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**Summary**

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# Economic instruments to reduce transport-related emissions with cost-benefit analysis

## Urban pricing in Paris: lessons to be learned from abroad

Urban pricing includes all forms of road user charges or fees applied in urban areas. In practice, application methods are variable and depend on the main objectives. Experiences from abroad have proven that urban pricing can work to get extra revenue sources, to reduce traffic, to improve modal shift, to improve air quality and to develop a sustainable transport system. Successful experiences such as Oslo, London and Stockholm have led to widespread consideration of the adoption of urban pricing schemes.

Urban pricing can be classified in three categories according to their main transport policy goals: funding, congestion pricing and environmental pricing.

Funding pricing schemes in large urban areas have been established since the mid-eighties in Norwegian cities in order to finance road and public transport investments and to alleviate traffic congestion. On the other hand, the main aim of Singapore’s, London’s and Stockholm’s urban pricing schemes is to regulate road demand and tackle congestion without increasing supply. The environmental pricing schemes such as Milan and London LEZ are based on the polluter-pays principle: the main objective is to reduce negative impact of road user choices on the environment.

Even if urban pricing is not yet allowed by the French legislation, this paper attempts to show that implementation cannot be modelled on the successful experiences cited above because of the differences in urban structures.

Traffic conditions are getting worse in urban areas. Increasing concern over economic and environmental effects has led to more sustainable transport policies. New funding sources are therefore needed to promote cleaner transport alternatives. Experiences from abroad have proven that urban pricing can be an effective transport policy tool to solve these problems.

Urban pricing includes all forms of road user charges or fees applied in urban areas. It can be classified in three main categories according to their transport policy goals: funding, mitigating congestion and reducing environmental side effects. Schemes can be of three types: infrastructure-based (link or network), cordon-based or area-based.

***Experiences from abroad***

Tolling is a time-tested funding mechanism for inter-urban roads, bridges and tunnels. Collected money is allocated for a particular road project, generally to cover investment costs. One can find a few examples of urban toll roads in big metropolitan areas such as New York State Thruway (1954), Paris A10 highway (1996), Toronto ETR 407 (1997), among others. Yet, urban pricing for funding urban transportation plans was a new concept introduced by Norwegian cities in the mid-eighties. In fact, by using a different form of toll (cordon pricing instead of infrastructure pricing) and thus widening the tax base, Bergen found in 1986 an additional source for funding, not only one project, but a whole investment plan. The successful experience of Bergen opened the way to other Norwegian cities. In 1990, Oslo established a toll cordon to finance 55% of the Oslo Package 1, an investment program over 18 years (1990-2007) comprising fifty projects (1 800 M €), with 20% allocated to public transport projects. It has been renewed until 2027 to finance the Oslo Packages 2 and 3 with a higher share devoted to public transport projects.

Trondheim has also followed, but with a mixed objective: financing up to 60% the Trondheim Package (€ 266 million) over fifteen years (1991-2005), and regulating traffic during peak hours. The Trondheim urban pricing experience ended in 2005 as planned. Net revenues are high because of lower operating cost: about 20% in Bergen and only 10% in Oslo and 7% in Trondheim. Unlike the congestion pricing characteristics, the area covered is larger than the congested area, the fee levels are relatively low (about 2 €) and discounts are applied to frequent users to maximize revenue. Hence, traffic reduction is relatively small: 3% to 5% in Oslo, 6% to 7% in Bergen and 10% in Trondheim due to the modulation rate (peak / off-peak).

Norway has been a pioneering country in developing urban pricing schemes. A key factor for acceptability and success is the fact that collected money is earmarked for a particular investment program. Thus, pricing schemes have a limited lifetime.

While the use of toll revenue as a finance mechanism is a common practice (at least in the form of infrastructure-based pricing), congestion pricing is not.

Even if since Dupuit, Pigou (1920) and Vickrey (1969), economists have advocated pricing as an optimal way to regulate traffic, there was no real case application of this economic theory until 1975 when Singapore set up its arealicensing scheme (ALS). ALS was implemented to tackle congestion. A prepaid windshield sticker entitled drivers to enter the restricted area of the central business district. In fact, Singapore's policy package intended to reduce car use led to a traffic drop of 45%. Operating costs were then about 25% of gross revenues. In 1998, the sticker was replaced by an electronic toll collection system (ERP). This new system enables rates to be adjusted according to the routes and time of day to maintain optimal speed on the network. This technological improvement has contributed to a further decline in traffic of 15% and has reduced operating costs to 7% (FHWA, 2009).

Yet, Singapore’s political and geographical characteristics made it difficult to extend it to other metropolitan cities until 2003 when Ken Livingston, the former Mayor of London, introduced the London congestion charge.

“Annualised results for 2007 compared with 2002 reveal reductions of 16% in total vehicles entering the central zone” (TfL, 2008). However, the greatest effects towards mitigating congestion (30% in 2003) have decreased because of changes to effective network capacity. Congestion in 2007 was identical to pre-charging values. Even if operating costs are about 45%, the scheme generates an average net revenue of £120 million that is spent in public transport improvements.

Since London’s experience, political and institutional feasibility of congestion pricing in major democratic cities has been proven. As a result, other metropolitan areas are considering the adoption of urban pricing schemes.

In January 2006, Stockholm experimented, for seven months, a cordonpricing scheme where tolls were modulated by time of day. After this successful trial and a favourable outcome in the referendum undertaken within the city (48%, 43% cons), the congestion charge scheme came into effect on August 2007. The main objective has been largely achieved: the traffic crossing the cordon toll is down 22% instead of 10% to 15% expected.

No significant traffic increase was observed on the unpaid outer ring road (+1%). The toll is financially amortized over four years and the overall operation in six years. Operating costs of the toll account for 29% of revenue. Although the main objective was not improving air quality, the models show that polluting emissions are reduced through the relief of traffic congestion (about 14%).

In fact, reducing emissions of air pollutants and greenhouse gas emissions has become a major transport policy in metropolitan areas. Moreover, given the GES European standards, the establishment of “low emission zones” is being spurred today. In this context, selectively-modulated pricing by the level of vehicles' emission is a tool to guide user's behaviour. Among the first experiences are London Low Emission Zone (LEZ) and Milan Limited Traffic Zone (LTZ). Both started in 2008. Under the name of Ecopass, an environmental pricing scheme has been in effect in Milan since January 2008.

The access to the historical heart of the city is restricted for the most polluting vehicles. Price varies from no-fee to 10€, depending on the pollution level of the vehicle. Results of the first year of application (AMA, 2009) show that emissions decreased from 9 to 37% depending on the type of pollutant1 (CO2, NH3). The number of vehicles entering the area was reduced by about 14% inside the zone and about 3% outside. A secondary objective was to raise extra revenues to invest in the program for sustainable mobility funded by the government, the Lombardy region and province. Gross revenues in 2008 were around 12M€, half of what was expected and operating expenses accounted for more than 50% (6.5M€). Therefore annual net revenues are low. System characteristics (exceptions for the least polluting vehicles and motorcycles) may lead to eventual adverse effects on traffic and therefore on emissions of pollutants as the main expected effect is a modification of the fleet and not a decrease in the Vehicle Miles Travelled (VMT).

***Compared to European metropolitan areas*** that have established urban pricing schemes, the Paris Region is twice the size of Stockholm County, 6 times larger than Milan Province and 7.6 times larger than Greater London. It is also the most populated: 1.5 times more than Greater London, 6 times more than Stockholm and 8.7 times Milan Province.

The Paris metropolitan area has higher densities, in particular in its inner core. Unlike Paris, densities in London are quite homogeneous whatever the distance from the centre is. The maximum density is located further away from the centre than Paris.

Employment is also highly concentrated in Paris (32%) and in the inner suburbs of the region (37%). Population and employment distribution reflects on mobility patterns. The London Household Survey (Tfl, 2004) shows that almost 50% of trips take place in the Outer London. In the Paris Region only 35% of trips take place in the outer part of the region (Grande Couronne) (Courel, 2008). Trips within or into the London City Core only account for 16% compared to 29% for Paris.

Those patterns show the weight of Paris City in the Region interactions. Therefore, an area-based or cordon-based scheme that isolates the city centre from the Region outskirts wouldn’t be socially and politically acceptable.

Even if the European Commission encourages urban pricing, there are still some issues to address in the French context: political and legal feasibility, acceptance, technical feasibility and appraisal.

First of all, urban pricing is not yet allowed by the French legislation. Political debate around this subject began in 2000 with the proposal to amend the Social Cohesion and Urban Renewal Act to allow cities to implement trials as part of the policies of urban mobility plans. The proposal was rejected because of insufficient information on the consequences of such a decision.

Political interest on the subject has been recently renewed. In autumn 2007, at the closing session of the "Grenelle Environnement"2, the French President committed to entitle local authorities to introduce urban pricing schemes as a sustainable transport policy tool. But the "First Grenelle" Act3 only included “the Creation of Ecotax based on mileage payable for trucks using the nonconcessionary road network” and the commitment to study the establishment of selectively-modulated interurban highway tolls by the level of vehicles' energy efficiency, time of day and vehicle occupancy rates vehicles. This can be seen as the first steps for political and legal feasibility of urban road pricing in France.

The National Commitment Towards the Environment Bill also called “Second Grenelle” Bill introduced by the Government in January 2009 did not establish any legal base for urban pricing. But, at the first reading stage at the Senat held in October 2009, the bill was amended to give the possibility for public transport authorities complying to three conditions to implement a three-year trial. Conditions are:

1. To have more than 300 000 inhabitants

2. To have approved a sustainable mobility plan

3. To have adequate public transport capacity to meet the increasing demand from modal shift

Nevertheless, urban pricing remains an unpopular measure in France. On the one hand, “regalian origins of tolls explain to a large extent the suspicion (…) surrounding users assimilating tolls to an unjustified tax rather than reasonable payment for the use of safe, efficient infrastructure” (CERTU, 2007). Road users perceive infrastructure as a public good that should be free of charge and it will be difficult to change their point of view. On the other hand, some toll experiences in urban and sub-urban motorways (Western Lyon bypass, A64 motorway in Toulouse) lacked of transparency, good information and communication. This has led to car users' reluctance to accept road pricing. Therefore, measures recommended by CERTU to enhance project acceptability should be carefully followed.

Urban pricing needs strong political commitment and a clear governance framework. Especially in the case of the Paris Region, institutional and governance problems are other key issues. Unlike London and despite decentralising reforms, there is no regional body to take such a political decision without interfering with responsibilities and competences of others (Paris City and the other 1800 municipalities, the Ministry of Transport). In fact, Regions have only competences in the fields of territorial planning and economic development. Public transport authorities coordinate the provision of public transport services and determine the fare policy. They do not have competencies over the road network which is under the umbrella either of the Ministry of Transport or the local authorities which are also responsible for the parking policies.

Several structures of institutional cooperation between Paris and part of its suburbs are emerging. On the one side, the mayor of Paris has lately signed political partnership agreements with Mayors of dozens of local authorities around Paris to create “Paris-Metropole”, a form of regional and intercommunal cooperation structure. On the other hand, the French Government is planning to create the “Greater Paris”, an institutional structure encompassing Paris and the surrounding municipalities in charge of large scale urban projects. These structures may provide institutional frameworks for future discussion of an urban pricing scheme as an innovative financing mechanism for transportation investments plans.

Without a governance framework suitable for implementing an urban pricing scheme, there is a higher risk of project failure. The New York congestion pricing project is a good example of it. “Since the Mayor and City Council of New York City lacked the authority to implement congestion pricing, it was necessary to build political support for the proposals, especially in the outer boroughs, before seeking approval from the Legislature” (Konut, 2008). Because of its vulnerability, the project failed.

Urban pricing experiences have proven to be an effective transport policy tool. It reduces traffic flows in congested areas: the number of vehicles entering pricing areas is 4% to 16% less than pre-charging values. Singapore case is exceptional with traffic levels down by 45%. It also improves air quality through reducing emissions of pollutants. Furthermore, once the capital costs amortized, it is an additional funding source. Even though, it should be used as part of a whole transportation strategy and key characteristics of the scheme should be properly defined in order to meet the primary objective and avoid unwanted side effects.

Particular attention should be paid when choosing the type (cordon, area or infrastructure), the extent of the area covered, the rules (modulations and possible exemptions), the average fee and technology choices. Operating costs vary depending on technology: 45% of revenue (for London) to 7% (for Trondheim) but technological improvements can lead to a reduction of these costs.

The introduction of an urban pricing scheme is a difficult political choice, which meets with public opinion reluctance and that requires political commitment. Nowadays the French context, especially in Paris, is not very favourable to urban pricing trials. Ecotax and the new amendment are the first steps for the legal feasibility. Although, there is a long way to overcome political and public acceptance issues. Technical feasibility still needs to be further studied. In particular, alternative measures such as HOT lanes or TDP pricing should be assessed and compared with other type of schemes.

## Impact of Law emission zones (LEZs)

<http://www.lowemissionzones.eu/>

As a number of LEZs have now been operating for over a year, it is becoming possible to assess the actual impact.

Low Emission Zones (LEZs) are areas or roads where the most polluting vehicles are restricted from entering. This means that vehicles are banned, or in some cases charged, if they enter the LEZ when their emissions are over a set level.  
They are also known as Environment Zones, Umweltzonen, Milieuzones, Lavutslippssone, Miljozone, Miljözon.

They are often the most effective measure that cities can take to reduce air pollution problems in their area. The emissions that are aimed to be reduced by LEZs are mainly fine particles, nitrogen dioxide and indirectly ozone.

Vehicle emissions are classified by the Euro Standards for the vehicles that they affect. In many cases another factor is whether or not the vehicle has a particulate filter or catalytic converter.

Communication of the LEZ details should be clear and effective for operators, and EU-wide if foreign vehicles are affected, for EU law. National frameworks have made communication easier. A wide range of communication approaches has been undertaken in existing LEZs. For example, in German LEZs affecting private vehicles, information has often been sent to each resident, making the national sticker scheme and LEZ concept well recognised nationally and internationally. The EU-wide LEZ Network LEEZEN has helped LEZ information to be spread EU-wide. An awareness of air quality as a health problem may also help acceptability.

All LEZs affect heavy duty goods vehicles (usually over 3.5 tonnes Gross Vehicle Weight (GVW)), and most buses and coaches (usually defined as over 5 tonnes GVW). Some LEZs also affect vans, cars and motorcycles.

Most LEZs operate 24 hours a day, 365 days a year, with some of the Italian LEZs currently the only exceptions to this rule.There are various ways to measure the impact of LEZs. One of the most commonly used ways is to calculate the emissions of the vehicles that would enter the LEZ and compare that with an estimate of what the emissions of the vehicles would be without the LEZ.

***Berlin LEZ:***

The environmental zone has been effective since 1 January 2008 and covers the centre of Berlin inside the S-Bahn ring ("Großer Hundekopf"). This has an area of approximately 88 km². The area is particularly closely built-up. Around one million of the 3.4 million inhabitants of Berlin live here. The environmental zone is indicated by traffic signs at the bridges and underpasses of the S-Bahn railway. The southern part of the city highway, which lies inside the S-Bahn ring, will not form part of the environmental zone and will remain freely accessible given that the motorway ring serves as a bypass for the zone. In addition, nine streets within the ring are not part of the environmental zone, whereas one street outside the S-Bahn ring has been added to it.

One year after stage 1 of the environmental zone was introduced the emissions of diesel exhaust particulates have decreased by 24 %. Emissions of nitrogen oxides have fallen by 14 %. This resulted in around 62 tonnes less diesel particulates and 960 tonnes less nitrogen oxides in the air.

One year after stage 2 of the environmental zone has come into force, emissions of diesel exhaust particulates have gone down even more drastically by more than 50 %. Emissions of nitrogen oxides have fallen by 20 %. This means around 170 tonnes less diesel particulates and 1500 tonnes less nitrogen oxides in the air. Accordingly, traffic related black carbon concentrations measured along busy roads in the low emission zone were halved since the low emission zone was launched beginning of 2008.

From January 2007 **in 9 cities of Netherlands the LEZ was initiated**. In summer 2008, the actual air quality improvements were slightly less than predicted, with improvements between 0 - 2μg/m 3.

Impact limited by gradual enforcement and many exemptions for vehicles where diesel particulate filters were not available. Both of these will improve and expect to increase the air quality impact by a factor of 1.5 - 2.

A recent enforcement drive to increase the effectiveness of the LEZs. In Den Bosch 83% of lorries complied – up from 70%. In Eindhoven 91% of vehicles now complied. Vehicles which did not comply and did not have exemptions were fined the € 150 fine. This increased compliance will increase the impact of the LEZ on air quality.

There are currently 11 cities in the Netherlands that have introduced environmental zones in their city centres. These cities are Amsterdam, Utrecht, Rotterdam, Den Haag, Eindhoven, Breda, Den Bosch, Tilburg, Delft, Leiden and Maastricht.

Only clean lorry may enter environmental zones. To be clean, diesel lorry weighing over 3,500 kg must comply with the Euro 3 emission standard or higher. Lorries with Euro 0 or Euro 1 and Euro 2 engines may not enter environmental zones. Lorries with diesel engines that comply with the Euro 3 standard must be fitted with a particle filter and may not be older than 8 years. Lorries with Euro 4 or Euro 5 engines may enter environmental zones without having to be modified. The penalty for non-compliance with the admission criteria is € 160.

Environmental zones will help improve air quality in urban areas where the EU-standards for fine particles (PM10) and nitrogen dioxide (NO2) are being exceeded.

Environmental zones are marked by a sign which bears the word ‘Milieuzone’ (‘environmental zone’), the Netherlands did not introduce special stickers to show the emission levels of engines (like the German ‘Umweltplakette’). Instead, enforcement is based on the vehicle licence number, which is linked to the environmental class and vehicle age.

The authorities are currently examining whether the restrictions in environmental zones can be applied to foreign vehicles. For the time being, all foreign vehicles will be allowed to enter environmental zones without restrictions.

***London LEZ*** [*http://www.tfl.gov.uk/roadusers/lez/*](#_Impact_of_Law)***:***

Starting since February 2008, the first phase expected to reduce the area over the 2010 PM10 Limit Values by about 5.8% in 2008.

Feasibility study predicted gain of 5200 years of life, and the avoidance of: 310,000 cases of lower respiratory symptoms, 30,000 cases of respiratory   
medication & 231,000 restricted activity days for all phases.

Cost Benefit Analysis shows £250-670 million benefit, £90-250 of which are outside Greater London.

Heavy vehicles, buses and coaches are currently required to meet the Euro 3 standard for particulate matter (PM) emissions. Larger vans and minibuses will be included in the LEZ from 3 January 2012.

This phase will require the following diesel-engine vehicles to meet the Euro 3 standard for PM emissions to drive within Greater London:

* Larger vans and motorised horseboxes: between 1.205 and 3.5 tonnes gross vehicle weight
* Motor caravans: between 2.5 and 3.5 tonnes gross vehicle weight
* Minibuses: passenger vehicles with more than eight seats plus the driver's seat, below 5 tonnes

Vans and minibuses first registered as new on or after 1 January 2002 are assumed to meet the Euro 3 standard. Vehicles not meeting the emissions standard can be made to do so by modifying them. Alternatively, operators of vehicles that do not meet the standard would need to pay a daily charge of £100 to drive within the zone.

Vehicles that came into scope in 2008 will be required to meet the Euro 4 standard for PM emissions from 3 January 2012. Operators of vehicles that do not meet this standard will need to pay a daily charge of £200 to drive within the zone.

***Cologne***

To improve air quality in Central Cologne, a Low Emission Zone (LEZ) was introduced on 1st January 2008. Only motor vehicles equipped with a red, yellow or green fine pollutant LEZ sticker are permitted to enter the City Centre and parts of the boroughs of Deutz and Mülheim.  Sticker colours vary according to the classification of the respective vehicle pollutant group. Car registrations are entered on the corresponding stickers.

First results from the first year of operation show that air quality concentrations in Colognes LEZ have reduced more than the surrounding background. For NO2 by 1.2 μg/m3 (background reduction was 0.5μg/m3), PM10 by 4 μg/m3 and 17 exceedences of the limit value (background reduction 4 μg/m3 and 7 exceedences).

In Cologne, only the general exemptions stipulated in the national LEZ scheme apply. Residents and commercial traffic is not exempted from the LEZ. In cases of special hardship owners of vehicles that are banned from the environmental zone under the national LEZ scheme can apply for a special exemption. Cologne has adopted guidelines and details individual exemptions from the driving ban granted by the transport authorities in Cologne’s districts.

## Promoting car sharing and car clubs in rural areas: government response

<http://www.liftshare.com/business/pdfs/dft%20-%20making%20car-sharing%20work%20-%20good%20practice%20guide.pdf>

***Car sharing***

This guide is aimed at a wide variety of groups - employers, public agencies, site managers, community groups and many more, to provide help on the delivery of car sharing and car club schemes for specific organisations and communities.

It is the outcome of a detailed study carried out in 2004 into the effectiveness of current schemes established across the UK, and draws on the experience of over 20 case study sites. The guidance is supported by a detailed study report and full case study reports. The approach to delivery of car sharing schemes and car clubs varies according to local circumstances. There is no one template for success; hence this guide is designed to offer practical advice to suit the needs of your particular site or community.

Fundamentally, this guide seeks to enhance existing guidance given in other best practice notes, particularly those related to travel plans. It recognises the importance of developing car sharing and car club solutions that integrate with a wider package of sustainable transport measures. As such it has been designed to offer more than just a ‘glossy promotional leaflet’ and explains some of the more detailed issues necessary for success.

The term ‘car sharing’ as used in this guide, refers to a situation where two or more people travel by car together, for all or part of the car trip. This guide is focussed specifically upon car sharing for closed communities – i.e. for a defined group such as an employer. In general terms, car sharing can be described as:

• formal - an organised scheme that puts drivers and passengers together who may not otherwise have come together to share car journeys; and

• informal - generally where family, friends and colleagues agree among themselves, on an ad hoc or regular basis, to share car journeys.

There is a wide range of car sharing schemes operating in a variety of contexts, and no one model provides an ideal template for all situations. However, based on experience, schemes that flourish do so under the following conditions:

1. ***Problem Definition:***

• A tangible problem exists, such as a severe shortage of car parking, significant local

congestion, and limited alternatives to travelling by car.

• An external factor exists, such as a planning condition on a development that requires an organisation to limit the volume of cars accessing its site.

2. ***The Business Case:*** The organisation introducing the scheme has a clear understanding of the business case for promoting car sharing, including an appreciation of the full costs it currently bears for providing car parking.

3. ***Management Support:*** There is strong management support and commitment for car sharing, and managers are involved in promoting the scheme, as well as leading by example.

4. ***Travel Plan:*** Car sharing ideally should be part of a supporting travel plan as, compared to single occupancy car drivers, car sharers are more likely to use a variety of transport alternatives.

5. ***Partnerships:*** There is partnership working between the organisation(s) involved in introducing a car sharing scheme, the local authority and, if appropriate, the software provider.

6. ***Proper Preparation:*** Preparation before the scheme launch is both thorough and robust. Workable, realistic and cost-effective technical and administrative approaches are adopted, consultation with staff / unions is carried out at an early stage, and any issues raised are seen to be addressed.

7. ***Confidence of Users:*** The confidence of users is engendered from the outset.

8. ***Sufficient Resources***: In terms of staff time and a budget, there are sufficient resources available for the development, implementation and maintenance of the scheme.

9. ***Marketing and promotion:*** An effective marketing campaign is sustained.

10. ***Incentives:*** Incentives and supporting measures are provided, which aim to address objections and deterrents to car sharing.

Where priority parking is provided for car sharers, enforcement measures may be necessary. The approach taken should be carefully tailored to meet local needs. The most important consideration is to ensure that enforcement is recognised by users and non-users such that the scheme does not become devalued through infringements.

Three broad options exist:

• Self enforcement, where staff are involved in informally policing infringements, and feeding back information to the scheme administrator – particularly suitable for sites without a managed car park and/or with a strong sense of staff commitment to the car sharing scheme and where spaces are dedicated in prominent locations.

• Random enforcement, where checks are made on an ad-hoc basis, usually supported by some sort of permit system to be displayed on the dashboard or windscreen – particularly suitable for sites with an attended managed car park, and where concerns over staff enforcing the use of spaces have been raised.

• Automatic enforcement, where physical entry to reserved parking areas is restricted to car sharers only by means of: a swipe card and barrier entry; or personnel – particularly suitable for large complex sites, with multiple car parks, and where barrier controlled car parking exists (or could exist).

Having successfully implemented a car sharing scheme, it is important to monitor its effectiveness in reducing the impact of single occupancy car use. This provides valuable performance data to senior management on whether the investment in car sharing is being spent wisely, and, in the case of new development, can provide important data to enable local authorities as to whether conditions associated with planning agreements are being met. It is important to consider the approach to monitoring at an early stage in the development process, such that baseline data can be established, that the technical approach can be agreed and budgets for monitoring activity can be secured.

Having monitored performance it is well worth the effort in conveying performance back to staff. In most cases staff will have seen the benefits first hand through reduced local congestion, and less parking pressures on site, but nevertheless, this stage of the process enables the car share coordinator to thank sharers for their contributions.

The feedback should be done in accordance with the marketing strategy, continuing to raise awareness amongst all staff. It is worth considering the use of ‘related benefits’, such as the amount of CO2 saved, total reduced mileage per annum, or the average financial saving per sharer.

Interesting example is presented on the web-side, where is a page with a calculator <https://www.liftshare.com/uk/default.asp>. The motto of the calculator is “Start saving money and reduce CO2”.

***Car clubs***

For the purpose of this guide a ‘car club’ is a club that provides its members with flexible access to the ‘hire’ of a vehicle. Vehicles are parked in reserved parking spaces, close to homes or workplaces and can be used, and paid for, on an hourly, daily or weekly basis.

In 2003, CarPlus established a toolkit aimed at defining the process of establishing a car club (see www.carplus.org.uk for further details). This is a very comprehensive resource covering all aspects of car club development. Therefore, this guidance does not seek to replicate that work, but draws upon some of the success factors that are evident in current UK schemes, and sets a framework in which car clubs can flourish in line with European experience.

Information in this guide relates to car clubs in *closed communities*, which refers to a scheme that is limited by defined boundaries. These can be geographical boundaries or, more typically, an operating unit, such as a business, public sector organisation, or academic institution. There are currently (summer 2004) around 26 car clubs established in the UK.

*Closed community* car clubs in the UK are generally developed and managed by one of the following players:

• Commercial operator (e.g. Smart Moves, Streetcar, Urbigo, Whizzgo).

• Community group / partnership / not for profit organisation.

• Cooperative.

• Employer operated scheme (e.g. expansion of pool cars fleet).

• Informal residents group.

• Management group (e.g. on behalf of a housing development).

While seeking to avoid duplication of the CarPlus toolkit, for context this guide provides a basic outline of how car clubs are run. We have therefore included a basic summary in Appendix B of the options available for various aspects of car club operation. The choice of technology and the operating structure are driven by the needs of the specific site and, to some extent, the resources available. Advice on the approach to be taken is generally determined through the scheme feasibility study.

One of the key issues identified by the research that supports this best practice guide is the need for a five year support plan for new start-up car clubs. This should be seen as a one off investment rather than on-going revenue support. After five years, it is anticipated that car clubs should become self-financing (or a decision can be made as to whether to continue subsidy support).

Membership costs are determined locally based upon the financial model developed by the operator. As a general rule the following applies:

• Clubs charge a membership fee, paid annually or monthly, typically of the order of £100 per year.

• When starting up, clubs offer subsidised membership rates for a limited period, to establish a membership base.

• For vehicle use there is a two-part payment: for vehicle hire (typically £2 - £4 per hour), and for mileage (typically 15p – 20p per mile).

• Vehicle use charges generally increase with the size of vehicle.

• For smaller clubs, with only a couple of vehicles, hire charges are often structured to discourage longer hire periods, of more than a day, as this pattern of hire reduces the availability of vehicles for other club members.

• Membership and hire charges can be varied to encourage second household membership and low-user membership.

• An alternative model is to consider pricing tariffs, offering flexibility to change tariffs on a month by month basis to suit particular needs of users.

Research shows that a wide variety of people join car clubs, and they generally do so because significant lifestyle changes lead to an increase, or decrease, in car use. Car clubs can allow an increase in car use, while avoiding the need to buy a vehicle. They can also enable people to dispose of their car (or second car), if their need for it declines, while providing for those journeys that can only reasonably be made by car. Transitions in life that can lead to adjustments in car use include:

• Change of house.

• Change of job.

• Retirement.

• Car too old and costly to repair again.

• Children leave home.

• Loss of a company car.

Car clubs can offer a variety of benefits to individuals and society as a whole.

Car clubs provide flexible and affordable car use, without the costs and hassles associated with car ownership. They have added appeal for those who:

• Have no, or limited, on- or off-street parking near where they live.

• Cannot afford to run a car themselves, or do not want the inconvenience of being responsible for maintaining one, but need car access for particular journeys.

• Occasionally need a second (or third) household car, but do not have the means or desire to own one.

• Have recently moved to an area, as it can provide a means of making friends and becoming integrated into the community.

• Own a vehicle, but sometimes need a different type of vehicle for a particular purpose.

Car club users develop a balanced approach to their use of transport generally, and through ‘pay as you go’ motoring, recognise more clearly the true costs of travel and can therefore compare more easily the different options available to them for each trip.

Because car club membership is often associated with members using cars less for some types of journeys or for journeys at some times, car clubs can help local authorities to reduce traffic volumes, reduce the amount of public land set aside for car parking, and reduce levels of congestion. It is estimated that every car club car has the potential to replace five privately-owned cars. This does not take into account the number of people who choose not to buy a car, because they have joined the car club instead.

Research has shown that car club members who give up a car are likely to reduce their mileage by around 60-70%. The average change in mileage for all car club users is a reduction of 33%. This takes into account those who join the club who did not previously own a car and those who use the car club to have access to a second car.

Car clubs can enable higher density residential and commercial development by reducing the number of on-site parking spaces, and maximising the available land for usable space. This can be achieved without compromising mobility, provided that a long-term commitment to the delivery of the car club can be secured.

## Green parking scheme in Richmond: lower emission cars pay less

From 1 October, Richmond Council is extending its innovative and controversial CO2 related parking scheme to all Council on- and off-street parking in the borough. Under this new approach all cars that park in Richmond upon Thames will be charged according to how much CO2 their cars produce, with lower rates for the least polluting vehicles.

The scheme also provides for ‘on street’ parking at just 20p for 20 minutes and for drivers of low/medium CO2 emitting cars it will be 10p for 20 minutes. On Thursday afternoons motorists will be able to park from 3.00pm for a flat charge of £1.50 or £1.00 for low/medium cars. It is hoped that both of these initiatives will help shops and the local economy in general.

Richmond upon Thames is the first borough in the UK to introduce such a charging policy. The system works for drivers who use the RingGo system to pay for their parking. Motorists register and pay by phone, and RingGo accesses the DVLA database for each customer's registration to determine emissions data on the car.

Those who drive gas-guzzlers will pay 25 per cent above the standard rate while those who drive eco-friendly cars will pay 25 per cent less than the standard rate. Motoring association the AA has claimed that the move is more about raising revenue than being green.

The aim is to encourage motorists to use greener vehicles and therefore help local and national government to meet their targets for emissions.

## Mobile Travel Information Services for the Public (MTIS)

<http://www.niches-transport.org/fileadmin/NICHESplus/G4Is/21582_policynotesWG3_2.indd_low.pdf>

***Concept definition***

This concept focuses on provision of travel information en-route for public transport users. This can be via on-board units, variable message signs, e-kiosks on street and at stations, and personal mobile devices. Mobile Travel Information Services (MTIS) enhance convenience and confidence when travelling by various transport modes, particularly public transport.

***Characteristics***

• These services offer assistance to travellers whilst they are on their journeys, anywhere and at any time.

• They enhance public transport modes by improving the quality of service.

• The services can be location-based, tailored to an individual’s particular needs, and can be based on real-time information.

• Implementing MTIS needs the integration of various information and communication technologies (ICT), including mobile communication, wireless, dedicated short range communication, Internet, satellite, and computing technologies.

***Benefits***

MTIS bring benefi ts to all types of transport users. They:

• provide **extra flexibility** for travellers and a stronger feeling of being in control of the journey, and as such can contribute to enhanced convenience and confidence when travelling;

• provide **assistance** to public transport users by guiding them throughout the journey, and especially at interchanges, **in real-time**;

• will generally have **political** support, as by improving the public transport experience, they can provide increased patronage;

• increase **economic** efficiency by adding value to existing public transport services and transport networks;

• reduce **social** exclusion and promote **independent** travel opportunities by making existing transport networks and public transport services more accessible.

There may be positive **environmental** side-effects through induced public transporttrips and possible lasting **loyalty to non-car modes.**

***Costs***

The costs of MTIS depend on the level of services that are to be provided.

Highly accurate, real-time, location-based, personalised and context-aware information services can be costly as they require high levels of technological integration and sophisticated management between partners.

Systems also need to be operated and maintained, although costs are marginal once the MTIS is running. If information services are to be provided free to users (i.e. without subscription) then additional revenue sources need to be considered. Advertising existing transport services through MTIS is one possible source of revenue, which could attract commercial investment towards the MTIS.

The main impacts and measures of success are efficiency, safety, environment and accessibility.

MTIS can add value to public transport services, and improve efficiency of transport operations and networks. However, the real economic impact can be difficult to quantify.

## STEPs (Scenarios for the Transport system and Energy supply and their Potential effectS)

http://www.steps-eu.com/

The success of transport has relied on the wide availability of petroleum fuelling the ever-increasing human need and desire to travel. Both factors influence and affect each other; the relatively cheap form of energy supplied to vehicles has helped the expansion of transport and this has driven the need for vehicle fuel. However, over recent years concern for the environment and the knowledge that petrol is slowly diminishing has led to investigations into the use of alternative fuels to power motorised transport. Driven by these issues and a desire to test various methods of reducing overall energy use **STEPs** was born.

**STEPs** (Scenarios for the Transport system and Energy supply and their Potential effectS) was a project being carried out as part of the European Union Sixth Research Framework Programme, under its ‘Sustainable Surface Transport’ priority. Within this programme the purpose of **STEPs**, was to *"strengthen the scientific and technological bases of industry and promote research activities in support of other EU policies"*

***STEPs Objectives & Targets***

The European Commission is progressive in setting challenging targets for future developments in the transport energy system. These derive from:

* the need to reduce the use of polluting transport means in populated areas while maintaining the same level of accessibility;
* to put on course the transition towards an environmentally harmless transport system based on renewable fuels and reduced environmental noise emissions;

The target for **STEPs** included:

* reduction of greenhouse gas emissions and to reach a level of 30% replacement of fossil fuels by 2020;
* Objectives like the development of medium term technologies necessary to meet the Euro V emissions standards.

The overall aim of **STEPs** was to develop, compare and assess possible scenarios for the transport system and energy supply of the future and supports both the overall FP6 programme objective and the specific future needs of the transport energy sector. In doing this it took into account effects such as:

* autonomy and security of energy supply,
* effects on the environment,
* economic, technical and industrial viability,
* interactions between transport & land use.

***Conclusions***

The results of the STEPs analyses serve as a basis for the development of a view on future policy and research requirements in the area of transport and energy scenarios. The partial conclusions of each analysis were presented and discussed during clustering meetings and soundboard forums throughout the project. The synthesis of overall conclusions was presented at the final conference, and gave rise to a debate involving various views on future policy and research requirements.

This chapter presents a synthesis of the main findings on trends and policy scenarios, and the policy recommendations based on the STEPs results. Then some general reflections are presented, and we end with recommendations for further research.

***Trends***

The long-term future of energy supply for transport appears difficult, and the situation has become significantly more critical even during the short project period of STEPs.

Today a growing majority of experts believe that because of a combination of scarcity in cheap oil, increased global energy demand and greater supply disruptions provoked by Geo Political Dependence of Europe, fuel prices will continue to rise in the medium and long term. Indeed, mostly due to the emerging economies in Asia (in particular China and India), energy demand is rising significantly more than oil production and oil refining capacity, making disruptions in energy supply a major and increasing concern. The share of worldwide energy demand and energy market stress that these markets bring along with their expansion is overwhelming. The growth of mobility and transport systems in most Asian countries has progressed at a different speed – India and China had a slow start but has now surpassed Western regions in their economic growth rates, which is directly reflected in their transport demand, mobility growth, and increased energy demand.

All trends in economic activity, goods transport and personal travel, point towards longer distances and, despite energy efficiency gains, to more energy consumption. This reflects a pattern shared by most industrialised countries which have developed their economy and lifestyles firmly rooted in the promise of cheap energy supply. We observe a trend towards an ever-increasing intensity of freight transportation. In the passenger transport sector we continue to observe a trend for increased mobility coupled with faster and more flexible realization of mobility needs and an increase in the use of private automobiles. This is noticeable in the increasing traffic flows, the modal split, high car dependency, etc. These trends are unsustainable vis-à-vis the trends of declining energy supply, increased supply disruption risks, higher energy costs and the growing risks of climate change.

All efforts to decouple economic growth and energy consumption and to reduce greenhouse gas emissions have, with a few local exceptions, failed and are insufficient to meet the more demanding post-Kyoto targets.

***Policies***

Demand management policies making road transport slower or more expensive (push measures) are more efficient in reducing transport fuel consumption than policies promoting more sustainable transport modes, such as walking/cycling or public transport (pull measures). Integrated strategies combining push and pull demand management policies, technology development policies and land use policies are more successful than isolated individual policies. The efficiency depends on the level of change of both push and pull measures, and availability of alte rnatives.

Technology development policies making vehicles more energy-efficient or promoting alternative propulsion systems are successful in reducing fuel consumption per km, but tend to result in longer distances travelled by both passengers and freight unless the higher costs of new technologies are taken into account.

All policies using dominant push measures resulting in lower fuel consumption for transport have negative effects on accessibility and hence economic activity. Public transport fare reductions (pull measures) would have good impacts on accessibility and lower fuel consumption.

***Policy recommendations***

The widening gap between global energy demand and declining energy resources and the growing risks of climate change require immediate, strong and probably unpopular policy action, including transport, regional, agricultural and technology policy. The common transport policy of the European Union needs to be fundamentally reviewed in the light of the urgency of these risks.

While it is irrelevant for the behaviour of users whether fuel price increases are caused by rising resource costs or fuel taxes, for decision-makers or governments it makes a difference. Fuel taxes contribute a lot to government revenues which may well be affected directly and indirectly through impacts on other taxes. A harmonised system of vehicle taxes, fuel taxes and road pricing for cars and lorries on all types of roads should be introduced in all EU member states to achieve the necessary energy savings and emission reduction targets, with special exemptions for disadvantaged and peripheral regions.

Fuel taxes can be used to mitigate or reinforce the effects of increases in fuel resource costs. Consultation among governments could result in a unified fuel tax policy throughout Europe, aiming at increasing global competitiveness.

Co-ordination between different government sectors and levels of government should be enhanced in order to design and implement integrated strategies combining policies from different policy fields, such as transport policy, regional policy, urban land use policy and environmental policy.

The production and use of biofuels in Europe is seen as a promising short- to medium-term option to decrease European energy dependency regarding transport related energy consumption. Yet, despite the positive indications contained in the EU policy supporting the production of biofuels as an alternative to fossil fuels, there are little evidences that biofuels can effectively be seen as a full alternative to conventional sources, but rather as an interesting complement to satisfy a parcel of the energy demand in transportation.

National, regional and local governments should be encouraged to support domestic economic linkages, regional and local production circuits, less car-dependent, more compact forms of settlements and pedestrian-friendly neighbourhoods.

The EC should vigorously adopt a long-term goal to drastically reduce CO2 emissions from transport by promoting, through stricter regulation and activation of public procurement, improvements of current vehicle technology, and tightening the standards for the introduction of near-zero emission passenger vehicles.

One of the main instruments at EU level so far has been the voluntary agreements with the car industry. This approach is proving relatively weak in view of the challenges ahead and should become more ambitious if consumption of fossil fuels is to be reduced to a more sustainable level.

European technology policy should increase funding of research and development for more energy-saving and alternative vehicles.

The impact of energy scarcity and growing greenhouse gas emissions are a bigger threat together than either is alone. These concerns should be combined as issues and a comprehensive policy approach developed to deal with them as a package.

***General reflections***

The future of energy supply to the transport system will be closely tied to the development and the options in stationary power plants. Hence, there will probably be no partial energy supply system dedicated to transport but rather a Global Energy Supply model shared by most applications including transport, which will adopt energy carriers rather than primary sources to fulfil mobility needs, necessarily bringing the discussion on this subject to a higher strategic level than is currently the case.

The transport projects co-financed by the EU under the Structural and Cohesion Funds need to be re-assessed with more emphasis given to energy saving and sustainability targets.

There is an urgent need to mobilise and combine fossil fuel-based energy supply concerns as a supporting driver for CO2 reduction, since both challenges largely call for measures of a similar type. There seems to be no single policy solution to solve the energy supply issue to transport which brings us to the point that a multi-instrument approach is required if we want to reverse energy supply trends and associated problems.

Particular attention should be paid to road transport, where most of the energy demand and CO2 emissions in transportation have their origin. In particular regarding private transport performance, there will be a need to create a level playing field to market more energy-efficient power trains and climate neutral (bio-) fuels. It is also necessary to promote a more energy-efficient driving style (supported by in-car devices), traffic management to improve traffic flow, and innovations in logistics and freight demand management, where GALILEO applications will play a crucial role. European transport policy should therefore make maximum use of the potential of GALILEO as an instrument to implement energy saving oriented policies.

The combined use of European models and regional models proved successful in examining effects of the scenarios at European and regional level. Linking the regional response to the more global modelling applied in environmental studies and climatic change analyses could add an additional dimension to the scenario assessment.

The policies analysed in STEPs, are general strategies, rather than specific, operational policy measures. Policy measures will only be implemented if they have sufficient social and political support. Creating the basis for change is a process that can be stimulated through information, education, etc. STEPs clearly shows that change will be necessary. Anticipating this by starting the process of creating a social basis for change, will help smooth the transition, rather than waiting for shocks in the global energy markets to dictate sudden policy decisions with potential drastic effects.

***Recommendations for further research***

Forecasting fuel price increases seems to be more difficult than forecasting the impacts of fuel price increases. Research should therefore address the issue of likely market responses to exogenous energy price shocks and the related policy responses.

Future research should study more extreme energy price scenarios than were examined in STEPs in order to advise policy makers how to avoid or mitigate them through more energy-efficient technology, more sustainable transport and less car-dependent cities.

Future research should study the impacts of energy price shocks not only on transport but also on land use, i.e. on urban form, the relationship between city and countryside and the related changes in lifestyles and work patterns.

Further research is needed to explore the optimal tax policy under different oil price scenarios***.*** A cost benefit approach could be used to find optimal prices/taxes. This perspective could also address the rural/urban issue: is fuel tax already too high in rural areas and too low in urban areas? We need to rethink the instrument for demand management.

More advanced vertical (EU-regional/local) and horizontal (energy-land useenvironment) integration between models, would provide a very powerful tool to assess regional impacts of European transport policies.

# Best practice in providing incentives for use of public transport

## Individualised Marketing – An Effective Tool for Reducing Car Use

[***http://www.socialdata.de/info/Car\_use.pdf***](http://www.socialdata.de/info/Car_use.pdf)

This lecture explains the reason why dialogue marketing is so successful, why people may change their travel behaviour on a voluntary base and how this works. It was produced by Socialdata, a German organization that developed a well-known individualized marketing technique called IndiMark®. The technique is based on direct dialogue with individual households. It has been applied in Australia, the UK and North-America in a programme called TravelSmart®. The Socialdata website (www.socialdata.de) features many interesting resources in its Publications section. Individualised Marketing (IndiMark®) is a dialogue-based technique for promoting the use of public transport, cycling and walking as alternatives to car travel developed by *Socialdata*. It is a programme based on a targeted, personalised, customized marketing approach which empowers people to change their travel behaviour. Using these “soft policies” to make people think about their travel behaviour has proven to be highly successful in achieving shifts in mode from the car; shifts that are proving to be sustained in the longer term.

In the 1990s *Socialdata* undertook a series of projects of an experimental nature, in order to prove the effectiveness of so-called "soft policies" for public transport. The starting point of these experiments was the recognition that much opposition to the use of public transport is due to a lack of information and motivation. Potential users of public transport were contacted directly, to motivate them to think about their travel behavior. They were then thoroughly informed about the availability of public transport to meet their specific needs. As an added incentive, selected test candidates were given a special ticket to use the public transport system free of charge for one month.

The development of the method was supported by an International demonstration project called “Switching to Public Transport”, initiated by the UITP (International Association of Public Transport) – the world-wide association of urban and regional passenger transport operators, authorities and suppliers, with scientific leadership from Socialdata. In 13 European countries 45 projects were carried out. This demonstration project showed that personalized encouragement, motivation and information could lead to considerable increase in public transport use, that the approach could be applied on a large scale and that it was relevant for many very different, countries. Since then about 100 large scale projects in Europe have promoted public transport by IndiMark®. It has proven to be highly successful in achieving mode shifts from car to public transport.

Following from this, the approach of Individualised Marketing was extended to all environmentally friendly modes in order to reduce car use. It has been very successfully implemented on a large scale for the first time in Perth, the Australian metropolis said to have been built for and around the automobile. In a local council area (South Perth) with 35,000 inhabitants, without introducing any special measures as restrictions, the project succeeded in reducing the number of car trips by 14 % and the kilometers travelled in cars by 17 %. The share of trips made on foot rose by one third, bicycle trips increased by two thirds, public transport trips by one sixth (bus only by one quarter) and 10 % more trips were made as car passengers.

Mobility Management is primarily a demand-orientated approach to passenger and freight transport that involves new partnerships and new tools. The aim is to support and encourage a change of attitude and behaviour towards sustainable modes of transport. The tools of mobility management are based on information, communication, organisation and co-ordination. These tools must be promoted. Mobility Management, which is a novel and promising concept for the promotion of sustainable transport, varies in its scope and level of implementation from country to country.

## Tax-free employer-provided benefits for public transport: background, history and 2008 status

This paper summarizes the central concepts, history, impacts and current status of an innovative tax incentive strategy for involving the business community in efforts to reduce traffic congestion, diminish greenhouse gas emissions, conserve energy and promote use of public transportation.

***Definition***

Tax-free employer-provided benefits for public transport (“transit benefits”) refers to the increasingly common governmental taxation policies through which fares paid by employees for using public transport are allowed as a tax-free employer- and/or employee-paid benefit, and delivered through an array of programs and services provided to employers.

***Experience to date***

As of mid-2008, transit benefit policies exist in the US (where they have been used for over 25 years), in Ireland (introduced in 1999), the UK (regulations established in 2007), and in Hungary. Transit benefits are also being seriously considered in Canada, where a House of Commons enabling bill was introduced in July 2008. Public transport tax incentives are also reported to be under discussion in Australia (an element of the Rudd Government’s 2020 visioning initiative). Relative to the American experience, the Irish and UK provisions have far less participation (and require some revisions to gain broad participation). Accordingly, the information below details the evolution of the practice in the US. (At this writing, the author has little information on the experience in Hungary.)

***Alternate policy applications***

US transit benefits are provided in two alternate ways, with a third being a combination of the two. The longer-standing application is as “employer subsidy” for public transit, with the practice directly analogous to employer-provided (including employer-paid) parking, where the expense is borne by the employer.

The relatively more recent, and more popular, application is where employees pay for their transit fares using before tax salary, i.e., deductions are made from gross salary before income or employment taxes (such as those for retirement or health programs) are applied. This application is called a “pre-tax benefit” benefit in the US and “salary sacrifice” in the UK and Ireland.

The third or combination alternative allows for “fare sharing” where the employer pays for a portion of the benefit as a tax-free subsidy, and the employee pays a portion using pre-tax salary. In practice, beyond the basic alternatives, employers adopt numerous variations in the program to make it appropriate to or consistent with the employer’s overall benefits package or “corporate culture.” For example, employers might choose to subsidize one-half of employee fares, or a flat amount such as $30 per month, or require participation for a certain number of months. The US programs are liberal in allowing many variations, which is surely an important element in the acceptance the programs have had.

***History and the Voucher Innovation***

The history of US transit benefits and some key vectors in its use appear below.

**History of U.S. Tax Free Transit Benefit Legislation**

1970’s: Employer pass programs emerge

1984: Legislation “codifies” use of transit benefits, allowing $15 per month maximum benefit (“cap”); limited to employer subsidy

1987: First transit voucher plan implemented in New York

1990: Commuter Check Services Corp. formed as first national transit benefit service

1991: Inflation adjustment raises transit benefit cap to $21

1992: New legislation raises cap to $60 per month

1995: Inflation adjustment raises cap to $65

1998: Employee-paid pre-tax payroll deduction feature added

2000: Executive Order mandates transit benefits for federal employees

2002: Monthly maximum benefit raises cap to $100

2005: Inflation adjustment raises cap to $105

2007: Inflation adjustment raises cap to $110

2008: Inflation adjustment raises cap to $115

2008: City of San Francisco adopts transit benefit ordinance

The transit benefit was formally established in US federal tax code in 1984. This was done in part to clarify the status of informal practices known as “employer pass plans” which existed in some cities. Some transit agencies developed large programs, and it is notable that these cities had basically one transit operator, in contrast to other cities where there were multiple service providers. In pass plans, employers buy monthly passes (that the programs were limited to passes is important), and sell them to employees, sometimes at a discount with the benefit being tax-free. The procedure was relatively complex, with employers needing to order the correct number of passes (there might be more than one type), receive and store them, distribute them monthly, receive payments or co-payments from employees, return unused passes and pay the transit operator (consignment sales were most common, with monthly reconciliation), etc. Employees would often change their requirement, e.g., during a vacation or month with business trips or holidays. These numerous complexities – the administrative burden -- gave pass programs very limited use, except in a very few cities such as Seattle and Boston, where it did become a popular with larger employers. The cities with more “complex” transit services (such as those with multiple modes, operators and zonal fares) did not have these programs, mostly due to the even greater burden that an employer would have.

The untapped promise in this area, and recent market research findings showing employer subsidized parking was common even in the New York (Manhattan) business district, led transit advocates to pursue clarification of the practice in the tax code. In 1984 legislation, the transit benefit was defined as a “de minimus benefit” and established its maximum value at $15 per month.

Subsequent regulations specified that the benefit could be provided as passes, tickets, tokens or vouchers. Permitting vouchers (they had not yet been used) reflected a desire to implement transit benefits in cities with more than one transit service, like New York, Chicago, Philadelphia and San Francisco. Vouchers were seen as a way to make employer participation practical and reasonably simple. Market research found administrative simplicity vital to employer consideration of any fringe benefit, and an employer pass plan in New York could require an employer to handle dozens and dozens of fare instruments, for the numerous rail, bus and ferry services, and different pass types and fare zones. In contrast, the voucher was script (in most cities a specialized bank check) that employers could simply buy and distribute to employees, who would then redeem where passes or tickets were sold. That it didn’t expire from month-to-month was another element in easing the administrative burden.

Piloted by a multi-agency effort of New York transit operators, with Federal Transit Administration funds, the voucher plan was implemented in 1987. The administrative advantages and overall simplicity of vouchers enabled the plan to draw considerable attention. In contrast to employer pass plans that sought primarily to have employers serve as pass sales outlets, and as private sales outlets were not needed in New York, the voucher plan sought what the employers could uniquely provide: subsidies and tax benefits. It became clear that asking employers to be sales outlets and provide subsidies meant that, in most cases, they simply did not participate. Many transit agency pass plans also had minimum order quantities, which meant by definition that small employers could not participate. In contrast, most employers joining voucher plans proved to be small and medium sized employers. An interesting fact showing the importance of smaller employers is that there are over 80,000 employers in the New York Central Business District, but only 2000 have 100 employees or more. Those with fewer than 100 employees account for 42% of total employment.

While some cities developed local programs, scale economies and the appeal vouchers had to employers (who were found willing to pay nominal fees for voucher services), caused a nationally-focused company, Commuter Check Services Corp., to be formed in 1990 solely to market and administer transit benefits. Within a few years “Commuter Check” programs served over a dozen cities. Transit agencies were main beneficiaries, enjoying the ridership and revenue gains the programs provided, but as the programs were privately operated, there was no expense to transit agencies beyond the supplemental marketing support (rider-focused communications) they willingly provided. The cost to transit agencies of receiving and processing vouchers was generally minimal, usually negligible, because the vouchers were bank checks. Most often they were received and deposited by private sales outlets, such as groceries, which meant transit agencies didn’t even receive them.

The voucher succeeded due to the new “design features”it offered. It was a new “least common denominator” instrument – something all employees could use. In the way most often used, employers did not have to worry about which one was for which employee, as they were essentially interchangeable and did not expire for over a year. It easily allowed programs to not be limited to monthly pass users and avoided employee co-payment, another seriously limiting parameter in most of the then-existing employer programs.

Vouchers can be redeemed for any fare type; this means that the less-than-regular and even infrequent riders can participate, which is critical for many reasons. With employers keenly sensitive to equity, most simply would not adopt a program if only some of their transit-using employees could participate. Even if an employer adopted a program limited to passes, it would yield far less new use of transit. This is certainly true for programs that limit participation to annual pass purchasers, as the UK and Irish programs do. Research has shown that the mode shifts (induced transit trips) resulting from voucher plans most often reflect non-users becoming occasional users and occasional users riding moreInstances of non-users converting to regular users were more rare. Consistent with this, numerous US and Canadian market research studiesobserved a “transit rider life cycle.” In these, on-board survey data revealed that most transit riders begin using transit for occasional work trips, and if they continue riding -- many stop – they then increase their use and some diversify their use to also include off-peak trips. These studies also suggested that transit benefits would diminish the turnover (rider attrition) rate, which was found to be significant.

While most transit commuters are typically thought to ride every day, the US and Canadian market studies found less-than-regular riders comprising a large and sometimes majority share of transit commuters. A national study6 performed for the US Department of Transportation stated, “Those who say they use transit to get around constitute about 27% of transit riders, with usual auto users who use transit only on an occasional basis constituting about 62%. A professional paper7 reported that these “surprising” findings suggested a need to re-think transit marketing, pricing, fare instruments, advertising, etc.

To include these users, a transit benefit program can’t be limited to passes. For example, if a pass costs $50 and a transit benefit plan limited to pass users offers employees a $20 reduction in a pass price, employees don’t not save anything until $30 in rides is taken. (Additionally, someone who already rides that much is unlikely or even unable to ride much more.) This suggests, counter-intuitively and contrary to the focus of employer pass programs, that the most important target for a transit benefit program is the less-than-regular and infrequent rider market segments. The role of infrequent riders also means a large share of employees will participate in a transit benefit program that is not limited to passes. Rather than serve a few employees, and thus likely have limited appeal to employers, a voucher program can serve most employees; perhaps over a period of a year, virtually all employees might be willing to buy a pre-tax $20 voucher, for example. This is very important as the more employees that a benefit can serve, the more appeal there will be to employers. In this way, serving infrequent riders is vital. Ironically, the large number of irregular or even infrequent users can “drive” the success of a transit benefit initiative.

In sum, being simpler and more equitable for employers to use and applying to the “first dollars” of fares, the voucher innovation profoundly increased the interest in and impact of employer-based transit programs. It re-wrote the book. It took a dramatically under-used idea and made it an important part of transit marketing and revenue generation strategies, and employer benefit packages.

In contrast to the earlier pass plans which generally appealed to a limited number of employers (mostly larger ones), vouchers appealed to many more and were particularly effective in drawing thousands of small employers, where there was previously no participation. With this demonstrated appeal, transit benefit advocates were successful over the years in expanding the enabling legislation. The $15 limit became $21 as an inflation adjustment adopted due to the demonstrated interest and resulting political pressure. Subsequent increases, and a massive broadening of the program via the introduction of the employee-paid pre-tax option in 1998, resulted from legislative changes. In January 2008 the monthly tax-free limit became $115. Following earlier efforts, legislation proposed in 2008 would raise the limit to $220, the current parking benefit cap.

***Newer Services***

Other service innovations proved just as important as vouchers. As internet-based services emerged, new transit benefit programs further tailored the transit benefit to employer needs. Vouchers did not appeal to many larger employers (although many do use them such, as Hewlett Packard and Apple Computers, to name just two, and the US Government), and were also not well suited to the needs of employers with branches in different cities. To meet these, “on-line/at-home” transit benefit programs were devised. Many larger and “multi-site” employers disliked having to purchase, store and distribute vouchers (which varied by city), and needed streamlined procedures to match employee fares with their more complex payroll systems.

Further expansion in the use of transit benefits resulted from integrating transit benefits with the benefit services provided by “third party administrators.” These are companies that administer payroll, health, retirement and similar programs. Most large employers and many medium and smaller ones use third party administrator services.

“Ecopass” programs were also used in some cities with one transit operator. These plans entailed employers buying sharply discounted annual passes for all employees.

Smart cards presented challenges but ultimately resulted in another opportunity to expand transit benefit use. Essentially, transit benefit value must be transmitted electronically to the smart card administrator and each employee’s card. This created significant complexities, as employers do not want to be involved in the particulars of their employees’ fare payments. To avoid this, a most recent extension for integrating smart cards with transit benefits involves a “virtual voucher” which marries the appeal and efficiencies of the voucher with the conveniences of smart cards and the internet.

A virtual voucher is not physically redeemed; it is purely electronic. While most employers prefer to, there is no need to distribute anything; value is “contained” in the number and not on a piece of paper where it may be printed. Virtual vouchers can even be distributed simply as e-mail messages.

***Summary***

It is worth highlighting the evolution of these programs, regarding the key determinant of employer involvement: simplicity and administrative ease. Higher levels of efficiency were achieved, and therefore participation, when vouchers became the primary mechanism. Further efficiency was achieved as on-line programs emerged, meeting needs of larger and multi-site employers and bringing in third party administrators.

## Free transit on smog days: clearing the air

***Community Context***

The City of Windsor, with a population of about 210,000, sits across the Detroit River from the state of Michigan. Much like neighbouring Detroit, Windsor is a major automobile manufacturing centre — six of its eight largest private employers are members of the auto industry. Other notable economic drivers include advanced technology, consumer and industrial products, agriculture and food processing.

The Windsor census metropolitan area (CMA) includes adjacent municipalities and has a population of over 305,000, making it the 15th largest metropolitan area in Canada. Statistics Canada expects the Windsor CMA to have the third-highest rate of population growth among Canada's metropolitan areas from 2001 to 2006.

Transit Windsor is an agency of the City of Windsor that reports to a board of directors while taking its financial direction from City Council. It carries about 6 million passengers annually on almost 100 buses, with a revenue/cost ratio of 60%. Adult transit fares in 2003 were $2.25 in cash, $19.50 for 10 tickets, and $72 for a monthly pass.

Transit use in Windsor dropped by about 40% between 1987 and 1997, although it has since stabilized. While 90% of Windsor CMA workers commuted by car in 2001, just 3% took transit. This compares to commuter transit shares of almost 10% in Victoria, B.C., and just over 7% in Oshawa, Ont., two communities of a similar size.

***Policy Context***

In September 2001, Windsor Council adopted the following resolution by a margin of five votes to four: “That approval be given in principle to the allocation of $30,000 for Transit Windsor to conduct a pilot project to offer free transit on smog action days subject to a further report for the 2002 Budget Sessions on the availability of public and private sector funding to assist in providing the program.” In making the decision, Council recognized that cars and light trucks emit six of the seven major air pollutants, and that transportation is the leading regional source of greenhouse gas emissions.  
Windsor works to improve local air quality through its participation on the Windsor-Essex County Air Quality Committee. That group includes representatives of other local governments, industry, labour, and environmental and health groups. It has prepared an air quality action plan that recognizes the need for financial incentives, public education and improved service to help transit attract travel from the auto mode. The action plan is intended to influence, rather than prescribe, local government policy.

***Rationale and Objectives***

Windsor's air quality is a significant public issue. Contributing factors include the city's large manufacturing base, busy border crossings, and proximity to Detroit and the Ohio Valley. The frequency of poor air quality days in Windsor is generally increasing. There were 14 days of poor air quality in 2000, 19 in 2001 and 23 in 2002.  
While much of Windsor's polluted air is generated in the United States, the city felt it was important to demonstrate the value of local action in raising awareness and reducing pollution. Transit Windsor did not set firm ridership objectives for the free transit initiative. Rather, as a pilot project, one of its purposes was simply to quantify the response as a guide for future efforts in Windsor or other Canadian cities.  
A number of American transit systems in the Delaware, Pennsylvania and Washington, D.C. areas have offered free transit on “Code Red” days, when public alerts are issued about expected high concentrations of ground-level ozone, a key ingredient of smog. At least in some cases, Code Red days have led to significant increases in transit use (e.g. 40% in Delaware and up to 20% in Virginia).

***Actions***

Following City Council's 2001 approval in principle of funding for a free transit pilot project, the City approached the federal government to solicit matching funds. Environment Canada agreed to a $30,000 contribution, and the pilot project was set to run in the summer of 2003.

***Advance promotion***

In advance of Windsor's typical smog season, Transit Windsor distributed promotional posters (see accompanying image) and flyers to key destinations including its sales outlets, information stands, community centres, libraries and large employers. It also placed an advertisement (see accompanying image) in the local daily newspaper for three successive days and in printed route schedules. These efforts fulfilled one of Environment Canada's funding conditions — that Transit Windsor must spend a small portion of the federal contribution directly on project-related public awareness measures.

On 30 June 2003, near the time that smog alerts usually begin, Transit Windsor issued a media release announcing the pilot project. It notified the public that free transit would be offered on as many subsequent smog days (likely four) as funding allowed.

***Implementation***

When an Ontario community's air quality has a high probability of deteriorating to poor (i.e. an air quality index reading of 50 or greater), the province's Ministry of the Environment issues a smog advisory. The purpose of the advisory is to warn vulnerable individuals and to encourage others to reduce their smog-causing emissions. For the free transit pilot project, Transit Windsor checked daily with the Ministry of the Environment just before 2:00 p.m. to see if the Ministry planned to issue a smog advisory for the next day. If so, Transit Windsor immediately asked media outlets to announce that transit service would be free the following service day (from 5:30 a.m. to 12:30 a.m.) on all routes other than charters and tunnel buses to destinations in Detroit.

On the morning of each smog day, Transit Windsor placed special canvas covers on the fareboxes of all buses operating in regular service, adding a decal that explained the covered boxes and identified the project's municipal and federal sponsors. While planners did not proactively adjust service schedules to provide additional capacity, operations staff closely monitored demands and responded quickly to actual needs. Drivers played an important role in promptly reporting instances of overcrowding, enabling dispatchers to add buses to key routes.

With its available funding of $60,000, Transit Windsor was able to offer free transit service on four smog advisory days in 2003 (Thursday, July 3; Friday, July 4; Friday, July 25; and Saturday, July 26). On the day before each of these dates, Transit Windsor issued a media release confirming that transit would be free the next day. When each smog advisory period was over, Transit Windsor issued another media release on the day before it resumed regular fare collection.

Transit Windsor issued two other media releases during the pilot project. The first was on July 4, following the first free transit day, to announce preliminary ridership results and assure the community that its response was both measured and valued. The second additional media release was on July 31, after funding for the pilot project funding had been exhausted, noting that a smog advisory was in effect for the next day but that free transit service could not be offered due to a lack of funds.

***Results***

Windsor residents responded to the free transit pilot project with enthusiasm. On the very first day of free service, transit ridership increased by 36% over the previous Thursday, 28% over the system's average weekday ridership, and 45% over the equivalent day of the previous year. Over the four smog days that free transit was offered, the typical year-over-year ridership increase was in the order of 50%. Demand on some routes exceeded planned capacity, although additional buses were pressed into service when required (even after midnight, in some cases) to meet the needs of riders. These ridership increases exceeded the expectations of planners, who had informally anticipated a jump of perhaps 5%.

Transit Windsor was very pleased with the pilot project results, and interpreted them as evidence of a high degree of public understanding of Windsor's air quality problem and the role of transit in remedying it. The transit agency was also overwhelmed by the extensive public feedback it received, and by the numerous enquiries from media (including local and national print, radio and TV outlets) and other municipalities. Negative responses were more limited than expected, and came only from a small number of passengers who had bought monthly passes and felt the project did not benefit them — but who withdrew their objections once they understood that the project's purpose was to attract new riders, not to benefit existing riders.

***Participants***

The City of Windsor and Environment Canada each provided 50% of the pilot project funding, and Transit Windsor implemented the project. Most of the transit agency's departments were involved in some way, although marketing staff experienced the greatest increase in workload arising from the project.

***Resources***

Before the pilot project began, Transit Windsor estimated the cash cost (i.e. foregone revenue from cash fares only) of providing free transit on a weekday to be about $15,000. Saturdays would have about three-quarters of this cost due to their lower service levels, and Sundays significantly less. Therefore, the $60,000 in funding provided by the City of Windsor and Environment Canada was expected to replace the lost revenue from no more than four days of free service, unless two or more smog days fell on Sundays.

After the first two smog days in July 2003, Transit Windsor unsuccessfully requested additional funding from Environment Canada and the Province of Ontario. Using the 23 total smog days in 2002 as a basis, it estimated that the additional funds needed to carry the pilot project through the end of the 2003 smog season would be about $285,000 (i.e. for 19 service days at $15,000 in foregone revenue each day).

***Lessons Learned***

Important lessons arising from Transit Windsor's free transit on smog days include:

Where public awareness of air quality issues is high and transit capacity exists, significant daily ridership increases can be expected — up to 50% in Windsor's case.

Public and media attention is highly favourable, making free transit days a potentially valuable public relations tool. If the media are engaged, additional promotion may not be worth the effort or expense.

Radio and television outlets are more effective than daily newspapers in getting out the free transit message ahead of smog days.

Media outlets should be advised that government smog advisories issued after a certain hour, without an accompanying media release from the transit operator, do not mean that transit will be free on the next day. Smog advisories issued too late in the afternoon or evening do not provide enough lead time for the free transit message to get out to the public through media channels.

The success of a short-term project may raise public expectations for ongoing or repeated implementation in future years. Possible strategies for meeting this expectation should be investigated as soon as possible.

***Next Steps***

Transit Windsor continues to seek funding partners to reintroduce this program. In the meantime, however, it has initiated new projects to offer free rides, increasing the public's awareness of transit and letting non-riders try it at no cost. On the first three Sundays and Christmas Day of December 2004, holders of a valid December bus pass were allowed to bring up two adults and two children with them, for free. Transit Windsor intends to offer similar “free rides with paying fare” events in the summer of 2005.

Transit Windsor is also reviewing its fare structure in an effort to improve fare media options, and to offer incentive programs that will attract new riders.

## Advanced measures for companies to increase public transport use of their employees [http://www.eu-benefit.eu/](#_Advanced_measures_for)

The project BENEFIT assists public and private companies as well as their employees to switch from the private car to public transport. The aim is to conserve 2.3 million litres of fuel and 5.600 tons of CO2, respectively per year by the end of the 36 month project time (start: September 2008) by using awareness raising activities and highlighting the advantages of public transport.

Europe-wide motorised individual traffic is on the rise despite the fact that fuel costs increase continually and even dramatically. Obviously, energy-efficiency and environmental awareness are contradictory to the need of individuals to drive to work in their personal car. To counteract this trend by promoting attractive alternatives in the area of public transport, is one of BENEFIT’s most important tasks.

BENEFIT has two essential target groups: on the one hand the direct beneficiaries – people working in public and private companies – using public transport already or potential new users. On the other hand lobby groups (trade unions, chambers of commerce), public transport operators as well as stakeholders in public and private companies. These groups play an important role as supporters for current projects, but also as multipliers for future projects in other cities.

BENEFIT has five main objectives:

***More energy savings***

BENEFIT aims at reducing the total fuel consumption of passenger traffic by 2% in the selected target area until the end of the project. It’s planned to increase this number 5 years after the end of the project to 5%.

***Fewer pollutants***

The transition from private car to public transport automatically reduces the emission of toxic substances.

At the same time, broad awareness for the importance of public transport with regard to the quality of life, air quality and the reduction of pollutants shall be raised.

***MORE PUBLIC TRANSPORT IN CITIES***

It is intended to increase the number of public transport passengers by active awareness raising tasks, new information paths, innovative incentives and an improved public transport offer. The project strives to increase the number of public transport users in selected target areas of the 7 BENEFIT partner cities by 20%.

***Less individual traffic***

The attractiveness of public transport is increased by companies cooperating with public transport operators, e.g. by reduced tickets for employees. This automatically results in a reduction of individual traffic.

***Role model for other cities***

Other cities can use measures and results of BENEFIT as role models for their own mobility work. Therefore, it is important to communicate the results properly and nation-wide as well as to obtain multipliers.

BENEFIT concentrates on the new member states Czech Republic, Slovakia, Romania, Bulgaria, and Slovenia as well as on the two Mediterranean countries: Italy and Spain.

7 cities from these countries are BENEFIT project partners: Brno, Zilina, Bistrita, Sofia, Maribor, Bologna and Palma de Mallorca. The cities establish local working groups, consisting of traffic experts and representatives of public transport operators, e.g. trade unions, chambers of commerce, public transport companies, and universities. The whole project is coordinated by Austrian Mobility Research (Graz).

## A process approach to public transport design

The multitude recommendations makes it hard for policy makers on a metropolitan level to develop a sound policy, making public transport more efficient and more effective. They understand the line of reasoning of the traffic engineer: public transport has to be a hierarchical network of services to be attractive for the traveller. Coordination, in terms of uniform ticketing, clear schedules and interconnection nodes will enhance the quality of the product. In addition, they understand the economist: companies should work efficient and follow trends in demand, and open competition will offer them a strong incentive to do so. Furthermore, they find themselves presented with a dilemma knowing that the design of a network by a single agency for integration sake obscures the possibility of flexible competition between a number of competitors.

In different European countries various directions are pursued to restructure public transport, in order to compete with the car. Switzerland and England show the most extreme examples, Switzerland of the integration of services in a hierarchical network and England of deregulation and privatisation of companies. In other countries choices are less extreme, policies reflect major influences from both theoretical schools, for instance in France and Denmark.

A framework to analyse and evaluate the consequences of a specific policy on these matters does not exist. It should address how regulation, co-ordination and the design of the services should be structured comprehensively in order to achieve synergy on efficiency and effectivity. The development of such an integral framework cannot be undertaken from a single scientific theoretical background. The contributions of different theoretical disciplines have to be assessed in the light of their effect in practice on the efficiency and effectivity of metropolitan public transport systems. The only way this can be procured is by empirical analysis of the efficiency and effectivity of different types of organisation of public transport, that were developed in reaction of the dilemma presented here.

In addition, such a research can only focus on a process, incorporating the smaller processes of the set-up of a regulatory regime, devising co-ordination between companies, and the design of a network of services by each company. These different sub processes can be combined in to one process because their successive conditional character. The introduction of such a conceptual meta process makes a more integrated evaluation possible. This avoids that a separate judgement of the service network will prove the transport engineer right. And when only the regulatory regime is judged, who will prove the economist wrong? In practice these two are not linked in decision-making but their functional interdependence makes an analysis as a meta process possible.

They are defined three different levels of analyses correlative to the levels of decision making: with a macro, meso and micro perspective (not concurrent with the economic use of these terms).

The levels are defined by the actors between which the main interaction occurs when the design is operational. For example, when governments demand the securing of certain interchanges between train and bus, governments participate in the coordination process on a tactical level. However, on an operational level the train and bus companies have to interact to secure the interconnection between their services. Companies operating together form the meso level. The direct involvement on an operational level of the government is nihil, though it can be significant in the design phase.

On the macro level level interactions on an operational level are between governmental bodies and companies. It generally represents the regulatory regime. Though the design of the institutional framework is generally a governmental matter, often companies are involved in the design process to ensure their expertise and cooperation is fed into the process. It results generally in a legal framework or, for example, a tendering system or subsidising scheme for public transport services. In some cases interference of the governments exists also on the level of physical structures, for example when they provide special infrastructure for public transport or the design of a spatial structure best fitted to public transport.

On the meso level interactions operate reciprocally between companies. At an operational level, they have to ensure together that interconnections are secured. The design process on this level comes to a more or less integrated public transport system.

It finds its justification in the fact that customers often don't just use the services of a single company, but of more companies in one trip. They consider public transport as a single product. How an integrated public transport network of services is constructed is dependent on the possibilities created by the regulatory framework on the macro level. Different forms exist: governments, can define a time-table with interconnection and carry the services out. When tendering public transport services, they can put forward a design of an elaborated time-table or they can demand certain connections, synchronisation points or a common traffic control.. Furthermore, they can rely on competition to ensure that people are transported at an interchange point, because demand exists.

Finally, on the micro level standard interactions operate between a company and the traveller. A service is offered and tickets are sold, supported by the design of a network of services, routing of busses, planning of drivers. Sometimes governments are involved in this design process but the final design operates between the customer and the company (be it a public or a private company). Meso and macro designs offer the framework in which the planner can design the network of services. This stratified description of the public transport design process is a simplified one. In the real world processes on the three levels develop parallel and often completely detached. They do not follow on each other, though the fact that they present a set of constraints to each other might imply this. It is the structurisation by this framework which makes the mutual influences of the processes visible by separating them. In addition, the framework makes it possible to scruflnise how the different types of decisions on regulation, on co-ordination between companies and on the design of the schedule influence each other.

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The process approach offers another advantage. By taking a process perspective all rationales can be given their own place in the process finalising in a set of public transport services. Each rationale focuses on a specific level, but the solutions offered bear implications for the other levels. For instance, the economical rational focuses on the macro level, it suggest an optimal type of regulation. This bears implications for the meso level: from an economic rationale, competing bus companies should not be allowed work together to avoid the evolvement of a cartel. They can co-ordinate their schedules with other techniques (intercity trains, metro), but regional monopolies on a single techniques should be avoided. On the other hand, engineers from a technical rationale would start at the micro level, designing an integrated network of services to optimise the product. To produce such a network, a co-ordanative structure would be useful to design the network, and control its execution. Little can be lett to the companies. This makes competition on the road is virtually inoperable. The process approach makes it possible to come to an empirical evaluation of different applications of the rationales in the whole process.

## How can land use planning encourage the use of public transport

<http://www.distillate.ac.uk/outputs/Deliverable%20F%20Appendix%20D.pdf>

Several studies indicate that if development is planned specifically to encourage public transport there can be a significant reduction in per capita car travel. Public transport nodes, including rail stations, serve as a catalyst for more accessible land use by creating higher density, mixed-use, pedestrian-orientated centres. Households living in such neighbourhoods tend to own fewer cars, and people working in such areas are more likely to commute by alternative modes (partly because they do not need a car for lunchtime errands). These factors result in higher levels of public.

There are two specific but inter-related ways in which land use planning can encourage the use of public transport:

• by locating trip origins and destinations near public transport routes;

• by ensuring trip densities are sufficiently intense to establish an efficient service.

The general principle is thus to ensure that trip origins and destinations are arranged in nodal or linear patterns which are compatible with the demand patterns needed to ensure that public transport services, both bus and rail, are viable and efficient.

In its guide 'Shaping Up', the state government of Queensland (Government of Queensland, undated) offers guidance on the design of public-transport-friendly development, in the form of idealised 'how to do it' and 'how not to do it' examples.

The Guide suggests the following approaches to good practice:

• Public transport is more cost effective and efficient if organized along a linear corridor with highly accessible activity nodes, so development should be concentrated along major corridors based on a main 'line haul' public transport route (with feeder routes wherever appropriate).

• Major activities, employment nodes and higher density residential areas should be encouraged near stations, significant stops and interchanges along public transport routes (preferably within 800 metres of a railway station).

• Urban development should be compact, concentrated along public transport corridors, and focused around key business and activity nodes which incorporate public transport interchanges.

• The overall road network should ensure that 90 per cent of the urban area is within 400 metres of public transport stops located on the arterial and collector road network. (This also supports faster public transport services and enables stops to be 250 metres apart).

• A mix of business and residential land uses should be concentrated at clearly defined nodes located at the intersection of local arterials where 'line haul' public transport services converge. This concentrates trips at a discrete number of locations which allows multi-purpose trips and increases public transport passenger loadings.

• Public transport interchanges should be integrated into these mixed-use business and activity nodes. This increases public transport use and enables easy and convenient passenger transfers between bus, rail and taxi services." ('Shaping Up': Government of Queensland)

It should be noted that large scale park and ride facilities can conflict with accessibility and liveability benefits: a railway station that is surrounded by large parking areas and by main roads with heavy traffic is unlikely to provide the best environment for residential development or for pedestrian access. As part of land use planning, it is thus important that such facilities be properly located, designed and managed to minimise such conflicts.

***Demand impacts of this instrument***

Increasing development densities and altering the development mix to encourage public transport can have an effect on demand in several ways:

• Encouraging public transport use by improving conditions to enable public transport to operate more efficiently;

• Reducing walking and waiting times for public transport;

• Reducing the need for motorised travel (especially private motorised travel) by ensuring origins and destinations are closer together (dealt with separately under ‘development densities and mix’).

It is the demand impacts of this instrument can be as follows, all of which would reduce vehicle kilometers travelled:

* Change of destination: Use of public transport will cause the ‘best’ destinations to undertake particular activities to be re-appraised, making shorter journeys possible;
* Fewer trips: Better public transport accessibility will encourage shift to walk or cycle (destinations are now closer) and cause the number of car trips to be reduced;
* Change mode: Change of mode to public transport is expected to occur (the main objective of the instrument) and cause the number of car trips to be reduced;
* Sell the car: Better public transport will make the ownership of a car (or a second car) less important. Also, where the instrument makes a greater range of destinations available within a short distance, a car may become less necessary.

***Supply impacts***

The direct and indirect supply implications of this instrument are as follows:

* Higher density and appropriately planned development should improve conditions for public transport and thus encourage greater public transport supply;
* There will not be an increase in the supply of road space from land use instruments per se;
* If the land use policies are implemented on a regional scale, there could be a nett reduction in the need for road space (compared with doing nothing) in line with the decrease in the amount of travel;
* Reduction in private motorised travel could encourage an increase in the supply of cycle and pedestrian facilities;
* Any increase in public transport use and reduction in car ownership would reduce the need for residential parking supply;
* Increase in the use of public transport would reduce the need for non-residential parking supply.

***Financing requirements***

Though the costs of new development are considerable and land use solutions are, at their most extreme, the most expensive of the policy instruments contained in these pages, the cost usually falls in the main on the private sector (through investors, developers and occupiers). However, local authorities may have to bear some additional indirect costs (provision of extra traffic control, parking, public transport interchanges, etc).

The main way of financing the extra costs of achieving a transport-friendly development policy, particularly where the extra cost would normally fall on the local authority, is through developer contributions (including commuted payments).

# Best practice in providing incentives for use of environment-friendly kinds of vehicles

## Mobi.E: The Portuguese Programme for Electric Mobility

As many other countries, Portugal is dependent on imported oil and refined products. However, the electricity production is largely based on renewable energies, which creates an opportunity to break the oil dependence chain. Therefore, Portugal is investing in an ambitious programme to infrastructure the entire country with a recharging network for electric vehicles.

In this context, the use of new technologies to explore new mobility management models is a natural step and electric mobility appears to be the most adequate solution.

Electric mobility presents several advantages:

(1) it implies less operation costs for users;

(2) it may induce a more flat energy demand throughout the whole day, allowing a better integration of (intermittent) renewable energy sources;

(3) in the future, the development of *vehicle to grid* technologies may allow the energy stored in EV batteries to feed the grid in case of need; Portuguese companies and universities are conducting resurch and developing projects in this area;

(4) it reduces the environmental footprint of road transportation; the scenarios for the reduction on GHG emissions forecast a reduction ranging from 772 kton of CO2e to 3,894 kton of CO2e between 2011 and 2020, depending on the number of EV and the emission factor considered (see next table);

(5) it reduces the energy dependency; currently almost every car runs on fossil fuels, with a minor blend of biofuels, which represents as previously analysed a drain on the Portuguese trade balance;

(6) it has a significant economic impact, creating wealth (€3 billion of expected investment) and employment (6,000 new jobs expected) according to the National Energy Strategy 2020.

The Portuguese Electric Mobility Model (Moby.E) grants universal access to any cars and batteries manufacturers, Electricity Retailers for Electric Mobility, and Recharging Network Operators. This means that competition will be permanent and that users may choose the best offer in the market at any time.

There is full interoperability and integration of all stakeholders, meaning that every investment reinforces the pre-existing network. This feature reinforces the bargaining power of users.

Further, the model facilitates the integration of information, energy and financial flows through the Managing Authority, which will act as a Clearing House. The creation of such mechanism will reduce the cost of transactions and will ease the relationship between the user and his or her suppliers and among all the suppliers.

The Mobi.E model has relatively low initial investment costs, which will reduce barriers to entry and make the system grow faster.

Mobi.E has a truly national scale, anticipating the mass introduction of electric vehicles, while most initiatives have a local focus. It will be the first nationwide recharging network operating in the world. Additionally, the Mobi.E platform was developed in order to facilitate roaming agreements with players from other countries (or regions), meaning that in the future a Mobi.E user will be able to use his or her Mobi.E Card in other countries.

The implementation of Mobi.E – The Programme for Electric Mobility in Portugal encompasses several initiatives – and is creating some challenges. The most significant for the general audience are presented in the following structure, and are structured around three axes.

***Product and concept development***

As a pioneer, the Programme for Electric Mobility in Portugal faced the need of developing both the software and the hardware needed to create the system. First, because the architecture defined for the electric mobility system (presented above) required a specific IT platform that didn’t exist. The open model architecture now allows this product to be used in any country around the world, independently of the chosen architecture. Second, because the existing hardware products in the market still weren’t mature enough and the programme required a robust solution.

The Mobi.E system relies on a comprehensive IT management platform that interconnects all stakeholders around a well defined service value chain, through the integration of all information, energy and financial flows, ensuring transparency, service integration, competition and reinforced management capability for all stakeholders.

Main system features include:

1. Real time visualisation of recharging points, including recharging status and vacancy information;

2. Remote monitoring recharging process;

3. CRM platform for stakeholders’ management;

4. Web-based multiplatform access: PC, PDA, cell phone;

5. Integrated invoicing with complementary services – parking, public transports, domestic electricity, creation of personal and business accounts;

6. *Roaming* between electric mobility electricity retailers.

Following a service based approach, the following are services provided within the MOBI.E system:

For Users

- Multi-platform access

- Charging station location and availability

- Charging station reservation

- Car battery status

- Charging station reservations

- Mobility management and historical track

- Aggregation of other services

For Charging Operators

- Information on network status

- Remote management of charging stations

- Financial compensation service for other services (parking, …)

- Pre-paid / post-paid billing capability for vas

- Integration with third party loyalty programs

For Electricity Resellers

- Metering information

- CRM platform (clients, contracts, tariffs, helpdesk)

- Pre-paid / post-paid billing capability

- Loyalty programs

- Financial compensation service for base and other services

***Recharging concept***

The recharging concept developed by MOBI.E partners for street charging is fairly innovative, being based on a highly flexible and modular solution:

1. One CENTRAL STATION capable of managing several satellite stations, concentrating authentication, management and communication in one single unit;

2. A set of SATELLITE STATIONS (plugs).

Modular design and construction and module sharing allows low and easy maintenance and repair and quick response to technological evolution.

The concept allows the development of multiple solutions for street, parking and home recharging with shared modules.

- One central command station will be able control up to 250 charging stations:

- Easy to scale up / Low cost / Modularity

- Flexibility to be inserted in different architecture

- Easy installation and maintenance

- Evolution to the future mode 3 standard IEC 62196 connector (currently cable mode 1 or 2, with IEC 60309 connector)

***Legal framework***

Additionally, there was the need to develop the legal framework, as previously presented. This legislation defines the electric mobility architecture, its players and roles, associated business and service models. New legislation is being prepared in order to set the technical specifications and the remuneration of all the involved stakeholders in the cases in which those specifications still do not exist. This is a crucial task as one of the goals of this programme is to create a competitive market, avoiding a regulated market situation.

***Technological partners***

Technological partners include a growing set of national and international firms, as displayed below, forming a dynamic consortium capable of delivering a comprehensive and innovative solution for different applications. Also, the development of new generation mobility solutions, within Mobi.Car and Mobi.Byke programmes, will complement the development of a fully electric integrated mobility solution. It is important to underline the partnership has signed an agreement with the Renault-Nissan Alliance.

***Demand***

The Portuguese tax system provides several incentives for the purchase and use of EV’s which are not available to ICE vehicles including Hybrids:

a) Vehicle tax exemption - EV’s are fully exempt from Vehicle Tax due upon purchase.

b) Vehicle circulation tax exemption - EV’s are fully exempt from the annual Circulation Tax.

c) Personal income tax allowance - Personal Income Tax provides an allowance of EUR 803 upon the purchase of EV’s. This exemption is not applicable neither to ICE nor Hybrid vehicles.

d) Company car tax exemption - EV’s are fully exempt from the 5%-10% company car tax rates which are part of the Corporation Income Tax. This exemption is not applicable neither to ICE nor Hybrid vehicles.

e) Electric vehicles special tax incentives starting 2010 - The Budget Law for 2010 provides for an increase of the depreciation costs related to the purchase of EV’s for the purpose of Corporation Income Tax.

## Electric vehicles - challenges with market introduction and practical user experiences

Alternative fuelled vehicles and especially electric vehicles (EV) are regarded as important instruments to reduce CO2-emissions from transport. 1 Electric mobility also gives benefits by reducing local emissions concerning environmentally harmful particles and noise, increased energy efficiency and the possibility to better integrate fluctuating renewable energy sources, Jochem et al. (2010). Electric cars are not a new idea as many of the first mass-produced cars were electric. By the turn of the 20th Century, electric cars were outselling gasoline cars. In New York, Paris and London, electric taxis had appeared and electric cars were liked because they were reliable, did not smell, vibrate or make noise and they were easy to drive (e.g. Boxwell, 2010).

In Norway, as in many other developed countries, the environmental benefits of electric mobility have brought measures to speed up the introduction of EVs in the car stock. The Norwegian means are among the most ambitious in Europe, and based on recommendations introduced by a Governmental appointed resource group chaired by The Norwegian Electricity Industry Association (EBL) (2009). A stated goal for the resource group is that 20 percent of Norway‟s car population will be wholly or in part electrified in 2020.

To reach this ambitious goal the Norwegian authorities has introduced a number of measures: tax and VAT exemption on purchase, strongly reduced car tax, free parking on public car parks, relief for road toll, free ferry transport, permission to drive in public-transport lanes, more favourable company car taxation and higher mileage allowance. Despite these substantial incentives the sale of electric cars has by no means expanded. Today there are only about 3.000 registered electric vehicles in Norway.

There are many barriers for the EVs. The vehicles are expensive compared to comparable conventional vehicles and operation range is quite short due to limited battery capacity. This, in addition to uncertainties regarding maintenance, resale value, insurance etc. make introduction of EVs quite challenging (Christensen et al., 2010). To reduce introduction barriers it is of crucial importance to obtain knowledge about what properties of EVs and the supporting infrastructure being most vital for potential users. For electric mobility strategies it is also highly relevant to consider socioeconomic impacts of different initiatives that may influence market penetration of EVs.

***Empirical data***

By June 2010 five firms/departments participated in the project using 17 electric vehicles leased from the company Moving City AS. The participators are:

* Bodø Energi (the local energy supplier) – 4 vehicles.
* Umoe iTet (data-firm) – 7 vehicles.
* Bodø municipality – 2 vehicles.
* Avis/Budget Bodø (car rental firm) – 2 vehicles.
* Iris Retura (garbage disposal firm) – 2 vehicles.

Two types of electric vehicles are used of which both are originally petrol powered and converted to electric operation by the firm Micro Vett in Italy (www.micro-vett.it):

* Fiat Fiorino; a small van with ‟manual‟ automatic gear box; a clutch pedal is used to shift the vehicle in gear after which it works as an automatic gear box. The vehicles have either two or five seats and have a maximum range of about 100 km.
* Fiat e500; a small two-door passenger car with automatic gear box. The range is about 140 km.

The vehicle fleet consists of 10 Fiat Fiorino and 7 Fiat 500.

***Methodology and data sources***

An extensive amount of data was gathered using both quantitative and qualitative methods. The respondents were both leaders (initiators to the acquisition of EVs) and employees (users of EVs), from now on referred to as *leaders* and *users*. Questionnaires were used to quantify the expectations and satisfaction of different aspects with EVs. Moreover, the respondents elaborated on the topics in question in personal interviews, group interviews and a dialogue seminar. The data collection was carried out in two periods; first, before receiving the EVs and, second, after about 3-4 months of use. In the second round a service technician was represented among the respondents.

***Framework for assessing importance and satisfaction***

In order to enable manufacturers, importing agents and distributors to make EVs more attractive, it is vital to have knowledge about which quality aspects (characteristics) that are important, as well as assessments of the users‟ current satisfaction. Information about which characteristics users valued as most important and the corresponding satisfaction was obtained by inviting the selection of EV-users to express their opinions by answering a questionnaire, categorised in three topics; *economy*, *user characteristics* and *environment and reputation*.

***Analysis***

The analysis focuses on 1) the actual use based on GPS travel data, 2) the expectations for quality elements of the EVs before use, 3) the assessment of which characteristics that were considered as most important and 4) the users‟ satisfaction with the EVs after about 3-4 months of use. Finally, the satisfaction with different characteristics with the EVs is compared with assessments of important properties with the EVs stated just before the period of use started according to the framework presented above.

***Conclusions and further research***

From the leaders it was expected that the EVs would not be profitable for the firm in the short run, but that the eco-friendly profile of the vehicles in the long run would make the investment profitable, e.g. by a positive economic effect for the firm through improved reputation.

Experiences show that the EVs worked quite badly in the beginning, partly due to lack of practical training and partly technical problems with the 12 volts battery (due to charging capacity). The battery problem was partly a result of extreme cold. The EVs worked reasonably okay after users got familiar with the EVs, the battery charging problem was solved and the extreme cold was over.

The experiences so far and the feedback from users and the car mechanical indicate, not surprisingly, that recharging is a crucial point. The short range of the EV (100 – 140 km on a full loaded battery) implies that flexibility in use is quite limited. More locations for battery charging during the work-day are needed. Fast charging options will give extra benefits in this respect. To make use of EVs more flexible, charging stations must be set up on strategic important locations.

Concerning further economic and behaviour related research on EVs in the project RFEV, we will especially emphasise the following:

* When the problems related to the cold winter are over, it is important to obtain user information from „summer use‟.
* It is interesting to analyse how frequency of use and user satisfaction will be affected by the technical upgrade of the EVs, especially related to the charging of the 12 volt battery. It will also be useful to document the influence of ‟driving training‟ and general driving experiences on user satisfaction.
* To get more knowledge about how EVs are used in the firms compared with their conventional car park, the GPS-loggers must be used more creatively than has been done up to now. E.g. GPS-loggers can be installed also in conventional cars so that the use of these vehicles can be compared to the EVs. Hence, the EV potential can be calculated.
* To better carry out analyses of more general interest, it is important to point out geographical, topographical and company specific differences in EV use. This will be handled by expanding the project to other regions in Norway that differ in population and industry structure and climate.

## Experiments and incentives for environment-friendly vehicles

<http://www.bestufs.net/download/BESTUFS_II/key_issuesII/BESTUFS_BPH.pdf>

***Research activities***

National but also municipal authorities have initiated research programmes and projects to encourage the use of EFV in the field of urban freight transport and logistics. In France the National Program on Goods in Cities (Programme National Marchandises en Ville) has developed and promoted research projects in co-operation with transport operators, the electricity (EDF Electricite de France) and gas (GDF Gaz de France) supplier. Within the program “Cleaner Vehicles” the national government has given financial support for research activities. Switzerland has taken part in the EU research project IDIOMA which has been financed by the Swiss Federal Office for Research and Education (SBF).

Most national research activities are not with direct focus on the usage of EFV within urban freight transport and logistics but more general with focus on propulsion and vehicle technologies. E.g. in Austria a lot of research activities have been carried out in connection with EFV but more with focus on technology. In Ireland the “Sustainable Energy Ireland” has funded research activities with focus on renewable energy like recovering of bio fuels.

Also in those countries where car manufacturer are located like France or Germany the private automotive industry is developing research projects with focus on environment-friendly vehicle technologies, but also on a more general level (private car usage).

***Incentives***

The promotion and usage of EFV in urban freight transport (but not only with focus on urban freight) is fostered by several incentives municipalities and national political authorities have used and uses:

The support measures that have been mainly used are:

* Informal PPP: creating a dialog and setting up a common concept.

Within those dialog the municipal authorities, transport operators and/or shop owners came together to set up a sustainable solution to a more environment-friendly form of urban freight transport like for example the following concepts:

* The PIEK- and DEMO-programme (NL)
* OPTRANS research project (DE)
* Environmental zone scheme (DK)
* Tax reduction for the usage of alternative fuels (mineral oil tax) or for the usage of EFV (vehicle tax)
* Private concepts of logistics operators are also known that have initiated the usage of EFV in their city distribution. Often those concepts are also part of research projects co-funded by public authorities, but not always:
* Hermes Versand Service (DE)
* La Petite Reine (FR)
* Tax reduction for the usage of modern filter technology
* Permissions for access to special areas like shopping areas, business districts etc. for vehicles with lower emissions (city access schemes) like the Danish trial in Copenhagen
* Road pricing schemes that takes into account the emission category of heavy goods vehicles (EURO-norm) like
* The London Congestion Charge
* the Heavy Vehicle Fee (LSVA) in Switzerland
* Funding of innovative research projects and trials in the field of urban freight transport by using EFV
* Programme National Marchandises en Ville (France)
* “Green truck experiment” under financial support of the ADEME-project and promotional support of the city of Paris.

***Main problems and failure factors***

One failure factor for the set up of environment-friendly distribution and logistics concepts in urban areas are higher investment and maintenance costs caused by the usage of EFV (like the concept of the city of Malaga/Spain). Especially for countries and municipalities where the financial budgets are narrow there is often no possibility to fund innovative environment-friendly projects with focus on EFV in city distribution. In Bulgaria for example the barriers to the introduction of cleaner vehicles and alternative fuels are high capital and life-time costs and a lack of refueling infrastructure.

The network of filling stations for alternative propelled vehicles is in most countries one of the main problem. This problem can also be described with the “hen–egg-problem”: if the infrastructure is not given the sale and promotion of EFV is quite difficult. On the other hand if there is no demand for EFV because of higher costs or other barriers an infrastructure net of filling stations will not be build up.

A special problem in case of electric vehicles is the short mileage provided by one charging battery and the weight of those batteries.

In the following a **general short overview** about the situation in different countries is given:

***Austria: much efforts, but not with focus on urban freight transport***

There have always been efforts to further develop alternative fuel systems, which was driven by the automotive companies and supported by the state. But there is no special focus on urban freight transport. The more general aim is to increase the number of alternative powered vehicles; especially in individual transport and public transport (e.g. bus fleets). The project “Clean City Traffic Austria” has shown that alternative concepts (in this case NGVusage) can lead to lower operational yearly costs, less emissions and a higher distance reach.

***Belgium: no focus on urban freight transport***

Belgium shows a high interest to support alternative fuel vehicles and set up a strategy for complying with the international standards set out in Kyoto.

Tax incentives and promotion activities like a « CO2 guide » support the usage of EFV. Nevertheless the focus of the Belgian policy is on private passenger car usage and public passenger transportation. Trials, projects and demonstration projects in the field of urban freight transport are missing.

***Czech Republic: no incentive programme exist***

In general, Czech public authorities support environment-friendly vehicle usage, proclaiming programs and adopting measures. In fact, financial support is addressed to the public passenger transport, it means to bus operators. The Czech government adopted “Assistance program for alternative fuels in transport – Natural gas” in May 2005. The goal is to substitute 20-23% of conventional fuels with alternative fuels by year 2020. Up to now no incentive programmes for the usage of environment-friendly

vehicles exist.

***France: a lot of efforts and support***

The freight sector, so far, is the least concerned with EFVs (with the exception of La Poste). There are very few EFVs in circulation today. But compared to other countries many trials and projects have been carried out and the political authorities support measures and concepts of EFV in urban freight transport.

In the recent past, the main incentive for developing environmentally freight vehicles has been the ELCIDIS European program, which has helped La Rochelle in developing a large scale experiment (this project and its results are detailed as one of the projects presented in the last section) and the National Program on Goods in Cities (Programme National Marchandises en Ville), which has cooperated with operators and with Electricite de France and Gaz de France to develop some experiments of electric and CNG delivery vehicles in French cities.

***Germany: EFV will gain more importance in future***

Alternatively propelled vehicles will become of more importance in the future as administrations have to take care and guarantee high air quality standards in the future. In Germany a lot of efforts have been made to support the usage of alternative fuels. The current discussion is about the reduction of PM-10 within the inner-urban areas which has also started a new debate on city-logistics and also on the usage of environment-friendly alternatives in city areas. Also the increase in fuel prices has started a new discussion to use environment-friendly vehicles, but not only with focus on urban freight but more in general.

## ****Tax Incentives for Environment-friendly Commercial Vehicles -**** Hong Kong

**Tax Incentives Scheme for Environment-friendly Commercial Vehicles**

Vehicular emissions are the major source of roadside air pollution in Hong Kong.  Reducing emissions from vehicles can improve our roadside air quality.  To encourage the use of environment-friendly commercial vehicles, which have low emissions, **starting from 1 April 2008**, reduction in the First Registration Tax (FRT) will be offered to buyers of newly registered environment-friendly commercial vehicles. Vehicle owners buying environment-friendly commercial vehicles can enjoy tax concessions and make an effort to protect the environment.

**Qualifying Standard for Environment-friendly Commercial Vehicles**

The emission performance of environment-friendly commercial vehicles shall be better than the prevailing statutory requirements. As a start, the qualifying standard for environment-friendly commercial vehicles is set at Euro V level. Compared with Euro IV vehicles, Euro V heavy duty diesel vehicles emit about 40% less nitrogen oxides (NOx). For light duty diesel vehicles, Euro V models emit about 80% less respirable suspended particulates and 30% less NOx. As regards Euro V petrol/ LPG vehicles, they emit about 30% less NOx.

Environmental Protection Department (EPD) will review the qualifying standard annually for tightening in the light of technological development and the prevailing statutory emission standards. The objective is to ensure that only vehicles of truly outstanding emission performance outstripping the prevailing statutory requirements are entitled to enjoy concessions for their FRT. If tightened, the new qualifying standard will be introduced on 1 April each year and published in EPD website.   
When the new qualifying standard becomes effective, commercial vehicles meeting only the previous standard will not be eligible for the FRT reduction.

**Details of the Tax Concession Scheme**

Under this tax concession scheme, "commercial vehicles" include taxis, light/medium/heavy goods vehicles, public/ private light buses, public/ private non-franchised buses and special purposes vehicles.

The rates of reduction of the first registration taxes for different vehicle classes qualified under the scheme are as follows–

* 100% for taxis, light buses, non-franchised buses and special purpose vehicles;
* 50% for goods vehicles (except van-type goods vehicles up to 1.9 tonnes permitted gross vehicle weight); and
* 30% for van-type goods vehicles up to 1.9 tonnes permitted gross vehicle weight.

The tax concessions are subject to vehicle-class-specific caps per vehicle. For details, please see the table below.

**Table 1. First Registration Tax Concession Rates and Caps for Environment-friendly Commercial Vehicles**

| **Vehicle Classes** | **First Registration Tax Rate (% of vehicle taxable value)** | **First Registration**  **Tax Waiver (%)** | **First Registration Tax Concession Cap ($ per vehicle)** |
| --- | --- | --- | --- |
| Light Goods Vehicles (vans) (weight1 not exceeding 1.9t) | 352 | 30 | 8,500 |
| Light Goods Vehicles (vans) (weight more than 1.9t, but not exceeding 5.5t) | 17 | 50 | 40,000 |
| Light Goods Vehicles (non vans) (weight not exceeding 5.5t) | 15 | 50 | 29,000 |
| Medium Goods Vehicles (weight more than 5.5t but not exceeding 24t) | 15 | 50 | 56,000 |
| Heavy Goods Vehicles (weight more than 24t) | 15 | 50 | 69,000 |
| Non-franchised Buses | 3.7 | 100 | 78,000 |
| Light Buses | 3.7 | 100 | 27,000 |
| Taxi | 3.7 | 100 | 12,000 |
| Special Purpose Vehicles | 3.7 | 100 | 63,000 |

1. The "weight" means "permitted gross vehicle weight".

2. The first registration tax rates of van type goods vehicles weighing up to 1.9 tonnes are 35% on the first $150,000 of vehicle taxable value, 65% on the next $150,000 and 85% on the remainder.

3. The tax concessions for newly registered environment-friendly commercial vehicles of the above vehicle classes are subject to vehicle-class-specific caps per vehicle. The FRT payable is based on the following calculation method:   
  (a) If FRT concession is **less than** FRT concession cap, FRT payable = [vehicle taxable value x FRT rate x (1-FRT waiver)];

  (b) If FRT concession is **greater than** FRT concession cap, FRT payable = [vehicle taxable value x FRT rate] – FRT concession cap.

For those vehicle owners who opt for environment-friendly commercial vehicles to replace their pre-Euro or Euro I diesel commercial vehicles under the one-off grant scheme that was launched on 1 April 2007, they are entitled to the above first registration tax waiver taking account of the additional environmental benefits of procuring more environment-friendly commercial vehicles. Please note the deadlines for replacing pre-Euro or Euro I diesel commercial vehicles under the one-off grant scheme.

**Environment-friendly Commercial Vehicles**

Environment-friendly commercial vehicles can be imported either by dealers authorized by vehicle manufacturers (i.e. authorized vehicle dealers), parallel importers or individuals. Details are as below:

**Environment-friendly commercial vehicles imported by authorized vehicle dealers and type-approved by EPD**

Vehicle manufacturers have provided sufficient information to prove to the satisfaction of EPD the compliance of these vehicle models with the environment-friendly commercial vehicle qualifying standards.  EPD has thus issued to each of the vehicle models an "Environment-friendly Commercial Vehicle Certificate" such that vehicles of the same model imported by the relevant vehicle manufacturer via his authorized vehicle dealer are also environment-friendly commercial vehicles (i.e. type-approved to be compliant with the environment-friendly commercial vehicle qualifying standard).

A vehicle buyer in consideration of buying an environment-friendly commercial vehicle should ask the authorized vehicle dealer for the "Environment-friendly Commercial Vehicle Certificate" issued by EPD for the vehicle model.

Below is a list of environment-friendly commercial vehicle models that have been type-approved by EPD.  The list will be updated when new environment-friendly commercial vehicle models have been type-approved by EPD.

**Environment-friendly commercial vehicles imported by parallel importers or individuals**  
Vehicles manufactured for different places may be designed to meet different emission standards and have different options for purchase which can affect their emission performance. Thus, vehicles of the same model name can be designed to meet different emission standards. Evidence should be submitted to the EPD for each of the vehicles imported by parallel importers or individuals to substantiate their compliance with the environment-friendly commercial vehicle qualifying standard.  Since these vehicles are imported on an individual basis, EPD will issue an "Environment-friendly Commercial Vehicle Certificate" to each of them.

A vehicle buyer in consideration of buying such a vehicle should ask for the valid "Environment-friendly Commercial Vehicle Certificate" issued by EPD for the vehicle. The Certificate will bear details of the vehicle including engine number, chassis identification number and vehicle model and the validity period of the certificate.

**Note**: Any vehicle without a valid "Environment-friendly Commercial Vehicle Certificate" issued by EPD will not be eligible for the FRT reduction for environment-friendly commercial vehicles, irrespective of whether the vehicle is imported by an authorized vehicle dealer, a parallel importer or an individual.

**Validity of “Environment-friendly Commercial Vehicle Certificate”**

Since EPD will review the environment-friendly commercial vehicle qualifying standard annually for tightening them in the light of technological advancement, the "Environment-friendly Commercial Vehicle Certificate" has a validity period.  Upon its expiry, the vehicle concerned will lose its eligibility for the FRT concession if it cannot comply with the new qualifying standard at that time.  Thus, vehicle owners or vehicle vendors should submit the first registration application to Transport Department (TD) during the validity period of the relevant "Environment-friendly Commercial Vehicle Certificate" to benefit from the FRT concession.

**How to apply for the first registration tax concession for an Environment-friendly Commercial Vehicle?**

With effect from 1 April 2008, a vehicle owner applies with TD for first registration of his commercial vehicle, which is compliant with the qualifying standard for environment-friendly commercial vehicles and have a valid "Environment-friendly Commercial Vehicle Certificate" at the same time will have the FRT reduction, subject to the vehicle-class-specific cap.

**Profits Tax Deduction for Capital Expenditure on Environment-friendly Vehicles**

Starting from 18 June 2010, businesses which have purchased eligible environment-friendly vehicles may deduct the capital expenditure incurred under profits tax.

## Incentives to promote Bioethanol in Europe and abroad

[www.best-europe.org](http://www.best-europe.org)

The project BEST, Bioethanol for Sustainable Transport, focuses on the introduction and market penetration of bioethanol as a vehicle fuel, and the introduction and wider use of bioethanol cars and buses.

During the project more than 67,000 bioethanol cars and 140 bioethanol buses have been introduced, demonstrated and evaluated. Fuel stations for E85 and ED95 fuel have opened. Low blends with petrol and diesel have been developed and tested.

Through BEST, the participating cities and regions aimed demonstrate the prerequisites for a market breakthrough for bioethanol vehicles and bioethanol. Another objective was to inspire others to follow.

During the project several incentives promoting bioethanol cars and buses and bioethanol fuels have been introduced locally and in some cases at the national level. Some of the sites faced barriers to the introduction of bioethanol in the beginning of the project and in certain locations these are still not solved. The barriers have mainly been taxation and regulation issues.

The participating cities/regions are: Biofuel Region (SE), Brandenburg (DE), Somerset(UK), Rotterdam (NL), Basque Country and Madrid (ES), La Spezia (IT), Nanyang (China), São Paulo (Brazil). Coordinating City is Stockholm (SE).

***Incentives on production***

***Brandenburg***

The chance to sell transformed cereals in a market that was competitive due to tax exemption was an answer both to combat climate change and rural development. In 2006 the Schwedt bioethanol factory “Verbio AG” became established. The VERBIO group is now the leading producer and supplier of biofuels and also the only industrial-scale producer of both biodiesel and bioethanol in Europe.

Because of a changing international ethanol market incentives on planting or processing bioethanol from rye seem to be no solution. It would be much more in line with economy that farmers would start to cooperate with the producers more closely. During high price times they could lose when selling at competitive prices for ethanol production but during low price times they would gain more.

Biofuel producers will in future enjoy fiscal and administrative support only if certain sustainability criteria are adhered to.

***Rotterdam***

At the moment there is hardly any bioethanol feedstock industry in the Netherlands. One small national subsidy was elaborated for innovative ways to produce second generation biofuels and was installed in 2008. The conditions were tough and the production methods have to be viable after the first years.

The Rotterdam harbour wants to become Europe’s energy port and is attracting Ethanol producers.

Amongst these, Abengoa and BER (Bio Enery Rotterdam) plan to produce bioethanol in 2009/2010 with a future strategy towards second generation bioethanol with Dutch feedstock. Rotterdam is also the biggest European import harbour for biofuels. This active policy can be seen as an incentive to get bioethanol available in the Netherlands and in Europe.

***Somerset***

Somerset has worked closely in partnership with Wessex Grain/Green Spirit Fuels in discussing incentives on production of biofuels. In all the discussions specific reference was made to the benefits to the rural and national economy from the development of local bioethanol production.

***Nanyang***

In Nanyang one of the five government approved plants to produce fuel ethanol is situated and Nanyang is one of the first demonstrating E10. In order to stimulate the production of ethanol the value-added tax of denatured fuel ethanol is levied first, and then given back to the provider (TianguanGroup). Also an allowance of 1373 Chinese yuan(appr. € 150) per ton of denatured fuel ethanol is paid to provider.

***Incentives on vehicles***

Most of the incentives for vehicles were into green procurement. Only in Sweden and the Basque country straight financial incentives for FFV’s were installed. Also private companies can organize very effective incentives, like Ford-Netherlands, who has offered an environmental benefit for FFV buyers.

For incentives on vehicles it is important to be able to define what the policy makers recognise to be a clean vehicle. Sweden has been able to organise a national definition of a clean vehicle. The local government of La Spezia considers an FFV as a clean vehicle. Rotterdam is working on a definition.

***Brandenburg***

Costs for a FFV-car are not higher than for a normal car and often 10-20% discounts are given to new buyers. Advertising with available cheap fuel or environmental benefits would be more valuable than offering extra discounts as incentives.

***Basque Country***

Since July 2008, EVE has offered a grant of €400 for purchase of vehicles of energy class A with CO2 emissions of under 120g/km. This category includes most of the flexi-fuel vehicles currently marketed in the Basque Country. FFV’s are favoured for CO2 reduction according to the procedure specified by AENOR (Spanish Association for Standardisation and Certification).

***Stockholm***

Stockholm has demanded clean transport in the procurement of all transport services, taxi’s, public transport, goods distribution, waste collection, internal mail deliveries and courier services and security services. Stockholm has been able to adopt the common accepted national clean vehicle definition.

***Rotterdam***

As a part of BEST the extra cost for FFV’s were subsidized. Since there were no, or hardly any extra costs Rotterdam did not continue with this incentive. After continued collaboration with the car manufacturers especially Ford offered FFV’s with an environmental bonus. The actual sales figures are proving this is a very effective incentive. Rotterdam has taken the lead in the Netherlands to make a definition of a clean vehicle. There was no Dutch definition. Rotterdam strengthened the already existing network to share this definition with in order to get maximum basis.

***Nanyang***

China central government encourages new energy vehicle development in China. There are many funds supporting the research of new energy vehicles, such as electric vehicle and fuel cell vehicle. But there are no detailed policies, nor incentives for vehicles in the market.

***Somerset***

The work of the Somerset Biofuel Project on incentives on vehicles has been to provide supporting evidence and an example of best practice to partner organisations Imperial College, Ford Motor Co and Green Spirit Fuels who have representatives on the Low Carbon Vehicle Partnership (LVCP).

LCVP is an action and advisory group, with over 280 organisations, to take a lead in accelerating the shift to low carbon vehicles and fuels in the UK. The LCVP is the man body advising government on the introduction of low carbon vehicles.

A national 2% reduction on company car tax for FFV’s has been installed in March 2007.

***Incentives on distribution***

Most incentives on distribution are to compensate some extra cost for the modification of service stations in order to offer bioethanol. In Sweden offering of bioethanol is mandatory for bigger stations, BFR guaranteed a minimal amount of E85 sales. The Basque country has been able to bring down the price through negotiations and coordination of ethanol transports.

***Brandenburg***

One of the key elements in Brandenburg’s activities has been to discuss better regulations. Several licensing procedures for different settings have successfully been managed. The knowledge is ready to be spread to followers.

***Basque Country***

EVE negotiated a ten year contract with a bioethanol producer which guarantees very advantageous purchase conditions for the product. These conditions are available for all service stations in the Basque Country and has made it possible to keep the sale price of E85 up to 28% lower than petrol, with differences of between 2 and 6 eurocent in the price of the E5 and E10 blends as compared to 95- octane petrol.

Service stations are buying only small amounts of ethanol. Given that the ethanol has to be transported more than 1,000 km from the plant in Abengoa in Cartagena (Murcia), as not to increase the price of the product it is essential to optimise transport and bring loads with full tankers. This needs coordination on the logistics of transport and is performed by EVE at no cost whatsoever for the service stations.

EVE gives financial support for alterations to the service stations that decide to offer the three blends of bioethanol EVE has decided to market: E5, E10 and E85. In exchange, the owner of the service station makes the following commitments:

* To guarantee the availability of E5, E10 and E85 in their filling stations for the next 10 years;
* To use the branding provided by EVE (including the BEST project and EC logos) for the next 10 years;
* To agree with EVE on a competitive price for E85.

***Stockholm***

National legislation demands that filling stations selling more than 1 000 m3 diesel or petrol each year have to supply at least one renewable fuel.

***Rotterdam***

The price of E85 is too high in the Netherlands, the oil company Tamoil uses its communication/PR budget to lower the E85 price.

A national subsidy arrangement has lead to applications for about one hundred fuelling points of biofuels all over the country in 2009.

***Incentives on taxes and regulation***

Incentives on taxes and excise reduction to get the price of ethanol competitive with other fuels are the strongest incentives to implement in order to achieve a market breakthrough. The problem is that this is a national matter and that it directly affects the national treasury. In order to achieve these kinds of measurements it takes time, influence, endurance and strong discussions.

Germany, Sweden and Spain took sufficient national excise measurements to make Ethanol competitive at the pump. The UK, Italy and the Netherlands did not. In these last three countries the focus of the sites has been on discusion with the national government.

***Brandenburg***

In 2002 the German Parliament decided to exempt biofuels from the gasoline tax to increase their competitiveness compared to conventional gasoline. The policy to promote biofuels is being justified by their allegedly positive effects on climate, energy and agricultural policy goals. An increased use of biofuels would contribute to sustainable development by reducing greenhouse-gas emissions and the use of non-renewable resources. By gradually increasing the tax rates on biofuels the stimulation of the market will be build off. 2nd generation biofuels and E85 are exempted from tax until 2015.

***Basque Country***

The most significant incentive currently in force is the application of a zero rate hydrocarbon excise duty on biofuels. This measure is helping biofuels to compete in price terms with conventional fuel.

***Stockholm***

The Swedish government decided to raise no tax on renewable fuels until 2013. Also the vehicle tax and the company taxes are lower for clean vehicles.

***Rotterdam***

With the start of BEST it was foreseen that the national government would make a start in 2007 for supporting the growth of flexi-fuel vehicles and the use of E85 in the year 2008. However, in the taxation plan for 2008 nothing has been mentioned in this direction. A renewed discussion was initiated in close cooperation with fuel suppliers, car importers and all other interested parties to interest national politicians for alternating the taxation plan 2008 in favour of bioethanol. This attempt has had some effect, because Rotterdam and other national partners working on the introduction of FFV’s and E85 have now been informed that the taxation plan for 2009 will integrate supporting measures for FFV’s and E85.

A change of the excise on biofuels according to their energy value was supported by the responsible ministries at technical level. The proposal seems to be blocked at political level by the Minister of Finance. The main argument is that there is too much insecurity about the justification of the use of biofuels at the moment. Rotterdam and all other interested parties in E85 are certain that fear for lack of income from excise duty is the main part of this governmental reluctance.Together with Italy and Somerset, Rotterdam has even brought the problems to European Parliament level.

In expectation of national excise measurements the Rotterdam region tried to install a temporarily local subsidy to compensate the extra cost of E85. Because of the risk of market interference and the risk of being accused of illegal state support no political support was gained.

***Nanyang***

The excise of denatured fuel ethanol (5%) is exempted. This is the incentive for E10 and also effective in BEST. The fuel tax in China has been discussed for many years. A decision for an excise of 30-50% of the fuel price is expected soon. If the fuel tax is issued and fuel ethanol can get the exempt of it, this is expected to push fuel ethanol development greatly in China.

Every vehicle in China has to pay for road maintenance. For 10 FFV and ethanol 2 buses in BEST in Nanyang now, the local government relieved road maintenance cost.

***Somerset***

A fuel duty derogation of 20 pence per liter (app. € 0,20) on bioethanol is in force in the UK.

Unfortunately this is not enough to make E85 competitive with petrol because the derogation is based on volume instead of energy content. E85 has lower energy content with the result a FFV needs more litres E85 for the same distance, without this correction on energy content it is still 10% more expensive to fuel high blend ethanol. The majority of the work of Somerset County Council on Incentives has been focussed on taxes and regulation to achieve fuel price parity of E85 with fossil fuels. Halfway BEST is was decided that work on national discussions was not thought to be able to deliver a result in the duration of the BEST Project. Somerset nevertheless continues to participate with other supporters in the High Blends Group of the Biofuels Division of the Renewable Energy Association, which is leading on efforts to promote incentives on taxes and regulation. Somerset has also gained a leading position in the Local Government Association for its work on promoting the use of high blend biofuels in the UK.

***La Spezia***

Every year Italy sets the excise duty reduction on the fuel for a fixed amount of bioethanol produced in Italy from agricultural feedstock. No incentives on taxes and regulation are installed. Neither are incentives for production, flexi fuel vehicles and fuel distribution. The Italian partners of the BEST project are continuing to understand how to obtain the tax exemption of bioethanol.

***Conclusions***

The importance of incentivises given in the report as:

* Incentives are very important to create a market breakthrough for bioethanol;
* To reach a self sustaining market the use of the incentive instrument is needed for a long time;
* The perspective for long term incentives is very important for investors;
* Incentives can be extinguished when the bioethanol production industry is fully grown;
* Incentives can particularly play a role in the implementing phase.

Good incentives:

* The one most important incentive is to make sure the price of ethanol is equal or lower then petrol;
* Congestion charging is a second most important instrument to stimulate the use of clean vehicles and bioethanol;
* Incentives on operational costs are more effective then incentives on the initial costs;
* An environmental bonus by car manufacturers proved to be very effective in the Netherlands.

Less effective incentives:

* A competitive fuel price has the most positive impact on sales;
* A one-time national purchase subsidy promotes significantly less sales;
* Free residential parking is not very effective.

Other factors

* Local bioethanol production industry is a key factor for market breakthrough;
* Cooperation with the right stakeholders proved to be very important.

Objectives

The objectives for the subject incentives in the BEST project were

* to have direct contacts with key decision makers and, on some sites, in close collaboration with
* companies, organizations and local governments to stimulate the development of effective incentives and incentives schemes;
* to have direct contacts with students, in high-school as for adult students;
* to study, implement and evaluate incentives as they are and how they could be.

It can be concluded that the objectives in the project were met. All the sites strengthened their network and have discussed incentives at several levels and with different stakeholders. Especially the BioFuel Region worked intensively with students, concluding that the need for information, knowledge and education is never satisfied and that coordination of the communication activities is necessary.

Also incentives were studied, implemented and evaluated. Incentives play a quite important role, national and local/regional incentives can strengthen each other. The experience from the Swedish and Brazilian partners have given the BEST project a unique chance to draw some conclusions on the effectiveness of incentives. By using the biofuel chain and the system approach, the importance of combining incentives, or actions, can be understood.

At some sites certain incentives were not possible to organise, the main reason for this was the lack of enough political support for excise measures. Also the sustainability discussion complicated the market introduction. Cooperation with stakeholders proved to be very important. By performing a stakeholder analysis BEST demonstrated a way to find out where to find stakeholders and with what stakeholders should be cooperated with. Most sites have shown perseverance by taking the lead and organised local incentives for end users.

The sites did not wait for the government to set an example, instead they lead the way. The local incentives differ from motor tax rebate, local purchase grants, access to restricted areas and free parking. Also information activities, demonstration and test facilities are organised. FFV’s are embedded into restrictive measurement policies.

***Which incentives work***

The one most important incentive is to make sure the price of ethanol is lower or equal to petrol for a long time. This can be achieved by a tax exemption for the ethanol fuel. The price at the pump will decide, the focus needs to be on price mechanism of the different transport fuels. Along with this Congestion charging is a second most important instrument to stimulate the use of clean vehices and bioethanol. A one-time national purchase subsidy promotes significantly less sales as well as the free residential parking.

***The importance of incentives***

To reach a self sustaining market the use of incentives is needed for a long time. After almost 30 years Brazil has been able to phase out most of the incentives and ethanol has been able to become competitive with petrol now. Incentives proved to be very important when it comes to create a market breakthrough for ethanol cars. The perspective for long term incentives is very important. Financial incentives can be transitionary and can be taken out when the market is fully developed.

***Installed incentives***

*Incentives for production*

The presence of a local bioethanol production industry is a key factor in achieving appropriate national incentives for market breakthrough. The activities on incentives for production took place at the sites with own local economical benefits for the production of biofuels. The activities were much into cooperation with producers and fuel companies. Nanyang is stimulating the production of ethanol financially.

*Incentives for vehicles*

Most of the incentives for vehicles were into green procurement. Only in Sweden and the Basque country straight financial incentives for FFV’s were installed. Also private companies can organize very effective incentives, like Ford-Netherlands, who has offered an environmental benefit for FFV buyers and Volvo offered eco-driving training to FFV buyers. For incentives on vehicles it is important to be able to define what the policy makers recognise to be a clean vehicle. Sweden has been able to organise a national definition of a clean vehicle. The local government of La Spezia considers an FFV as a clean vehicle. Rotterdam is working on a definition.

*Incentives for distribution*

Most incentives on distribution are to compensate some extra cost for the modification of service stations in order to offer bioethanol. In Sweden offering of at least one renewable fuel is mandatory for bigger stations, BFR guaranteed a minimal amount of E85 sales. The Basque country has been able to bring down the price through negotiations and coordination of ethanol transports.

*Incentives through excise and taxes*

Incentives on taxes and excise reduction to get the price of ethanol competitive with other fuels are the strongest incentives to implement in order to achieve a market breakthrough. The problem and the challenge is that this is a national matter and that it directly affects the national treasury. In order to achieve these kind of measurements it takes time, influence, endurance and strong discussions. Germany, Sweden and Spain took sufficient national excise measurements to make Ethanol more competitive at the pump. The UK, Italy and the Netherlands did not. In these last three countries the focus of the sites is on discussions with the national government.

*Incentives for end users*

Sites have been able to organise local incentives for end users in different ways. Besides this many good ideas are to be worked out. The local incentives differ from motor tax rebate, local purchase grants, access to restricted areas and free parking. Also information activities, demonstration and test facilities are organised. FFV’s are embedded into restrictive measurement policies. Besides security, comfort and road-holding characteristic the costs for service and maintenance and fuel consumption are the most important factors costumers address when buying new cars.Best practice in optimization of urban traffic

## Information and technological methods and tools

A number of high and low-tech tools have been developed to improve the decisions of developers, planners and elected decision-makers related to the management of settlement form and design. These include tools that are used to:

* describe and analyse the environment spatially through mapping
* evaluate the potential impact of individual development projects on environmental, social (including human health), economic and cultural values
* forecast and model future trends and develop scenarios, and their resulting impacts, based on various policy options
* monitor current trends and trace performance against indicators of sustainability
* audit environmental performance
* increase the knowledge-base available to decision-makers through research
* improve the environmental, social and economic performance of activities through information, communication, and technology (ICT) systems.

Several examples of information and technology tools are described below. Links to further information on the tools can be found in Section 9.

## Mapping

Mapping has been an important tool in managing settlement form and design since the earliest days of the urban planning profession. Traditionally, pen and paper maps were used to record legal property boundaries, urban zones, land uses and a wide range of geographic characteristics, including important environmental resources. Aerial photos have also been used to map land use and environmental information.

Since the 1990s, pen and paper maps have been largely replaced by computer-based Geographic Information Systems (GIS), which enable information to be stored and analysed more efficiently as electronic data. This electronic data can also be used to model and predict future trends, as discussed below. A common and widely used GIS mapping tool is ArcView / ArcGIS. This system is able to perform any GIS task, including: mapping, data management, geographic analysis, data editing, and geo-processing (<http://www.citilabs.com/arcgis/arcview.html>).

## Using GIS for regional transportation

The introduction of GIS mapping has also been a step forward for transport planning, and is used widely to assist in the planning process. GIS can be used for a range of purposes, from planning a public transport network, to road safety analysis. In particular, the development of GIS software has been instrumental in improving the understanding of public transport accessibility dynamics, and has enabled the development of accessibility mapping. Accessibility in this context primarily relates to access to key facilities (for example: health, education, employment, shops, leisure, and other services) by modes other than the private car, such as public transport, walking and cycling. Households without access to a car are often at a disadvantage accessing these services, and this is an issue of social equity. Accessibility mapping and planning are therefore key tools in ensuring sustainable settlement form.

In order to produce an accessibility map, computer-simulated travel ‘time plots’ are calculated to produce a map showing the time it takes to reach a destination by public transport, walking or cycling. This type of assessment highlights areas that have poor accessibility by public transport or active travel modes, and can be a useful guide to objectively identifying residential areas requiring improved public transport services. To assist in accessibility mapping and planning, a tool known as ‘Accession’ has been developed in the UK. Accession is a GIS-based mapping tool that enables users to determine network accessibility measures, undertake local accessibility analysis, and calculate composite accessibility functions.

GIS is used extensively by LAs in New Zealand to aid in their urban planning functions. Most councils now have property information accessible through GIS systems. An example is the publicly accessible ‘WebMap’ developed by the Dunedin City Council (DCC) which links information on land tenure, rates and resource consent applications to maps and aerial photo/boundary overlays (www.cityofdunedin.com).

Likewise in transportation planning, the LTMA (2003) states that in preparing Land Transport Programmes, regional councils and the Auckland Regional Transport Authority (ARTA) must take into account how each activity “improves access and mobility”. While there is no formal requirement for regional councils to carry out accessibility mapping, several councils have used it informally or are currently exploring it.

## Forecasting and modelling tools

The complement to a lot of the modern GIS-based mapping tools are a range of spatial analysis models that have been developed to:

* analyse past and present spatial patterns and ‘progress’ against key indicators and measures
* predict future spatial patterns and changes in indicators based on trends
* est future policies / scenarios in terms of future patterns
* develop more sophisticated and responsive urban and transport planning responses.

These tools are particularly useful for analysing complicated and multidimensional information to better understand the economic, social, and environmental aspects of urban change (Lahti, 1999).

In land-use planning, several ‘growth models’ have been developed to look at phenomena such as the interaction between: population size, urban form (land consumption), employment, and transportation, as well as scenario performance against a variety of social and environmental indicators.

Models are also used to inform the transport planning process by allowing the testing and analysis of different scenarios. Models provide unbiased information that allows decision makers to assess the effects of different options. In transportation planning, models are frequently used to:

* determine network capacity
* predict where future congestion points will be in the network, based on growth in population and car ownership
* assess the effects of different interventions on traffic flows (for example, public transport, bus lanes, or junction improvements).

Some transport models also include an element relating to air pollution and air quality, so that the effects of different traffic flows on air quality can be forecasted.

Examples of forecasting and modelling tools are listed in Table:

|  |  |  |
| --- | --- | --- |
| **Name** | **Description** | **URL** |
| **Index ®** | Interactive GIS tool for land use planning. Uses over 80 indicators to assess current conditions and model impacts of different scenarios. Indicators relate to land use, transport, urban design, housing, employment, and the environment. Analysis allows ranking of alternatives in terms of their impact. Also used for consultation and monitoring once plans are adopted. | http://www.crit.com/index/index.html |
| **QUEST** | Modelling software for land use planning at local or regional level. Allows evaluation of alternative scenarios by scoring their performance according to specified priorities. Designed particularly for use in engagement with stakeholders. Produces range of sustainability indicators to monitor progress. | http://www.envisiontools.com |
| **What If?** | Interactive GIS-based system which allows exploration of  alternative development scenarios. Allows assessment of alternative public policies in terms of their impacts on future land  use patterns and population and employment trends. | http://www.what-if-pss.com/ |
| **Prescott College /**  **Blueline Group**  **spatial growth**  **modelling** | Modelling software for planners, policy makers and the public.  Allows modelling of alternative scenarios both for growth and emergency management. Impacts of scenarios analysed in such areas as growth, natural resources, and local budgets. | http://www.tbrpc.org/spatial/ |
| **Community Viz™** | GIS-based analysis and 3D modelling for planning and resource management. Allows users to explore and identify different land use alternatives and their environmental, economic, and social impacts. | http://www.communityviz.com/ |
| **UrbanSim** | Simulation model used for planning and analysis of urban development, particularly: land use, transport, and public policy.  Can provide interface between existing travel models and the new land use forecasting and analysis capabilities. Free under GNU General Public Licence to stimulate continuing research and development. | http://www.urbansim.org/index.shtml |
| **Moland model** | Software tools developed to assist with preparation, development, and implementation of EU policies and legislation. Tools include: 1) landscape fragmentation analysis – for impact of urban expansion on spatial structure of urban and regional landscapes and 2) urban growth modelling – forecasting impacts to compare alternative future development scenarios. | http://moland.jrc.it/ |
| **CUBE** | Software used to model and analyse all modes of surface transportation, for both passenger and freight movement, includes modelling capabilities. | http://www.citilabs.com/ |
| **Sim Traffic** | Software for modelling urban traffic networks to allow transport professionals to analyse capacity and fine tune signal operation to maximise traffic flows. | http://www.trafficware.com/ |
| **CityGreen** | GIS-based system for land use planning and policy making.  Analyses ecosystem services including: storm water quality, air quality, carbon storage, and tree growth. Models impact of different development scenarios on ecosystem. | http://www.americanforests.org/products  andpubs/citygreen/ |
| **LTHIA** | Curve number-based model linked to GIS that analyses the effects of land use changes on aspects of hydrology such as surface runoff, groundwater recharge and non-point source  pollution. | http://gis.esri.com/library/userconf/proc9  9/proceed/papers/pap417/p417.htm |
| **ACCESSION** | Software tool for accessibility planning and mapping in transport developed by the UK Department for Transport. | http://www.within-reach.org.uk/data.asp |

## Greening the City

Greening the city refers to strategies and techniques that protect and restore ecology within urban communities. It means "combining urbanism and nature to create healthy, civilizing, and enriching places to live." It means a living area governed more by nature than legislature; and a sustainable human settlement based on "ecological balance, community self-reliance, and participatory democracy."

Urban ecology strives to create, preserve and restore green and open spaces sustainably. It provides many environmental benefits: it reduces the urban heat island effect, minimizes our use of pesticides, conserves energy, cleans urban air, and absorbs carbon dioxide from the atmosphere. But urban ecology also offers a practical day-to-day understanding and linkage between urbanites and nature. Environmental awareness and activism should also be encouraged to focus on issues inside the city.

Creating sustainable green spaces can begin with community parks, as they offer a host of ways to reduce the environmental impact of cities. The restoration and preservation of open spaces is another target for sustainable green initiatives, as is the desire to incorporate greening into private outdoor spaces. Some urban neighbourhoods, with their asphalt roads, concrete sidewalks, and concrete-block property boundaries, need more greenery in their street-level aesthetics; while other neighbourhoods may have adequate green spaces without benefiting from their multi-functional use and realizing their socio-environmental potential. Additionally, sustainability in urban green space is not only desirable, but profitable too.

Ambitious visions demand ambitious actions in Copenhagen.

<http://kk.sites.itera.dk/apps/kk_publikationer/pdf/674_CFbnhMePZr.pdf>

## ITS city pioneers - planning for intelligent transport in Europe's cities

**sportation System**

Intelligent Transportation Systems (ITS) have generated considerable enthusiasm in the transportation community as a potential strategy for reducing highway congestion, improving highway safety, enhancing the mobility of people and goods, promoting economic productivity, and reducing the environmental impacts associated with motor vehicle travel. However, as state and local governments across the country proceed with the deployment of ITS services and technologies, some policy makers are concerned that the detrimental emission effects of increasing the number of vehicle trips and miles traveled may partially offset the potential emission benefits of improved traffic operations and system efficiencies. The objective of thisstudy is to describe the types of modeling approaches needed to capture the short- and long-term transportation and emission/fuel consumption impacts of ITS deployment.

As illustrated in Exhibit 1, the deployment of ITS user services can be expected to affect the following general parameters, which can be thought of as deployment outcomes:

* traffic flow along specific links of the highway network
* the number of trips (vehicle or person) by time-of-day and mode along specific links
* trip distance for specific origin and destination pairings.

These general parameters are interrelated and encompass most of the factors that characterize transportation system performance and traveler behavior. For example, the integration of traffic management and traveler information systems may affect travel behavior as users of the system adjust their departure times, destinations, mode choices, and/or route choices in response to a more complete information set. Adjustments in these variables determine the number of trips and traffic flow along links, as well as trip distances across pairings. **&**

**Fuel Consumption**

A methodology for evaluating the emissions and fuel consumption effects of ITS must address all potential deployment outcomes, including the potential for induced travel effects. Induced travel is defined as: 1) trips that people would like to be able to take, but that they forgo because of associated delays and excessive travel time; 2) increases in motor vehicle trips resulting from mode shifts; and 3) increases in vehicle kilometre of travel (VKmT) stemming from increases in the distances of trips. Significant improvements in the transport system (usually, increases in roadway capacity) that lower users’ perceived costs of travel (primarily by reducing travel times) can induce additional vehicle kilometre of travel (VKmT), therefore increasing emissions and fuel consumption. Thus, a methodology will need to evaluate the impacts of modified traveler behavior that may, in some cases, reduce or negate potential emission benefits from improved traffic flow.

The European Commission introduced an **‘Action Plan for the Deployment of Intelligent Transport Systems (ITS) in Europe’**, which was adopted inDecember 2008, together with a proposal for a Directive laying down the framework for itsimplementation (approved in July 2010).

The Action Plan acknowledged that much of the activity in this field since the 1980s had been relatively fragmented, focusing on specific topics such as CO2 abatement, safety or traffic management. The aim of the Plan is to ensure the compatibility and interoperability of systems, to facilitate the continuity of ITS services, and to do so through a coordinated and concerted action at EU level. It therefore includes 24 targeted actions in six priority areas:

**•** optimal use of road, traffic and travel data;

**•** continuity of traffic and freight management ITS services in European transport corridors and conurbations;

**•** road safety and security;

**•** integration of the vehicle into the transport infrastructure;

**•** data security and protection, and liability issues;

**•** European ITS cooperation and coordination.

The ITS Directive is a legal framework for a coordinated deployment of ITS, intended to harmonise the specifications that will be used whenever ITS services or applications are adopted in the Member States. To increase its efficiency, the European Parliament and the Council have focused the activity by specifying the six priority actions on which the Commission will start its work:

**•** EU-wide multimodal travel information services;

**•** EU-wide real-time traffic information services;

**•** road safety-related minimum universal traffic information free of charge to users;

**•** interoperable EU-wide eCall (for emergency calls using a single dial-up number);

**•** information services on safe and secure parking places for trucks and commercial vehicles;

**•** reservation services for safe and secure parking of trucks and commercial vehicles.

## Other ways to reduce emissions from transport

### Business Savings Calculator

The U.S. Environmental Protection Agency (EPA) developed a Web-based Calculator that enables an employer considering Best Workplaces for CommutersSM to estimate the financial, environmental, traffic-related, and other benefits of joining the program. This tool was developed in two formats: [Fully Interactive](javascript:newWin('../calculat/welcome2.html')) and [Text-Only (accessible to those using assistive technology)](javascript:newWin('../calculat/calc508.html'))

They are clear system requirements mentioned: Best viewed with Internet Explorer 4.x or higher. Also viewable in Netscape 4.x with some aesthetic glitches. Does not work in Netscape 6 or 7.

Based on the information that employers enter into the calculator describing how their organizations will meet the *National Standard of Excellence* for commuter benefits, this fast and easy-to-use tool produces the following estimates:

* *Parking.* The number of parking spaces saved.
* *Parking cost savings.* The financial savings from the reduced parking demand (e.g., savings on construction of a new parking facility or enlargement of an existing one).
* *Employee recruiting and retention.* The estimated savings from reduced employee turnover.
* *Employer taxes.* The savings employers would realize in reduced payroll taxes if they select transit passes or vanpool benefits as a way of meeting the *National Standard of Excellence*.
* *Employee taxes.* The income tax savings employees would realize if they choose transit passes or vanpool benefits as a way of meeting the *National Standard of Excellence*.
* *Total financial benefits.* The total financial savings from parking facilities, taxes, and other financial impacts.
* *Employee productivity and stress.* The estimated improvement in employee productivity and reduction in employee stress (calculations that are based in part on a recent study in Southern California).
* *Traffic.* The reduction in traffic congestion.
* *Environmental Benefits.* The reduction in air pollution and global warming pollution, providing results that can be expressed in both layperson and scientific terms.
* *Safety.* The decrease in fatalities, injuries, and lost work time that results when the number of vehicle trips is reduced.
* *Energy security.* The reduction in demand for gasoline, a decrease that contributes to an improvement in U.S. energy security and energy independence.

They are different online calculators as a tool:

|  |  |  |
| --- | --- | --- |
| **Name** | **Description** | **URL** |
| Fuel Savings Calculation | Web based simple calculator to estimate how much fuel will be saved by reducing the amount of time your school buses idle. | <http://www.epa.gov/cleanschoolbus/idle_fuel_calc.htm> |
| Diesel Emissions Quantifier (Quantifier) | Interactive tool that can help evaluate clean diesel projects by estimating   * emission reductions * cost effectiveness * health benefits   The Quantifier can help state and local governments, metropolitan planning organizations, school districts, port authorities, fleet owners and operators, contractors and others in the preparation of applications for EPA or other funding assistance programs. The Health Benefits Module estimates health benefits from the reduction of fine particulate matter under specific retrofit scenarios.  The Quantifier has been developed as a tool for those without modeling experience. | <http://www.epa.gov/cleandiesel/quantifier/> |
| **Carbon Pollution Calculator** | Calculator helps to understand energy production and consumption in a whole new way. Use them to develop a personal profile of your own energy use. Curious how much? This worksheet allows you to easily tally up your own personal "carbon budget." | <http://www.infinitepower.org/calc_carbon.htm> |
| **Car Fuel Data** | This online calculator is designed for UK drivers to calculate their vehicle tax.  However, it also provides the user with an accurate calculation of grams per km CO2 emissions for a vast number of vehicle types, models, engines and fuels and so is relevant pan-EU. | http://www.vcacarfueldata.org.uk/ |
| **Carbon Footprint Limited** | Carbon Footprint Ltd is a leading carbon management company that helps hundreds of organisations and individuals to measure their carbon footprint generated by mode: Plane, Car, Bike, Bus, Rail.  The household calculator is available in 10 different European languages and is therefore a very transferrable tool at European level for stakeholders to quantify the impact of travel measures. | http://www.carbonfootprint.com/calculator.aspx |

## Pro-ecological Transport Solutions in Cracow

[**http://www.xiii-lo.krakow.pl/strony/comenius/pliki/Cracow\_Poland.pdf**](http://www.xiii-lo.krakow.pl/strony/comenius/pliki/Cracow_Poland.pdf)

***Public transport priority system***

In view of increasing traffic, it is important to expand the priority facilities to improve public transport (e.g. separate lanes for buses and trams, priority at junctions etc.), especially in the city centre. New solutions aimed at improving passenger comfort and overall service quality are needed if public transport is to compete with private car use which continues to grow. The principal achievement of these measures has been to create a high quality, passengerfriendly public transport system. The measurements recorded prove that the solutions implemented produce a positive effect for passengers and citizens in both transport corridors (tram-bus and bus). These are shorter intervals between services, greater speeds and more reliable operating times. As a result, time of the journeys has been reduced and a number of passengers has increased. Shared tram-bus and bus lanes can be implemented in additional transport corridors in Cracow and in other cities.

***High-speed tram***

High-speed tram is a kind of urban transport system which has features of tram and metro. In Cracow first high-speed tram line was open in 2008. It combines Kurdwanów and Krowodrza Hill. Currently, the tram track is 14 kilometers long. According to the projects it will be even longer. Tram tracks lead through the first Polish tram tunnel in which machine develops speed to 60 km/h. To ensure the proper speed of the traffic and passenger transport, trams have priority at crossings.

***Transition to clean vehicle fleets***

A major problem in Cracow is air pollution caused by cars. There are several cultural monuments in the area where public transport is available, and these monuments are protected by national law. The main goals of the transition were to directly and indirectly reduce the environmental impact of public transport and test new clean bus technologies to discover the best solution for larger-scale introduction in the future. In 2008 old buses were completely withdrawn and gradually substituted by clean vehicles that are compatible with European standards. Modernizing the bus fleet aimed reducing noise and fuel consumption. The tram fleet has also been modernized with the purchase of low floor trams that are equipped with an innovative recuperation system.

***TELE BUS***

The Tele-Bus is a part of CIVITAS CARAVEL project. It is an on-demand „many to many” public transport service. Passengers can decide about the time of beginning and ending their journey, so they don’t have to be limited by timetables. They can choose the stop which starts or terminates their trip in the area where Tele- bus operates. This service saves passenger’s time, so they don’t have to wait for the bus. It operates every day in the south-eastern part of the city and during specified operating hours. To reserve Tele-Bus, you can use a special free phone number. There is also a possibility of online booking if it has been done 30 minutes before the arranged journey.

***BROWSER FOR PUBLIC TRANSPORT***

***Jakdojade.pl***is a modern browser for public transport, which enables people to plan their trip around the city in a very short period of time. The service is also available on the mobile phone.



***NEW GOODS DISTRIBUTION SCHEME***

The City of Cracow developed a new scheme of goods distribution by using clean and more environmentally friendly vehicles. Initial implementation will be made within the city centre on the main square area. The private delivery service in the downtown will be reduced by about 50% by means of the goods distribution system.

***INTEGRATED TICKET***

In order to start seamless and intermodal connections in krakow through the use of common tickets, an integrated ticketing solution has been tested for the local public transport.

The first test focused on one corridor from Krzeszowice to Cracow. Motivated by the high acceptance rate after a short first trial, a new agreement has been signed to widen the system to a number of different corridors.

***INTEGRATED ACCESS CONTROL***

Cracow was one of the first city in the country to implement severe access restrictions in inner-city areas (A, B and C zones). As part of CARAVEL project in a city centre of Cracow enforcement a new strategy: 3 payable landing zones.

A new parking management scheme has been linked to access restriction; this has eliminated parking places in inner-city streets and other public places.

## Carsharing as a tool

Description

*Carsharing* refers to automobile rental services intended to substitute for private vehicle ownership. It makes occasional use of a vehicle affordable, even for low-income households, while providing an incentive to minimize driving and rely on alternative travel options as much as possible. It requires these features:

* + Accessible (i.e., located in or near residential neighborhoods).
  + Affordable (reasonable rates, suitable for short trips).
  + Convenient (vehicles are easy to check in and out at any time).
  + Reliability (vehicles are usually available and have minimal mechanical failures).

Carsharing is a middle option between having no vehicle and owning a private automobile. The table below compares personal transportation options. Carsharing offers medium convenience, and has low fixed costs and high variable costs. Private vehicle ownership offers the most convenience, has the highest fixed costs and lowest variable costs. Conventional vehicle rental businesses are not intended to substitute for private vehicle ownership. They are located at transportation terminals or commercial centers and priced by the day, and so are relatively expensive for individual short trips. They generally have high daily rates but low variable costs. Taxis are relatively convenient and have no fixed charges but the highest variable charges. Public transit has moderate to low convenience (depending on location), modest to low costs.

Below are typical variable costs for a single 15-mile trip by different modes:

            Carsharing                              $10.00

            Conventional Rental                $32.00

Private Car                               $2.00

            Taxi                                        $15.00

            Transit                                      $3.15

Other vehicle sharing strategies are possible. One proposed system would allow vehicle owners to identify when and where their vehicles are available (for example, at home or at worksites) through a matching service. Registered customers could rent the vehicle during those times, with access automatically controlled by an electronic key or pass code, and payments made from user’s to vehicle owner’s account. Travel time and distance could be recorded manually or by special meters installed in participating vehicles.

*Station cars* are a type of Carsharing. Station cars are rented at transit stations for travel between terminals and local destinations. This supports transit use, particularly in suburban areas where destinations are too dispersed for convenient pedestrian access. Because they are intended for short trips, station cars can employ small, alternative fuel vehicles, such as battery powered electric cars. [Public Bike Systems](http://www.vtpi.org/tdm/tdm126.htm) (PBS), which are automated bicycle rental systems designed to provide efficient mobility for short, utilitarian urban trips, similar to Carsharing.

Some studies indicate that access to vehicles significantly increases employment and average wages for disadvantaged people entering the workforce (such as *welfare-to-work* programs), and so recommend vehicle ownership subsidies (Blumenberg, 2003). However, Carsharing subsidies are probably better, if possible, since they do not require large up-front costs for purchase, registration and insurance, nor do they burden lower-income households with high fixed costs which may be unnecessary and unaffordable if, for example, a worker finds a job that can be reached more easily by alternative modes.

***How it is Implemented***

Carsharing organizations can be cooperatives or private businesses. Cooperatives sometimes receive grants to cover start-up and administrative expenses. Some Carsharing services are established at multi-family residential cooperatives as a service for users. Station cars are often implemented by public transit agencies. Governments can provide various types of support and incentives to help develop Carsharing services, including promotion, funding, favorable parking policies, incorporating Carsharing into public organizations and development projects, and favorable tax policies (Enoch and Taylor, 2006).

***Travel Impacts***

Because Carsharing variable costs are 2-10 times higher than for a personal automobile, users tend to minimize their driving. Overall travel reductions depend on what portion of Carshare participants would otherwise own a personal automobile (they typically reduce their vehicle use by 50-80%) and which portion would otherwise not own an automobile (they typically increase their vehicle use by a small amount). Most studies suggest that Carsharing typical results in a net reduction in per capita driving among participants that averages 40-60%, but this varies depending on the demographics of participants and the quality of travel choices in their community (Steininger, Vogl and Zettl, 1996).

In a study of the San Francisco *City CarShare* program, Cervero and Tsai (2003) find that when people join, nearly 30% reduce their household vehicle ownership and two-thirds stated they avoided purchasing another car, indicating that each Carshare vehicle substitutes for seven private cars, and that the average member drives 47% fewer annual miles after joining. However, since Carsharing tends to attract motorists who already drive relatively low mileage, total travel reductions may be relatively small.

Carsharing services are usually located in urban areas where there are suitable travel options so a significant portion of residents do not need own an automobile, and sufficient regular users within convenient walking distance (typically 0.3 miles) of the vehicles. In a typical region 10-20% of residents live in neighborhoods suitable for carsharing, and perhaps 3-5% of those residents would carshare rather than own a private vehicle ownership if the service were available. People who shift from owning a private vehicle to carsharing are typically lower-annual-mileage drivers who reduce their vehicle travel about 50% (i.e., they reduce their mileage from 6,000 to 3,000 annual miles). This suggests that carsharing services can reduce total vehicle travel by 0.1% to 0.2%, although much more in suitable urban neighbourhoods.

***Benefits And Costs***

Benefits include (Litman, 2000; Bonsall, 2002; TRB, 2005):

* + Increased consumer choice and financial savings.
  + Increased affordability for lower-income drivers who occasionally need a vehicle.
  + Reduced per capita annual mileage, resulting in reduced congestion, road and parking facility costs, crashes, pollution and energy use.
  + Reduced residential parking requirements and support for higher density residential development.

Costs are primarily related to startup and administrative costs of Carsharing organizations.

***Equity Impacts***

Carsharing is generally available to anybody who meets basic requirements, although only people who live in neighborhoods with such services are likely to use it. Carsharing services may require subsidies to become established. Carsharing tends to increase equity by improving the mobility options of people who are transportation disadvantaged, and by allowing lower-income drivers significant financial savings compared with vehicle ownership (Bonsall, 2002). It can help provide basic mobility under some circumstances.

Applications

Tends to be most effective and appropriate in higher-density, lower- and middle-income residential areas where there are good alternatives to driving (TRB, 2005). It can also be implemented in commercial centers and industrial parks (Reutter & Bohler, 2000). It may be particularly appropriate as part of [Location Efficient Development](http://www.vtpi.org/tdm/tdm22.htm) and [Car-Free Housing](http://www.vtpi.org/tdm/tdm6.htm). Station cars are located at major transit stations, particularly in suburban areas where a car is often needed to reach destinations.

Barriers to Implementation

A major barrier is the need to establish and maintain a critical mass of users (typically 30 members or more) in individual neighbourhoods. Carsharing cannot develop until enough potential users in each area are familiar with the concept, understand how it can benefit them, and are willing to commit themselves to a Carshare organization. This often requires education and marketing. Carshare organizations often require seed money to become established.

***Best Practices***

Below are some best practices guidelines.

* + Structure Carshare organizations to meet the needs of the community. Larger cities can support much larger Carsharing organizations than smaller communities.
  + Implement Carsharing in conjunction with other TDM programs that improve transportation choices. It is particularly appropriate as part of transit encouragement efforts (Huwer, 2004).
  + Find ways to minimize administrative and overhead costs.
  + Provide a variety of pricing options to serve different types of users (infrequent, frequent, extended trips).
  + Structure rates to include both time and mileage fees, so the organization will not lose money with either a high-mileage trip during a short rental period, or low-mileage trip during a long rental period.
  + Develop partnerships with organizations that are interested in reducing vehicle ownership, promoting public transit use, or providing occasional vehicle access to a particular group.
  + Use innovative marketing.

***Case Studies and Examples***

***Paris*** Offers Drivers Electric Cars To Beat Pollution - For A Small Charge

<http://driving.timesonline.co.uk/tol/life_and_style/driving/news/article3118755.ece>.

The Mayor of Paris is about to launch another novel scheme for fighting congestion and pollution: self-service cars. Bertrand Delanöe aims to start with 2,000 electric-powered vehicles that subscribers can drive off without booking at dozens of sites 24 hours a day and then leave anywhere in the city.

The so-called *Automobiles-en-Libre-Service* would greatly expand on similar small-scale services that exist in Europe and America. It is intended to complement the Vélib, the highly successful bicycle scheme that Mr Delanöe opened with 5,000 rental stations around the city.

The non-polluting cars, which will cost a few euros per hour to use, depending on mileage, will enable Parisians to carry passengers and loads on short trips without the bother and expense of hiring or running their own vehicles.

Just as the bicycle scheme was greeted with skepticism, doubts are being sounded over the viability of the *Voiturelib’* – free car – as it is being dubbed. Denis Baupin, the Green Party deputy to Mr Delanöe, is worried that Parisians could drop their new-found cycling habit. “Vélib users shouldn’t be encouraged to take a car instead of a bike,” he said. Some experts are also questioning whether the cars, which would be many times more expensive to operate than bicycles, could be subsidised through advertising space, like the Vélib.

***San Francisco Bay Area*** Station Car Demonstration ([www.stationcarinfo.com](http://www.stationcarinfo.com/))

The San Francisco Bay Area Station Car Demonstration was a field test sponsored by Bay Area Rapid Transit (BART) and Pacific Gas & Electric from 1995 to 1998, using 40 prototype electric vehicles. The project had total funding of $1,486,000. It was implemented to determine the viability of EVs for making short, everyday trips in a variety of settings: between home and BART station; between BART station and work site; and pool cars used at worksites.

The station car was a two-seat battery-powered electric vehicle (EV) made by the Norwegian firm, Personal Independent Vehicle Company. Charging ports were installed at selected BART stations. During the demonstration, the station cars were driven 154,802 vehicle miles of travel (vmt) and produced 179,470 passenger miles of travel (pmt). For the participants, internal combustion engine automobile use decreased 94%. Use of BART by participants increased by 125,222 (56%) during the demonstration, providing approximately $18,464 in increased fare revenue.

Based on this evaluation of the Demonstration, which shows the potential of the station car concept, the authors recommend that BART proceed with more complex and technically challenging demonstrations and field tests. These tests should include electronics for vehicle access by multiple users and electronics for tracking the vehicles and communicating with the drivers. Reservation and billing systems should be tested. Other participants from the mobility industry (i.e., car makers, rental car agencies, and electronics firms) should be invited to participate in and contribute to these tests. In addition, market research is needed to determine how and where station car use can be maximized. A study by Nelson/Nygaard (2003) found that station cars increase BART ridership and fare revenue, and that it provides overall benefits to consumers and society.

***Arlington*** Carsharing ([www.CommuterPage.com/Carshare](http://www.CommuterPage.com/Carshare))

Analysis of carshare activity in Arlington, Virginia (a suburb of Washington DC) found the following:

Carsharing membership in Arlington is growing rapidly and totals nearly 3,500 individuals in 2006. Five percent of Arlington residents living in the Metrorail (transit-oriented development) corridors are Flexcar or Zipcar members.

Carsharing has allowed members to reduce their vehicle ownership rates and overall vehicle-miles traveled while increasing transit use and walking. Members also have generally been able to postpone buying a vehicle.

Overall, the Arlington Carshare Program complements walk/bike/transit-friendly lifestyle available in multi-modal urban villages.

***Seattle*** Flexcar ([www.flexcar.com](http://www.flexcar.com/))

The Seattle area Flexcar organization has the following rate structure. This is predicted to provide net savings to households that drive less than about 8,000 miles per year.

***MOSES*** ([www.moses-europe.org](http://www.moses-europe.org/))

The MOSES (Mobility Services for Urban Sustainability) research program came to the following conclusions regarding the potential for Carsharing to improve urban transport.

The (European) city has a great potential for sustainable development. The proximity of functions, good networks of technical social and cultural infrastructure, and the concentration of know-how allow an urban lifestyle of lower consumption of resources and good access to all kinds of activities.

The quality of urban life is endangered. Economic activities became less harmful with the change from heavy industry to a service economy. Meanwhile, pollution and high noise levels are mainly due to the increasing level of transport.

Traffic is not only responsible for noise and pollution and congestion - with parking causing an increasing demand for space. With increasing level of car-ownership street space will become even more limited. Children, other pedestrians and cyclists have often not the necessary space to move around. As the flow of traffic and parked vehicles consume so much space, the quality of public space suffers: its functions as a social space – for encounters –  and as a cultural environment – carrying historical and local meaning – are being eroded.

Thoughtful solutions are required to manage the competition for public space between transport functions on one side and social and ecological functions on the other. Here lies the challenge to improve urban life quality for children, for families, for elderly, for disabled – for the entire community. The problems of public space are not yet fully recognised and no strategies have been developed at the necessary levels.

*The opportunity*

The modern service of Car-Sharing shows how to use the car in a better way. Car-Sharing gives access to a car – when required - in an easy way without the need to own one. The MOSES project has shown that Car-Sharing users can replace private cars and change their mobility patterns towards more use of environmentally friendly modes of transport. Important is the “pay as you drive” principle: since costs are directly related to how much you drive (variable costs).

Overall, the new philosophy of using instead of owning a car is a key element for a new mobility culture.

In Bremen, about 700 private cars have already been replaced by the service of Car-Sharing.   
We see a big potential for European cities, where at least 500.000 private vehicles could be replaced by customer orientated Car-Sharing services. Without restrictions for individual mobility we can then regain public space for social and ecological functions.

We can reduce the costs for providing parking facilities. Especially underground parking is quite expensive – it can easily cost about 10 - 15.000 €  and more per parking space. With the provision of Car-Sharing, urban housing developments can become less costly as fewer parking spaces will need to be made available. The result is a better urban environment.

*The MOSES insights*

The MOSES project has identified a low awareness level as one of the key obstacles for the further exploitation of the Car-Sharing potential. Even in Germany, together with Switzerland a country with more than 15 years experience with Car-Sharing, only about 19% of the population can explain the basic elements of modern Car-Sharing. Much more information and marketing action is required to make decision-makers, developers and as well potential users more aware. It is recommended that Car-Sharing and its options should be included in local transport strategies, parking management policies, urban development plans and building codes.

Car-Sharing is best understood as supplement to Public Transport. Car-Sharing customers use Public Transport more frequently. You’ll find potential Car-Sharing customers especially in the group of regular Public Transport users. Joint ticket offers are an important element to increase the attractivity of Public Transport and of Car-Sharing. Season tickets for PT may include the customership for Car-Sharing for a special attractive tariff. The examples of Zurich, Bremen, Aachen, Hanover and other cities show that the customer-relation will be improved, the car-sharer is using Public Transport more often (for example also more often in off-peak hours) – as PT becomes much more a basic mode of transport. Car-Sharers are more likely to use annual season tickets.

For new housing developments, the service of Car-Sharing opens up the possibility to reduce the conventional provision of car-parking. This innovative option allows the reduction of construction costs – especially in the case of underground parking – or to set aside more public space for social and ecological purposes. Until now, only few developers are aware about the options for better planning solutions with less costs but higher quality as it is less dependant on the provision of parking. Planning regulations (as in London) can directly integrate Car-Sharing into urban developments.

There is no need to reinvent the wheel. Setting off quality indicators for services is essential. Operators in cities that have not yet Car-Sharing services can build on the existing experience elsewhere. The key technologies are developed for providing an effective service, but they can be further developed and integrated. There are European operators, which offer service elements for new providers. Within MOSES the transfer of technology and know-how from Bremen to Belgium has successfully taken place.

Substantial support is required to get Car-Sharing out of its actual niche role and let it become mainstream. That means a further development of the service (e.g. through extension of the network of stations and interregional use, etc.), more co-operation with Public Transport and better integration into urban development.

*The decision levels*

At the local level, Car-Sharing is a key element for sustainable transport plans. With Car-Sharing, there is a chance to reduce the number of cars without restricting individual mobility. The joint offer with Public Transport and the integration into urban development are key responsibilities at the local level.

The national level may develop a support programme (as in Italy) and set quality standards (as in Italy, Germany, Sweden and the Netherlands). Eco-labelling for Car-Sharing can help to set high standards. In a number of countries amendments to traffic regulations are necessary to allow on-street Car-Sharing stations.

At the European level, there is a strong need for enhanced awareness work. It is essential to transfer the experience of Car-Sharing at an appropriate detailed level – especially to the new member states. This is an issue of European policy. As Car-Sharing is a key point for sustainable development, European research and demonstration programmes, as well as structural funds related to energy efficient transport and sustainable urban development should include an element about Car-Sharing. There is also the need to develop cross-border access for Car-Sharing customers.

Study of Car-Sharing Benefits In Québec, ([www.communauto.ca](http://www.communauto.ca/))

Carsharing in Quebec, Canada have 11,000 users and reduce annual CO2 emissions by 13,000 tons, and this could increase to 168,000 annual tons according to a study by the engineering firm Tecsult as part of an evaluation of urban mobility initiatives called *Projet auto + bus*, commissioned by an environmental agency (Conseil regional de l’environnement de Montréal) and the Communauto carsharing organization.

Tecsult assessed the carsharing market potential of 139,000 households. Considering that among those who subscribe to carsharing, some increase their use of a vehicle while others reduce it, overall users reduce their car travel by an average of 2,900 annual kilometers. Carsharing vehicles tend to produce less pollution than the fleet average. These factors together result in approximately 1.2 tons of CO2 emissions reduced annually per carshare user.

Car-sharing users in Quebec are, on average, 40 years old, have a very high level of education and relatively high incomes. Although they do not have a personal car (90% of the users’ households) and they do not feel limited in their mobility, since they use vehicles available in a “self-serve” fashion when necessary. Car-sharing users thus remain faithful to public transport, cycling and walking to meet their mobility needs.

## Edinburgh's active travel action plan - making Edinburgh a cycling city

Edinburgh has already implemented measures similar to those adopted on a wider scale by cities that have seen larger increases in cycling. These measures include:

* Land use and development control policies that treat cycling seriously. e.g. cycle links to major developments, cycle parking in new developments;
* Replacement of roundabouts by traffic signals;
* Exemption from one-way streets;
* 20 mph zones;
* Cycle lanes (many coloured when first installed) and advanced stop lines;
* Off-road routes where opportunities exist, with toucan crossings at main roads;
* Some point road closures, mainly in residential areas.

In walking, mode share has remained broadly stable over the past 10 years. Over this period, there has been investment in public realm schemes in the city centre and in a number of district shopping centres, but the stable mode share for walking is more likely instead to be the result of major employment developments in the city centre together with safer walking conditions arising from the growing number of 20 mph zones and additional signalled crossings across the city.

***Active travel action plan***

In order to build on work already done to improve conditions for cycling and walking and increase levels of active travel, the City Council has recently developed an Active Travel Action Plan (ATAP). The Plan proposes a wide range of actions, covering new infrastructure, maintenance, design guidance, marketing and promotion, and training. It was developed with other organisations, including NHS Lothian, Spokes (the local cycling campaign), and Living Streets.

The plan‟s actions are divided into joint actions, affecting both walking and cycling, walking actions and cycling actions. A brief summary of the some of the key actions is given below.

*Joint Actions*

* Improved design guidance and staff training.
* Better marketing and promotion of walking and cycling.
* Introducing an area-wide sign-only 20mph speed limit pilot.

*Walking Actions*

* Prioritisation of areas and corridor for investment and maintenance.
* Reducing street clutter and reviewing and where appropriate removal of pedestrian guardrail.
* Improving crossing and junction facilities for pedestrians.
* Tackling footway parking.
* Improving access to bus and tram stops and to railway stations.

*Cycling Actions*

* Creating a comprehensive Family Network suitable for less confident cyclists and families.
* Creating a Cycle Friendly City Network for day to day cyclists.
* Better integration with public transport.
* Improved Signing and lighting of cycleways/cycle paths.
* Better maintenance of on-road and off-road cycle facilities.
* Cycle training for children and adults.
* Small scale bike share schemes.

***Identifying future cycle networks***

The Action Plan envisages two main types of cycle „network‟, a Cycle Friendly City Network programme, and a „family‟ cycle network.

*The Cycle Friendly City Network* programme will aim to make travel by bike anywhere in the city convenient and attractive. This will involve provision for cyclists on main roads as well as crossings linking up quieter side roads. In recognition of the multiple pressures in space on the road network, this network will focus on making cycling feel convenient, safe and comfortable for adult utility cyclists. (That is commuters, shoppers, people otherwise going from A to B).

It is about encouraging cycling where it is a realistic option. So it will focus on:

a) Travel from areas with high cycling potential. These will be defined based on recorded levels of cycling (e.g. from the Census), potential for trips in the ideal cycling range of roughly 2-5 km and topography; and

b) Travel to areas with the greatest potential to generate utility bike trips. These include:

* the City Centre (especially major transport hubs such as stations);
* other major centres of employment and activity e.g. Gyle/Edinburgh Park, Leith and Leith Docks, Universities, Royal Infirmary area and Bio-Quarter;
* further education institutions, hospitals, Waverley and Haymarket stations and shopping centres; and
* other potential generators of bike trips including tram stops, suburban rail stations and selected bus stops, primary and secondary schools.

Building a cycle friendly city relies on continuity of cycle friendly routes. The programme will prioritise projects that most cost effectively link the areas with maximum cycling potential to places with the greatest probability of generating bike trips, in order to create a critical mass of cyclists, make cycling more visible and therefore make the case for further investment.

We envisage development of the Cycle Friendly City will include implementation of:

* Cycle facilities on main roads;
* 20 mph zones/ limits, to help create a wide network of roads where cycling feels safe);
* Crossing and linking main and quiet roads.

*The Family/Child Friendly Cycle Network* will consist of predominantly quiet roads and off-street cycle paths, made to feel safe and secure for less confident cyclists including family groups and older unsupervised children. Development of this Network will use a different prioritisation process taking account of:

* maximising continuity – this is even more important than for the cycle friendly city programme, as the family network will not work if it has hazardous „gaps‟;
* linking to key destinations – a network is no use if it leaves you short of your destination; and
* access to the network for potential users.

Routes on this network will aim for similar design standards as those set for the Sustrans National Cycle Network. That is, they should be suitable for use by an unaccompanied 12 year old.

The network has the over-riding aim of maximising potential for easy enjoyable cycling that gets people to a useful or enjoyable destination. In order to achieve this, it will need to cross the City Centre, as well as allowing trips to bypass the centre through the inner and middle suburbs. This is so, that people can cycle to the city centre and its many destinations, but also avoid it if their aim is a ride that avoids the business of the centre.

***Prioritisation of Areas and Corridors for Walking***

Some streets are far more important for pedestrians than others. Therefore it is important that the Council prioritises future pedestrian environment improvements and maintenance. With this in mind we have carried out work looking at categorising streets in terms of their importance for pedestrians. Our initial analysis for priority corridors and areas, as might be expected, has identified shopping areas, local centres, the city centre and roads in high density residential areas and near large employers as priority pedestrian areas. The final stage of this work will also include other trip generators, such as hospitals and schools.

The improvements on these priority corridors will either be identified and undertaken as part of one-off street audits or through regular street inspections that are undertaken by the street maintenance inspectors.

***Conclusion***

This paper has shown what other European cities have done to increase levels of cycling and outlined a methodology used by the City of Edinburgh to identify areas and corridors with the greatest potential for increases in cycling and walking in the future. Using this methodology and a series of actions similar to those used elsewhere in other European cities, Edinburgh‟s Active Travel Action Plan aims to increase the percentage of trips made by bike to work and education to 15% by 2020, and to keep the percentage of trips on foot broadly constant. Achieving this target is of course dependent on levels of available funding, but the Active Travel Action Plan provides a firm foundation.

As for many other local authorities around the country, the challenge that the Council is now facing is to deliver these laudable and ambitious plans in the current difficult economic circumstances. However, walking and cycling measures are comparatively better value for money than many other measures as a means of reducing traffic and its negative impacts, as well as increasing activity levels with attendant health benefits. Secondly, it is likely that costs of delivering such measures may reduce a little in the short to medium term due to greater competition in the construction industry.