease of reach, air quality, etc.). Urban chain mobility aims to make a transition to a urban mobility system that includes comparable or lower travel times (to and in the city center), less emissions and less spilling of petrol (and comparable or lower travel prices).

The actors involved
This case study will study the beliefs of the relevant actors, potential users and potential developers, that influence this development / transformation process.
As the relevant actors for this case study are seen:

- city governments
- city bus & metro / tram companies (maybe public, maybe private)
- individual city travelers
- groups of users: large companies or organizations that are situated in urban areas

Mapping beliefs; signs of receptiveness
By means of a questionnaire, insight will be gathered into:
- the beliefs of the actors with respect to chain mobility practices (willingness to develop, willingness to use).
- the actual behavior with respect to chain mobility initiatives
- Under what circumstances would there be more willingness / receptiveness

5. Review of barriers and drivers

As Hoogma, Kemp, Schot and Truffer (2002) argue, there is not just one barrier to the introduction of clean technologies (or sustainable practices), but a whole range of factors that work against their adoption. These factors are interrelated, making a policy approach aimed at reducing individual barriers one by one less likely to succeed.
The traditional way to address these barriers is to disseminate information on unsustainability of the present situation, and raise awareness of alternatives; subsidies for use of new technology, taxing the use of pollution technologies, public investment in infrastructure.
These policies are often focused to overcome one barrier each, instead of addressing the set of interrelated factors coherently (Hoogma et al., 2002).

Similarly, Van de Bruggen & Dijk (2004) state that a systematic analysis (system's approach) of such a complex regime and complex problem of unsustainability will neither lead to the elegant conclusion that one or two actors need to change their behaviour, nor one new technological artefact is needed, nor one new regulation needs to be adopted, for solving the problem. The problems relate to the state of regime (containing all relevant actors and their behaviour) as a whole. This statement is typical for a complex system's approach.

Transition management (Kemp & Rotmans, 2002) offers a concept to make a transition from an unsustainable system state or regime to a (more) sustainable regime. Main elements of this concept are: forming an arena of different type of actors. Second, agreeing a vision of the sustainable end-state of the system. Thirdly, designing and deploying experiments that are on the path towards the end-state. Fourthly, monitoring the movement on the path towards the end-state, with the whole arena.
Montalvo (2002) also mentions that collaboration of policy makers with industrial actors is the only way to find long-term radical solutions to environment problems.

> What exactly is a 'regime', and how to 'change a regime' (=regime shift)?
> 'Regime' is defined as (Rip, 1995; Kemp et al., 1994.): A technological regime is a rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, established user needs, regulatory requirements – all of them embedded in institutions and infrastructures.

The notion of a (technological) regime helps to explain why most change is of the non-radical type, aimed at regime optimisation rather than regime transformation. It helps to explain why so many new technologies remain on the shelf, especially systemic technologies with long development times that require changes in the selection environment (=new technological options and new decision criteria of users and developers).
Technological regime shifts entail a number of structural changes at different levels. The emergence of a new technological regime implies the simultaneous evolution of these changes. This simultaneous evolution is a co-evolutionary process: technological options, user preferences and needed institutional changes are not given *ex-ante*, but are required to be created and shaped, for the regime shift to take place.

The successful development of local niches ('niche-branching') is seen as the core dynamics of a regime shift, see figure below.

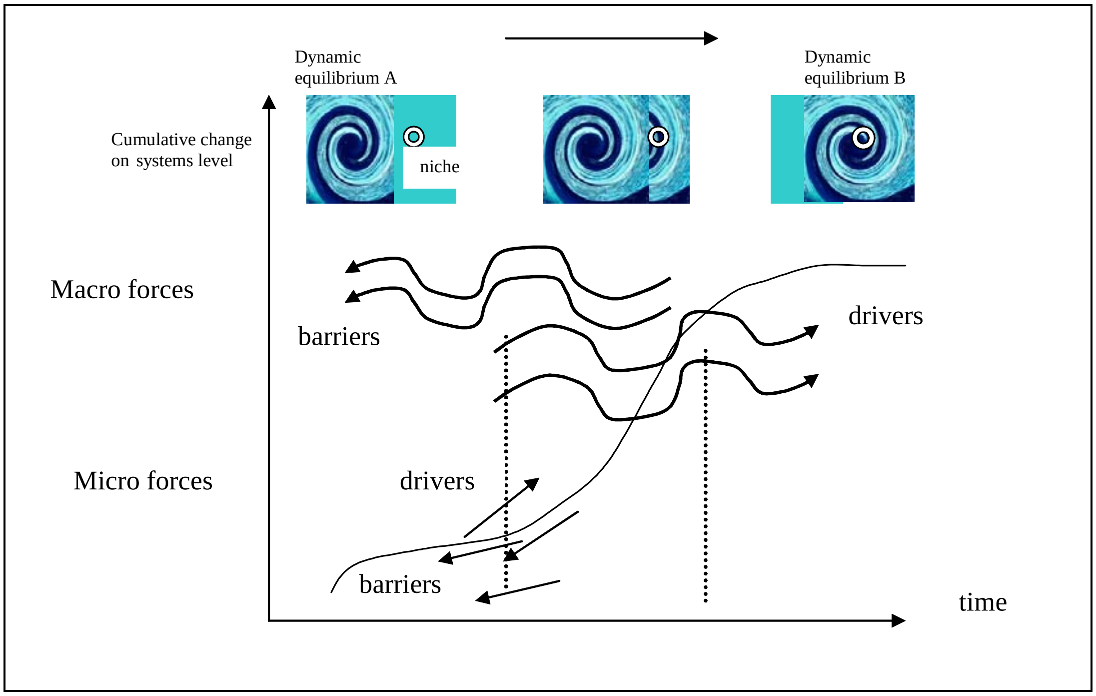


Figure 1: The successful development of a local niche is a process with different phases, and can be examined at different levels.(Geels & Kemp, 2000; Rotmans et al., 2001; Van der Brugge & Dijk, 2004)

The figure shows that barriers and drivers can play at different levels. They can be of a fundamental character (macro level), for example an opinion in society that emitting CO_2 is not so much a problem. There are also more local barriers and drivers (micro level), for example that an hydrogen engine is quite expensive for an individual actor. The total field of forces (the sum of the forces) determines the overall movement of the state of the system.

Hoogma et al. (2002) argue that a niche (in general) develops successfully if learning takes place on different aspects:

- Technological development and infrastructure: this includes learning about design specifications, required complementary technology and infrastructure
- development of user context: this includes learning about user characteristics, their requirements and the meaning they attach to a new technology and the barriers they encounter
- Societal and environmental impact: this entails learning about safety, energy and ecological aspects of a new technology
- Industrial development: this involves learning about the production and maintenance network needed to widen diffusion
- Government policy and regulatory framework; this involves learning about institutional structures and legislation, the government's role in the introduction process, and possible incentives to be provided by governments to stimulate adoptions.

Hooper & Jenkins (19XX) list a number of **barriers** to diffusion of clean technology. They argue that, given the combination of environmental and economic benefits, it might be expected that the demands of industry would drive this area of technological change. However, a number of obstacles to cleaner technology innovation have been identified:

- *The relative advantage of end-of pipe technology*. These relate to the reduced expenditure often associated with end-of-pipe technologies: the high profile nature of ‘add-on’ technologies which allow firms to ‘demonstrate’ their commitment to environmental protection; the greater disruption often linked to the more process – integrated cleaner technologies; and the existence of relatively well developed markets for end-of-pipe technologies.

- *The nature of regulation*. Environmental strategies that place excessive emphasis on emission and engineering standards are claimed to favor end-of-pipe solutions as they focus attention on adjustments to the waste stream itself, rather than the processes generating the waste in the first place. In addition, regulations, or their enforcement, are often too lax to stimulate the uptake of cleaner technology, a situation exacerbated by the lack of adequate financial incentives to encourage firms to go beyond compliance.

- *Time-scale*. The long-term return on investment in radical innovation(s) often thought necessary for the development of cleaner technologies can inhibit firms from making initial R&D commitments. In fact many cleaner technologies have been shown to offer rapid returns.

- *Lack of knowledge*. There appears to be widespread ignorance over the potential of cleaner technologies, which may be due to a lack of necessary technical expertise and limited dissemination of information. Firms can also be ignorant of the levels of pollution they are emitting.

- *Hidden benefits*. It is argued that the narrowly defined economic criteria used by most private enterprises, when assessing the viability of a given developmental option, frequently ignore the benefit derived from the reduction in the cost of pollution damage achieved by the adoption of cleaner technology, as this is not a cost borne by the firm (i.e. the environment is a ‘free’ good). The result is that in many cases cleaner technologies are not considered in corporate decision making as they are not regarded as cost-effective.

Hoogma et al. mention the following **barriers** against adoption of cleaner technologies and sustainable practices in the transport sector (presented separate, but in truth highly related):

Technological factors	These are compatibility problems of new technology; initial robustness problems; initial low economies of scale (hence: high cost/price)
policy and regulation	Regulation is sometimes too less guiding, sometimes too much locking into one technology
cultural and psychological factors	People have often projected their identity on the artefact they use. This favours the dominant technology in comparison to (new) niche technologies. (e.g. the car as icon of freedom)
demand factors	Many potential users wish to see the new

	technology to be proven in practice, and all their preferences fulfilled (this factor has a high interaction with factor (1) and (3); in Bijker's perspective they are inseparable (Bijker, 1995)
production factors	These are high sunk cost in existing production facilities, and also high risk and uncertainty in scaling up an experiment to mass production
infrastructure and maintenance	This is about the compatibility with existing infrastructure (this factor has high interaction with factor (1)). There is the problem of a threshold value: only above a certain critical number of vehicles, it becomes efficient to create a new infrastructure, even though vehicles require an infrastructure from the very beginning (i.e.: who takes these initial cost?)
undesirable societal and environmental effects of new technologies	The new technology may very likely also have some undesirable side-effects. There can be risk of new lock-inns

Montalvo (2002) developed a method to accurately identify and weight the factors that account for the resistance or willingness to change (in a clean direction) by industrial actors. This then allows for an effective policy negotiation with industrial actors. He argues that policy making on a collaborative basis is more effective for behavioral change (than one-directional penal regulation). Since this method can measure the *mindset* of the traveler and the developers, is a strong and promising tool that can be applied to many other sectors, like transport.

The Dutch organization for Sustainable Development (NIDO) mentions in her report BVD ('Bundelen voor Duurzaamheid') conditions or requirements that companies have, before start applying multi model transport.

Condition or requirement	**% of companies that mentions it**
Lower cost than road transport	45
Improvement of transport time	32
Punctuality / reliability	22
Flexibility	11

Source: BCI, 1998

- Is their difference between Western Europe, and the new member states in this respect? It is argued that the cultural and psychological barrier is even stronger in the New Member States, where car ownership is symbol of status, freedom, etc. The growing car ownership and related unbalanced infrastructure (increased traffic and congestion impacting heavily the public transport as well, sprawl of shopping malls, etc.) also makes people's life harder without a car.

EU and international development assistance (to the new member states) as well as national development strategies are focusing on road infrastructure development by a large extent, while railways are struggling with having sufficient resources even for maintenance purposes.

Dijk (2001) defines the term 'receptiveness' of new technology. This is a characteristic of a (potential) user. Summed over all actors in the system, the *'distribution of receptiveness'* in the population is then a measure of the chances for that technology in the system.
The model defines three external determinants ('characteristics of the situation') that determine whether a niche will grow and change the system, or whether a niche does not grow, and slowly dies. These three characteristics are:

- distribution of 'dissatisfaction with the present' over the actors (=potential users) in the population / system
- Distribution of Perceived initial usefulness (w.r.t. existing situation) over the actors (=potential users) of the population / system.
- 'Technology Gap'. This is the distribution of the cost / investments over the (potential) developers, which they have to make deliver their product, based on the new technology.

The model is 'agent-based', which means that it simulates the trade-offs of two different agents: the (potential) user, and the (potential) developer. This concept and model needs further study in theory and practice, to indicate its merit.

Barriers and drivers in new member states

- Cultural and psychological factors: This factor is even stronger in the New Member States, where car ownership is symbol of status, freedom, etc. The growing car ownership and related unbalanced infrastructure (increased traffic and congestion impacting heavily the public transport as well, sprawl of shopping malls, etc.) also makes people's life harder without a car.
- EU and international development assistance as well as national development strategies are focusing on road infrastructure development by a large extent, while railways are struggling having insufficient resources even for maintenance purposes.

6. Analysis of sector development (needs further elaboration)

This section is intended to describe and analyze the most important developments in the sector. This is done in order to place the technologies used as case studies in relation to the context in which the development or adoption could occur, the major characteristics of the sector will be described (i.e., level of competition, pace of innovation, regulatory and policy regimes, expected future prices and market evolution, business and investment cycles, etc.).

Key transport issues in the new member states

Based on EIB (2003) a number of key issues can be identified, which affected virtually all transport modes in CEE at the beginning of the 1990s:

- A large maintenance backlog due to shortage of funds for maintenance and previous unbalanced transport strategies: priority for new construction rather than maintenance of existing facilities.

- The deterioration of existing infrastructures due to the use of low quality materials (asphalt, cement, etc.) and poor quality control of works.
- Inefficient institutional framework and managerial structures, with a lack of know-how of financial and economic management tools, including inadequate procedures for investment selection and prioritisation.
- The limited introduction of market mechanisms in the transport sector, e.g. competition in the transport sectors, procurement procedures applied, etc.
- Non-existent or inadequate environmental standards.
- There was an inevitable impact on freight transport from: economic restructuring, the sharp decline in output which followed the disappearance of the Soviet Union, and the Balkan unrest which affected neighbouring countries.

Some growth was seen from 1993 onwards, and the sector managed to show around 10 % growth in 1995, but this could not be sustained. Low or zero growth continued in the years which followed, with variations between countries, and confirms the transport sector's sensitivity to economic cycles. Not all transport modes were affected to the same extent by these trends. Road transport overcame the decline by as early as 1993, while the railways, which had been declining since 1989, had to wait until 1995 before demand stabilised. Rail transport lost the lead it had held until 1990 and, by 2000, roads were transporting some 55 % of the total tonne-kilometres carried by road, rail and inland waterways. Inland waterway also saw its share decline, but not to the same extent as rail transport which has shrunk by almost half since 1990 (EIB, 2003).

While the New Member States have much lower road density the length of motorways has almost doubled between 1990-1999 and continue to grow rapidly (supporting the concept that transport infrastructure will drive economic development by national governments) causing serious threat on their territory with relatively high biodiversity by habitat fragmentation (Transport and Environment, WWF, BirdLife International, Friends of the Earth Europe, and CEE Bankwatch Network, 2003). The European Federation for Transport and Environment argues that there is hardly any evidence to prove that the construction of more roads will in itself result in economic growth and development in regions that are lagging behind. But what is certain, is that the development of road infrastructure will generate a bigger volume of traffic (Hollos, 1996).

The length of railways has been decreasing in the New Member States. Although trans-European transport network investments were originally targeted to have a dominant rail share, road network development is currently ahead of the railway network.

Box 1. Railway financing problems in CEE

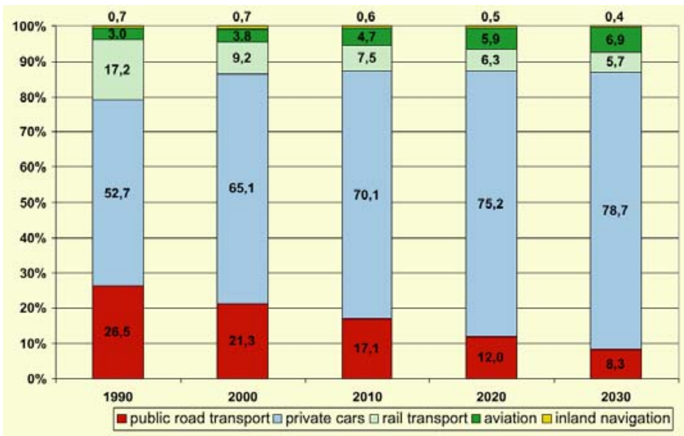
The distorted financing of CEE railways inherited from the old planned economies has caused many problems typified by the example of MÁV. Until 1982, ticket revenues plus government subsidies exceeded the costs of passenger transport. However, the increasing gap between revenues (including subsidies) and costs since 1983 meant that MÁV was forced to cross-finance passenger services from freight profits. It also meant that freight customers were financing social policy. This cut into the freight competitiveness and diverted resources from new investment and essential maintenance, resulting in deteriorating infrastructure and rolling stock.

In the early 1990s, the dramatic decline in MÁV's freight volume led to insufficient profits

from freight to cover passenger services. In 1994 and 1996, MÁV freight operations generated no profits and the railway was forced to finance operations with short-term loans guaranteed by the government from Hungarian commercial banks.
In 1994 and 1995, the government was forced to exempt MÁV from repayment obligations relating to operation loans. Financing part of passenger operations from guaranteed short-term loans proved to be very expensive.
Between 1989 and 1996, ticket prices increased by about 5% in real terms but the increase occurred before 1993 and prices have declined in real terms since then. During the same period, MÁV's passenger cost recovery ratio (passenger revenues/transport costs) declined from 32% to 22%.

Extracted from Tanczos, 1999

Chart1 *Expected trends in passenger transport in CEE*



Source: EC, 2003

An analysis of the EIB's portfolio in the CEE transport sector shows that lending (signed loans) to the road sector constitutes more than half (53%) of the Bank's financing, followed by rail at 21%. Lending to the urban transport sector stood at 15% at the end of 2001, compared with air transport at 10%. Ports play a minor role with only 1%. All of the port, air transport and rail investments were for rehabilitation and upgrading, as were the large majority of road projects. This order, i.e. Roads, Rail, Air, Ports, applies to six of the ten recipient countries (EIB, 2003).
Key issues:

- Traditionally strong railway and public transport infrastructure; however since 1990 there is a lack of financing for further development and sometimes even for maintenance. The length of railways has even decreased.
- Very strong political will to extend road network. Length of motorways has doubled in the last decade and growing rapidly further. There is a generally accepted concept that developing infrastructure will lead to economic growth, however recognition of the need for human resource development and other ways to increase the competitiveness of less developed regions is lacking.

- Increased affordability to own cars. Car ownership has grown in the last decade by more than 60%.
- Fuel quality has improved significantly. Phasing out lead has been completed in most of the New Member States. The fleet is getting younger in these countries, still some 4 years older than the average in EU-15.

The expected trends according to EC (2003) are even more modal shift to road transport both at passenger and freight traffic.

Chart 1 *Expected trends in freight transport in CEE*

Source: EC, 2003

Public transport

After the rapid loss of passengers in 1990-1995, varying between 15 and 25 percent in different countries, public transport in Central and Eastern Europe (CEE) entered a period of slower decline, with an average annual decrease in use of 1-3 percent. According to REC (2003), the reduction in public transport use amid the political and economic changes of the 1990s was caused by:

- the shift from public transport to passenger cars (mainly due to the opening of the car markets, improved well-being of the population, increased demand for public transport service quality and changing mobility needs);
- the significant reduction of state subsidies to public transport;
- the deterioration of public transport systems across the region; and
- the shift of urban transport responsibility from central governments to municipalities, which in most cases lacked the institutional capacity and financial resources to fulfil such obligations.

The following major trends and challenges in public transport have been identified though the studies conducted in Sofia, Tallinn and Warsaw by public transport experts preparing case studies (REC, 2003).

Mobility

- The number of trips has declined significantly for all means of public transport — in some countries by as much as 70 percent for all trips made by public transport.
- Private car ownership has increased and hence the number of car trips has increased (e.g. almost three times in Tallinn).
- The current public transport system does not offer an attractive alternative for the numerous new car owners.
- Time delays and street congestion are increasing for both private cars and public transport, affecting both passengers and operational costs.
- Traffic related accidents, noise, air pollution end energy consumption levels are all increasing.
- Car parking needs, road/street blocking and hence traffic obstruction are also increasing.
- New residential areas often lag behind old urban areas in establishing public transport services so private car ownership is promoted as a result.

Public transport management

- There is a lack of inter-modality, connections and links with other exiting public transport modes.
- Public transport systems have not developed fast enough to compete with private cars.
- With scarce financial resources, fleet renewal, infrastructure repair, modernisation and system development are reduced to the bare minimum.
- The market share of public transport in relation to other means of transport has decreased, in some cases down to 31 percent (e.g. in Tallinn).
- The average age of buses and trolleys in some countries is 20 years, and more than 26 years for trams.
- The basic structure of public transport systems has remained almost unchanged for the last 10 years.
- Overcrowding and the age of the fleet cause low service levels.
- There are no significant modal policies or traffic-management measures favouring public transport.
- The average speed of buses has slowed to 17.8 kilometres per hour in Warsaw, trams to 15 kilometres per hour.
- Suburban railway services have deteriorated.
- Municipalities have retained regulatory functions for public transport (service patterns, schedules, fares), often carried out by a specialised transport authority, leaving operations to company management; relations between operators and municipalities are regulated by service agreements (contracts).

Public transport financing

- Expenses for public transport have increased since the beginning of the transition period and most state governments in the region have stopped financing public transport (with the exception of the underground railway). States do not subsidise or subsidise in a very low amount public transport operations.
- Responsibility for public transport has been shifted to municipalities, but, as a rule, the state collects tax revenues.
- The lack of sufficient investment in public transport has resulted in an outdated rolling stock fleet and under-investment in public transport infrastructure.

- Fares are not adjusted on a regular basis, and no long-term fare policies are in place.
- Public transport companies do not receive full compensation for discounted fares and free rides given by the state (e.g. in Warsaw).
- State policy makes it practically impossible or very difficult for municipalities to use the funds from international financial institutions at their disposal, and state loan guarantees is an issue (e.g. in Warsaw).
- The fact that municipalities operate according to annual budgets makes long-term investment into public transport virtually impossible.

Conclusions

- Cities in the region have developed good policies and plans on how to manage or move towards sustainable development in the public transport sector, but they must now be put into practice.
- Without a significant and visible change in current policies, the negative trend in public transport system development will continue, marginalising public transport as a means for low income groups only.
- Surveys show the public prefers to give priority to buses and trams, even among private car owners. There is a notable preference of passengers for trams over buses. This option can be exploited further.
- Tram systems need to be rehabilitated and modernised.
- The absence of any state interest in public transport management issues is abnormal and has brought the public transport to the current status of degradation.
- The financing of suburban railway services needs to be assured.
- Cooperation between local governments in the metropolitan areas needs to be strengthened.

Urgent needs in the surveyed cities

The following public transport needs regarding management, infrastructure and financing need to be urgently addressed:

- renewal of tram and bus fleets (public tenders, eco-fleet);
- upgrade of selected tram lines serving the main corridors crossing the city centre;
- introduction of short sections of tram-line in peripheral zones;
- introducing trams/bus priority traffic control at intersections;
- extension of bus lanes;
- introduction of integrated management and control of public transport and car traffic (and control system) system; and
- improvement of the quality and service level, including an increase of operations (vehicle\kilometre), to decrease vehicle impact.

Salient policy developments in the New member states

Internalisation of costs

As the chart below shows the New Member States apply an excise tax on fuel well over the EU minimal level (359 EUR/1000 l). This brought the fuel price close to the one in Old Member States, although, calculating at purchase power parity the fuel price is above the highest ones in Europe in some of the New Member States. Hungary e.g. had higher fuel price than any of the surrounding countries including Austria, even in absolute terms.

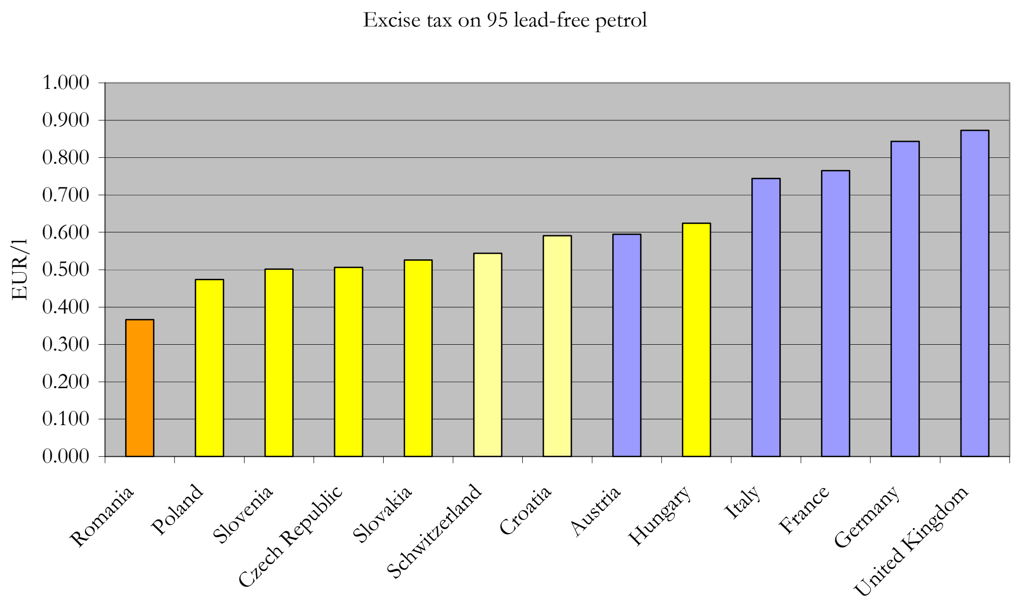


Chart 2 *Excise tax on 95 lead-free petrol as of 10 May 2004*

Source: MOL, 2004

Public Transport

Despite the financial constraints, CEE countries have made efforts to address public transport problems in recent years. Some big cities have developed and adopted sustainable urban transport policies, the interaction and dialogue among competent authorities and public transport companies has started to improve, the first steps towards increasing the efficiency of the public transport have been made, the public transport fleet has started to be renewed, city road infrastructures have improved, ring roads have been built, new metro, tram and trolley lines have started to operate, have been extended or are planned. However, in many other towns where the population is still relying largely on the public transport, many actions are awaiting decisions.

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