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**Working Party on National Environmental Policy
Working Group on Transport**

PROJECT ON ENVIRONMENTALLY SUSTAINABLE TRANSPORT

**Report of the Workshop on Innovation for Environmentally Sustainable Transport:
Mobility Services and Logistics for Passenger and Freight Transport**

Berlin, 27-28 September 1999

This report is the final version of the report initially presented to the Working Group on Transport at its fall 1999 meeting as document ENV/EPOC/PPC/T(99)7. It was since completed with materials presented at the workshop, short project descriptions where appropriate, and three papers submitted at the workshop. This new version was approved at the July 2000 meeting of the WGT as document ENV/EPOC/PPC/T(2000)2 and is now being made widely available. The code, which under the previous structure of the Environment Directorate would have been ENV/EPOC/PPCT(2000)2/Final, has now been changed to ENV/EPOC/WPNEP/T(2001)6/FINAL.

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FOREWORD

The Environment Directorate of the Organisation for Economic Co-operation and Development (OECD) is conducting a project on Environmentally Sustainable Transport (EST). The project's aims are to characterise EST and to develop policy guidelines for the attainment of EST. As part of the project, a workshop was held on Innovation for sustainable transportation in Berlin on 27-28 September 1999. The workshop was held in conjunction with Phase 3 (policy instruments and their implications) of the multi-year EST project which is being conducted under the auspices and guidance of the OECD's Working Group on Transport.

This workshop sought to explore practical and tangible cases where this gap is bridged by examining, for passenger travel, carsharing schemes, integrated mobility products, trip information and mobility centres, carfree housing initiatives, etc. Discussions centering on freight transport innovation explored a number of promising initiatives including city logistics, joint distribution centres, bundling of freight transport and other logistics measures.

Objectives

- To highlight the commercial and environmental benefits of innovative approaches and explore best practices in mobility service innovation and freight and logistics optimisation;
- To bridge the gap between policy and practice in order to seek practical ways in which mobility service and logistics innovation can support more environmentally sustainable transport;
- To review the technological options available for mobility service and freight logistics innovation.

The meeting was organised into a series of discussion-oriented panels prefaced by brief introductory statements. These are the proceedings of that workshop which have been reviewed by the Working Group on Transport. Other EST project-related documentation is available at the Environment Directorate's web page <http://www.oecd.org/env/ccst/est/>.

This report is published on the responsibility of the Secretary-General of the OECD.

ACKNOWLEDGEMENTS

The OECD would like to acknowledge the important support provided by the government of Germany that hosted the workshop. The German Federal Environmental Agency of the Federal Ministry of Environment was the representative body and co-organiser who provided additional financial and logistical support for the event. The help and efforts of the staff of these institutions, in particular Axel Friedrich, Hedwig Verron, and Norbert Gorissen, is well acknowledged.

Particular thanks go to Philippe Crist who assumed the principal responsibility for organising the workshop, co-ordinating the input from the different institutions, and setting-up the speakers. He also drafted the summary of the workshop discussions. The participation and contribution by the various speakers, discussion leaders and rapporteurs are also acknowledged.

The final report was reviewed and completed by Peter Wiederkehr and Masako Kuwata of the National Policies Division (former Pollution Prevention and Control Division) of the Environment Directorate. Editing, layout and logistical support was ably provided by Jane Kynaston, and Cilla Cerredo-Williamson.

Other substantive material on the related topic of carsharing was prepared by Eric Britton, ecoplan, Paris, and was released with the assistance of the Federal Environmental Agency, Berlin (*CarSharing, A Hammer for Sustainable Transport*, Special issue of The Journal of World Transport Policy & Practice, Volume 5, No. 3, 1999).

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Executive Summary

Achieving environmentally sustainable transport (EST) is one of the major challenges that OECD countries are facing. To this end, a new policy approach is needed. Recognising this need, the OECD initiated the project on EST to give some precision to the concept through the use of criteria which can be quantified and have environmental significance. In the course of this project, it has become evident that policy responses to transport-related environmental impacts will need to bridge the gap between technology and behaviour, between individual mobility and public transport and between the movement of vehicles and the provision of new mobility and logistical services.

This workshop on "Innovation for EST" was to explore practical examples for passenger and freight transport where this gap is bridged. The main objectives were to seek to:

- highlight the commercial and environmental benefits of innovative approaches and explore best practices in mobility service innovation and freight and logistics optimisation;
- bridge the gap between policy and practice in order to seek practical ways in which mobility service and logistics innovation can support more environmentally sustainable transport; and
- review the technological options available for mobility service and freight logistics innovation.

Over 50 participants to the workshop included transport industry and service sector representatives, transport researchers, and representatives of environmental and transport government agencies. They engaged lively discussions on a number of promising initiatives and detailed studies.

The main conclusions of the workshop are as follows:

- For passenger travel, carsharing schemes, integrated mobility products, carfree-housing initiatives, etc. were examined. The current development of many carsharing schemes represented a considerable innovation of integrated mobility services and showed a large potential to reduce the negative environmental impact while maintaining the same level of mobility. Environmental labelling schemes (e.g., Blue Angel) could help promote environmentally sound carsharing.
- A number of best practices in freight transport were presented, including city logistics, joint distribution centres, and bundling of freight transport. Promising examples, such as the German mail-order retailer Otto - Versand and the Swedish Rail's overnight parcel delivery service (GreenCargo), showed that it was possible for firms to reduce the environmental impact of goods transport with maintaining profitability and the same quality of service.
- Detailed studies on road freight in the UK revealed that there were notable opportunities for logistical and operations improvements, such as poor utilisation of lorry fleets, to reduce their environmental impacts. Also, a study noted that much of the best practice improvements involved vehicle operation and logistics rather than vehicle technology and fuel types.
- For both passenger and freight transport, it was noted that technological innovation, including internal combustion engine vehicles, hydrogen fuel cells, lighter-than-aircraft, and information technologies, would contribute to reduce the environmental impact. However, no technological solution will be able to prevent an overall rise in CO₂ emissions given the projected rise in traffic volumes and the overall life-cycle benefits from innovative production.
- It was concluded that EST meant the increase in the efficiency of accessing people, goods and services and the corresponding reduction of environmental impacts. This does not preclude the examination of market failures, which lead to excess transport activity, with a view to correcting them. Thus, achieving EST would rely also on spreading current best practices rather than investing in new vehicle technology and fuel types, especially in a life-cycle perspective.

**PART I:REPORT ON THE WORKSHOP ON INNOVATION FOR
ENVIRONMENTALLY SUSTAINABLE TRANSPORT:
MOBILITY SERVICES AND LOGISTICS**

THE WORKSHOP: INNOVATION FOR EST

1. Background

Access to people, goods and services and the mobility it often engenders is essential for ensuring broad societal welfare. However, as transport-related environmental impacts continue to mount, delegates from OECD countries concluded in 1994 that current policy frameworks seemed likely not to be able to move society towards more sustainable transport systems – in part because no definition of “sustainable transport” existed.

Recognising this need, the OECD initiated the project on Environmentally Sustainable Transport (EST) to give some precision to the concept through the use of criteria which can be quantified and have environmental significance. This project aimed at characterising EST and developing policy guidelines for its attainment. Unlike conventional approaches to transport system development, the EST project has started with a vision and a series of criteria for environmentally sustainable transport in 2030 (backcasting). Teams from nine countries undertook six case studies at different geographic scales (i.e. the greater Oslo region, the Quebec-Windsor corridor in Canada, Sweden, the Netherlands, Germany and the Alpine region comprising parts of France, Italy, Switzerland and Austria) to describe how this environmentally desirable future may be achieved. Since then Japan, France, Austria and a number of Central and Eastern European countries have launched their own EST projects.

2. Workshop Objectives

As the project has developed, it has become increasingly clear that innovative solutions that go beyond “business-as-usual” must be sought and implemented. Indeed, many such solutions are key elements of the different team’s EST scenarios. Future policy responses to transport-related environmental impacts will need to bridge the gap between technology and behaviour, between individual mobility and public transport and between the movement of vehicles and the provision of new mobility and logistical services.

The 50 workshop participants sought to explore practical examples where this gap was bridged by examining, for passenger travel, carsharing schemes, integrated mobility products, trip information and mobility centres, carfree housing initiatives, etc. Discussions

centering on freight transport innovation explored a number of promising initiatives including city logistics, joint distribution centres, bundling of freight transport and other logistics measures.

In particular, the participants sought to:

- highlight the commercial and environmental benefits of innovative approaches and explore best practices in mobility service innovation and freight and logistics optimisation,
- bridge the gap between policy and practice in order seek practical ways in which mobility service and logistics innovation can support more environmentally sustainable transport,
- review the technological options available for mobility service and freight logistics innovation.

3. Workshop Organisation and Participants

The meeting was organised into a series of discussion-oriented panels prefaced by brief introductory statements. Participants to the workshop included transport industry and service sector representatives (including vehicle manufacturers, mobility and carsharing providers, vehicle rental companies, and freight logistic providers), transport researchers and representatives of environmental and transport government agencies.

3.1 Passenger Transport

3.1.1 Integrated mobility services

Will people buy mobility services rather than cars in the future? What might the market for mobility look like and what might be its environmental impacts? Who needs to do what in order to facilitate the spread of these services? Speakers and participants examined existing “door-to-door” mobility packages that bridge the gap between public and private mobility by linking public transport, car sharing companies and other mobility providers. Presentations included: Carsharing examples (Carsharing, Bremen; Choice, Berlin; and Mobility Carsharing, Switzerland) and mobility service providers (Daimler-Chrysler, Germany and EcoProcess-Energy 2000, Switzerland). Environmental labelling (Blue Angel label) was highlighted as a regulatory tool for promoting environmentally sound carsharing.

3.1.2 *Environmentally Sustainable Transport (EST) and day-to-day life: Households*

How might an environmentally sustainable transport affect households' day-to-day life? What infrastructure and services might be necessary in order to retain good quality access to other people, goods and services? -- and who will provide these? Participants investigated the role of mobility centres, mobility service providers, "car-free" housing and tourism destinations, "station car" systems, trip information providers, as well as draw lessons from studies of those that voluntarily seek to live without a car(e). Presentations included: Carfree Life! (Germany), Carsharing experience (Netherlands) and Moving the Economy (Toronto).

3.1.3 *Technology, innovation and EST: Passenger travel*

Major transport system changes described in sessions 1 and 2 will undoubtedly require the use of existing technologies, new technologies and new uses for existing technologies. This session explored strategies for linking vehicle, fuel and information-based technologies to create less environmentally harmful mobility services. Presentations included: Hydrogen technology (Ludwig-Bölkow Systemtechnik), SmILE car (Greenpeace), Fuel-cell technology (UBA, Berlin) and CityCar Martigny (Switzerland).

3.2 **Freight Transport**

3.2.1 *Organisation and logistics: Innovative forms of goods distribution*

This session investigated how changes in the production and distribution of goods can serve to reduce environmental impacts from freight transport. Particular attention was given to solutions that address the entire production, logistics and mobility chain involved in goods transport --focusing, for example, on joint distribution centres, local sourcing strategies, intermodal goods distribution and innovative urban delivery services. Presentations addressed: Sustainable goods distribution (McKinnon, UK), Transport prevention (Netherlands), Logistics centres (Berlin), and Regionalisation of production and consumption (Germany).

3.2.2 *EST and day-to-day life: Businesses*

Can businesses reconcile practical concerns regarding competitiveness with less environmentally harmful goods transport? What options do firms have at hand to decouple profitability from the resource and energy intensity of freight transport? What constraints may prevent change in business reliance on traditional freight

transport patterns? This discussion centred on the practical experience of firms that have faced and attempted to answer these and other related questions. Presentations addressed: new concepts for rail (GreenCargo, Sweden) and mail-order company (Otto - Versand, Germany).

3.2.3 Technology, innovation and EST: Freight transport

As in session 3, this discussion covered the use of existing technologies, new technologies and new uses for existing technologies for less environmentally harmful freight transport. This session likewise focused on linking vehicle, fuel and information-based technologies to reduce the absolute environmental impacts from goods distribution. Presentations included: clean bus technologies (M.A.N. natural gas bus), railway technology for freight transport (TU, Berlin) and rigid airships for special transports (CargoLifter, Berlin).

4. Workshop Sessions

4.1 Passenger Transport

4.1.1 Session 1: Integrated Mobility Services

This session sought to address the development of new mobility services and their potential to contribute to the achievement of EST. Speakers and participants examined existing “door-to-door” mobility packages that bridge the gap between public and private mobility by linking public transport, car sharing companies and other mobility providers (see project profiles in Part II and papers in Part III of this report by “S. Ziegler and E. Reinhardt).

The presentations and ensuing discussion highlighted the emergence of a real diversity of mobility products around different carsharing initiatives. These range from providing customers with combined public-transport and car-sharing passes, individually tailored car leasing agreements (e.g. leasing a car during the winter or Monday to Friday), and public cars on call in urban areas. While these initiatives involve the participation of relatively few people, they are experiencing strong growth, especially in urban areas (Figure 1 provides the illustration of the development of Carsharing in Switzerland in the 1990's.).

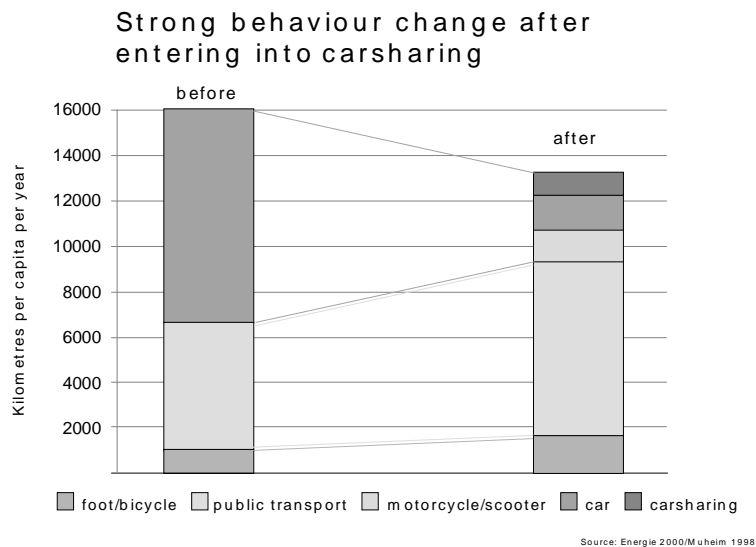
Figure 1: Growth of Carsharing in Switzerland (cars and customers)



While the concepts of public-cars, paratransit, and other forms of flexible demand-driven mobility services and products are not new, the current development of carsharing in its most advanced forms represents a considerable innovation in that it enables the “unpacking” of mobility needs into discrete elements that can be best matched to the most economic, efficient and environmental means of transport for the particular trip or trip segment. Whereas a car traditionally represents the single transport solution for most household trips irrespective of distance and passengers carried, car-sharing, when combined with public transport and co-ordinated by readily available information technologies allows households to match vehicles and modes (different-sized cars, public transport, rail, bicycle, walking, etc) to specific needs. This reduces considerably the number of vehicles present or parked, while ensuring full mobility of the members using carsharing (Figure 2).

Basic criteria for the award of the environmental label in Germany are used as a regulatory tool for promoting environmentally sound carsharing.

Figure 2: Transport Behaviour Change due to Carsharing



Many of the examples discussed are detailed in the 300-page special issue of the *Journal of World Transport Policy and Practice* on Carsharing that was edited in conjunction with the workshop (Available from <http://www.the-commons.org/>). Presentations and papers are listed in Pat III of this report.

4.1.2 Session 2: Environmentally sustainable transport (EST) and day-to-day life: Households

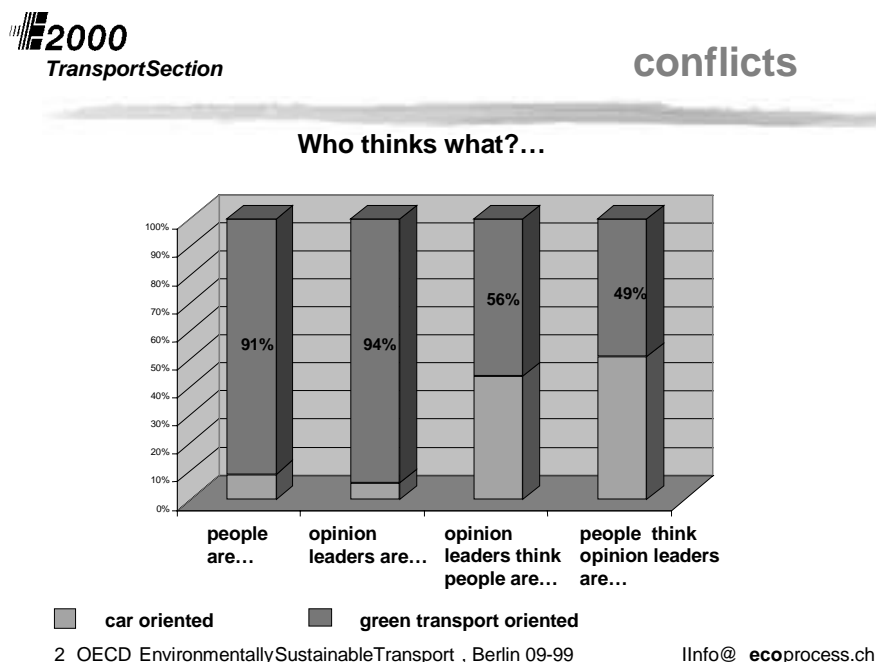
The presentations in this session examined some of the practical modalities of living in a world characterised by EST. In particular, participants discussed issues relating to day-to-day life with less use of automobiles (see project profiles in Part II of this report by N. Huhn, R. Meijkamp and S. Zielinski). Some conclusions are that:

Car free living actually is not a real innovation. 20% to 30% of people already live without a car today. However living without a car in a context where the bulk of transport decision-making caters to car-users is a difficult proposition. The adverse framework conditions do not support those who wish to, or cannot afford to, live without a car, thus further marginalising these people and preventing the remainder of the population to experiment with living a less car-dependant life (see project profile in Part II of this report by N. Huhn.).

Achieving EST will require cultural and lifestyle changes. These changes are likely to be led by "grass-root" initiatives that can provide the impetus for these changes. The private sector too has a role to play in deploying new products and services that support more environmentally sustainable transport. Finally,

governments have a role to play in establishing framework conditions that are supportive of EST. The power of emulation should not be underestimated and opportunities for showing well-known people, government officials or other cultural/social icons engaging in more environmentally sustainable practices should not be overlooked. There are strong misperceptions both by people and opinion leaders regarding the willingness to support “green” transport (see Figure 3).

**Figure 3: Who thinks what?
Misperceptions regarding willingness to support environmentally friendly transport**

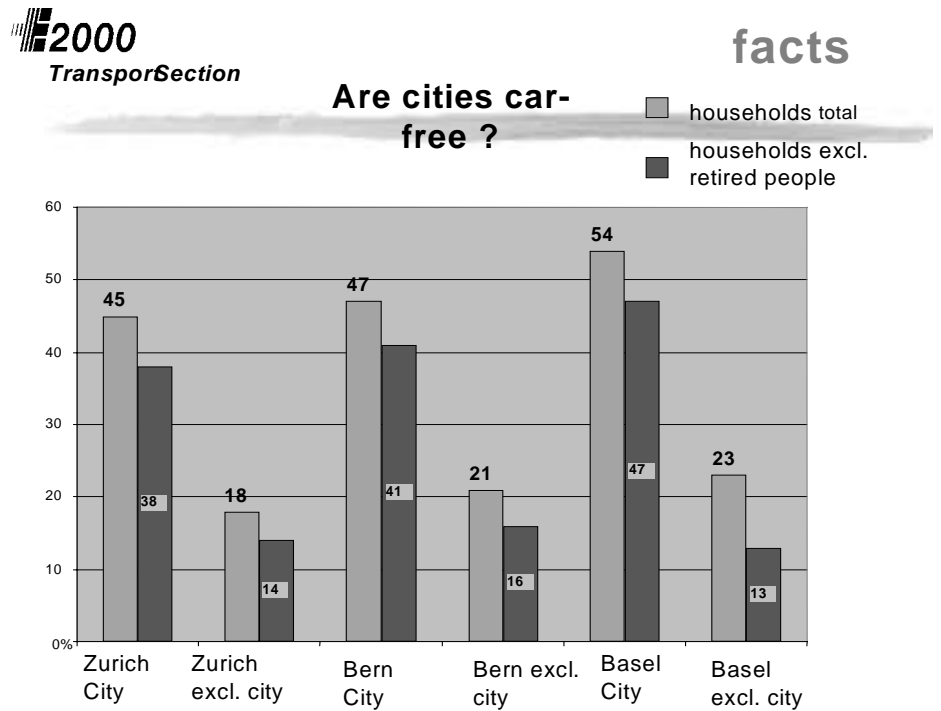


Achieving EST will require some structural changes in the transport-related components of OECD economies. These changes will involve shifts in production from certain sectors to others and will require tremendous new growth in transport-related services. Hence, EST represents an economic opportunity for many sectors of the economy and, according to some of the workshop participants, will generate a proportionally greater number of jobs than the business-as-usual alternative.

Car free settlements are an important innovation and are able to promote a different lifestyle: existing and developing good examples include Vienna, Edinburgh, Amsterdam, Hamburg and Halle/Saale (Germany). The percentage of car-free households in three large cities in Switzerland is shown in Figure 4, ranging

from close to 20% (excluding city centre population) to more than 45% to 54% when all household types are included (see project profile in Part II by E. Reinhardt, and related paper in Part III of this report.).

Figure 4: Car-free households in Swiss cities



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4.1.3 Session 3: Technology, innovation and EST - Passenger Transport

This session was designed to examine certain technologies and technology packages that hold promise for EST. The focus of the session was on advanced conventional internal combustion engine (ICE) vehicles, hydrogen fuel cells and the role of information technologies in the development of mobility services (see project profiles in Part II of this report by M. Altmann and related paper by R. Kolke in Part III of the report.).

Among the conclusions drawn were the following:

Promoting wider uptake of existing best practice in conventional ICE vehicles has the potential for leading to significant pollutant and CO₂ emissions reductions more cost-effectively than investing in many new

engine and/or fuel technologies, especially in a life-cycle perspective (see Figure 5 on hydrogen and Figure 6 on conventional ICE vehicles.). Noise and land-take, however, remain problematic for these technologies.

Figure 5: Energy Use for Producing and Processing Gasoline vs. Hydrogen

Comparison of the Primary Energy Expenditure for the Production and Processing of Gasoline and Hydrogen (KOLKE 1998)

Primary Energy Use for Different Production Processes

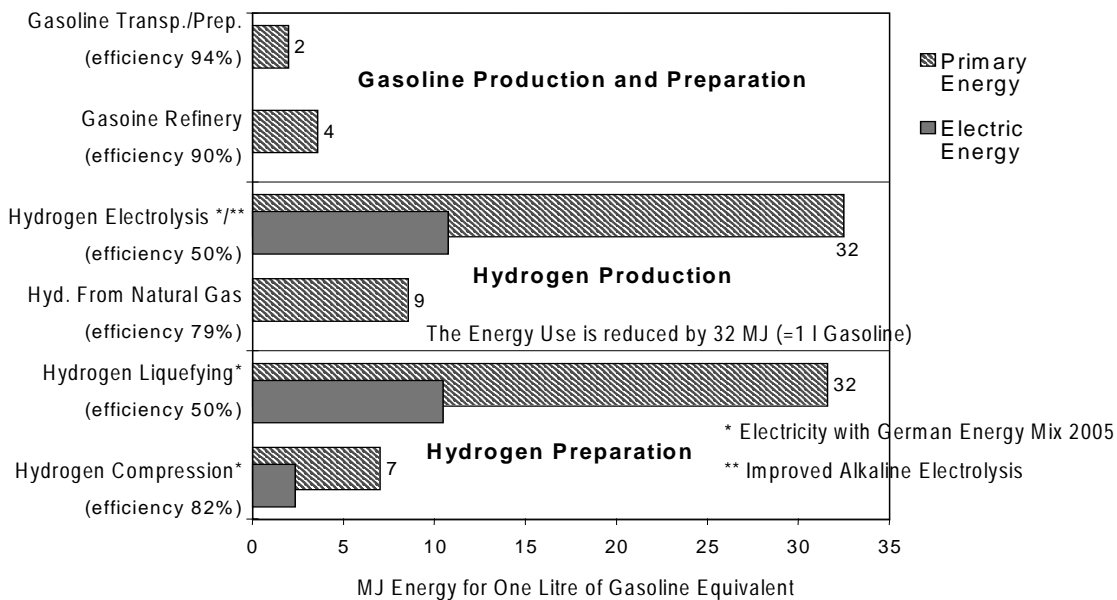
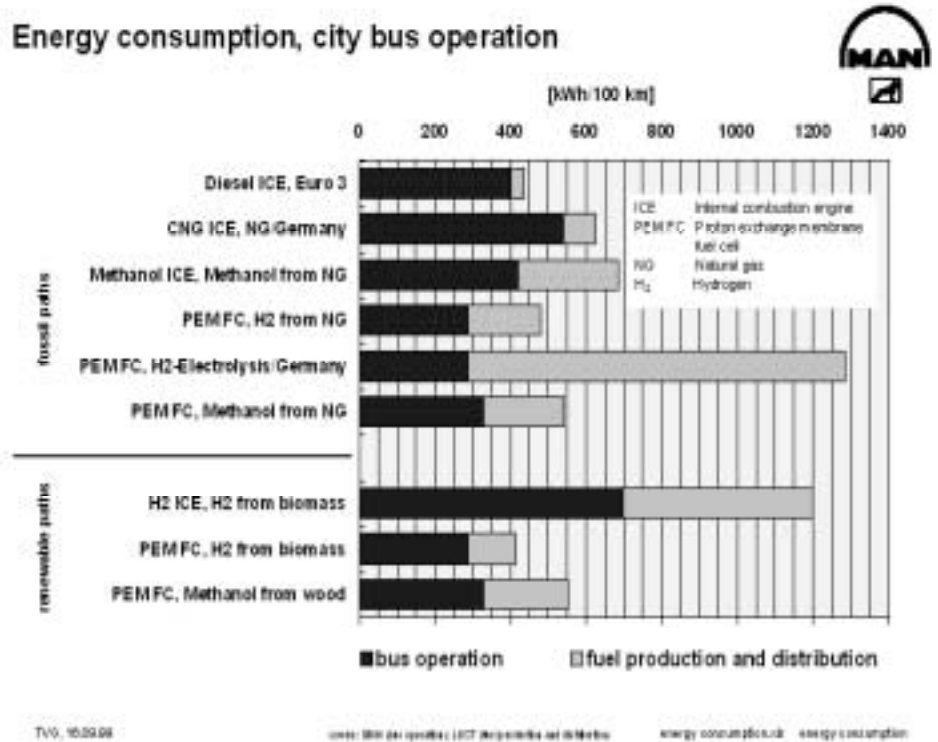


Figure 6: Energy Consumption in City Bus Operation



- Great advances in information technologies have made it possible to substitute information (e.g. real-time fleet management services, electronic booking and vehicle personalisation) in shared-use car fleets for the services normally enjoyed through the ownership of a private car. This, in turn, has allowed for the emergence of new mobility practices centred on a wide palette of mode choices ranging from non-motorised modes, to public transport and “public” cars. One result has been the “right-matching” of vehicles and modes to their specific uses and strengths.

4.2 Freight Transport

4.2.1 Session 4: Organisation and Logistics - Innovative forms of goods distribution

This session investigated how changes in the production and distribution of goods can serve to reduce environmental impacts from freight transport. Particular attention was given to solutions that address the entire production, logistics and mobility chain involved in goods transport.

Conclusions emerging from the discussions included the following:

- Detailed investigations of transport activity at the firm level have revealed notable opportunities for “transport prevention”. Transport audits of Dutch firms have revealed that such opportunities are often overlooked because of a lack of integrated logistics and transport accounting. Generally the audits have found that firms miss opportunities for reducing their transport needs by overlooking possibilities to reduce the volume and/or weight to be moved, to reduce the distance travelled and to improve the efficiency of return flows (see project profile by J. Schnitzeler in Part II and the related paper in Part III of this report.).
- While it is too early to say with certainty how freight transport in the UK will ultimately be affected by the fuel tax escalator (over a 5% real increase in fuel tax annually), one can place fuel costs in perspective as far as freight transport is concerned. Indeed these costs only account for 0.6 - 0.7 % of final sales revenue for goods in the UK. This underscores the need for a variety of instruments in order to reduce the environmental damage stemming from road freight transport.
- Trends in lorry fleets underscore that potential for logistical and operations improvements to reduce road freight environmental impacts. This illustrated in Figure 7 to 9 from a survey done by A. McKinnon, UK (see project profile in Part II and presentation in Part III of this report.). These trends include the decrease in average consignment size (Figure 7), the strong tendency for vertical space to be relatively poorly utilised (Figure 8), and the relatively high level and variability amongst operators of “empty running” (despite a significant decrease in overall empty running trips) (Figure 9).

Figure 7: UK Road Freight Transport -- Vehicle Utilisation by fleet

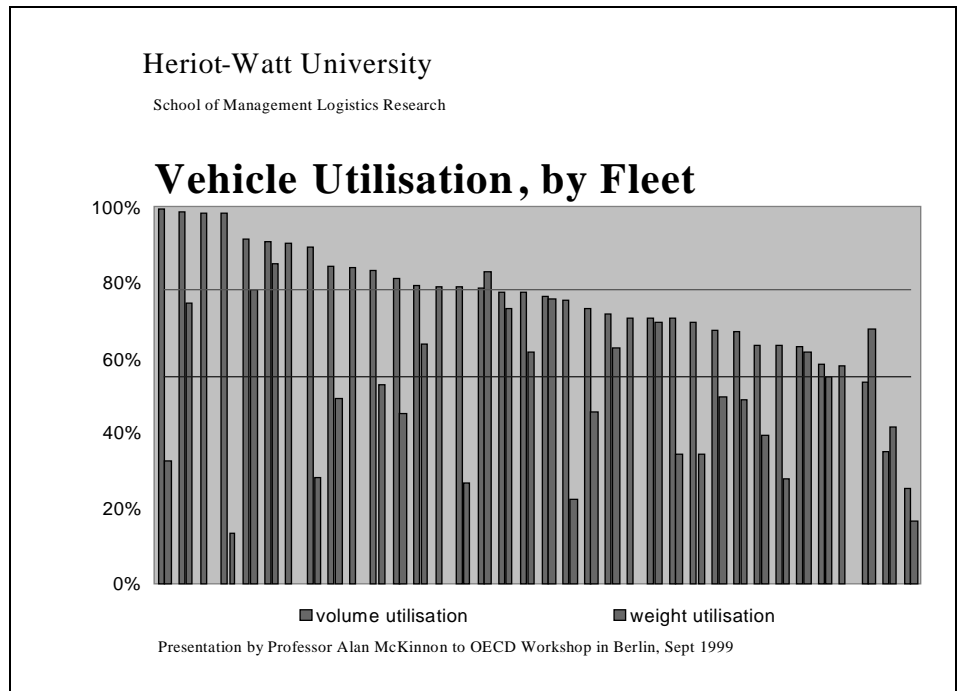


Figure 8: UK Road Freight Transport -- Height Utilisation

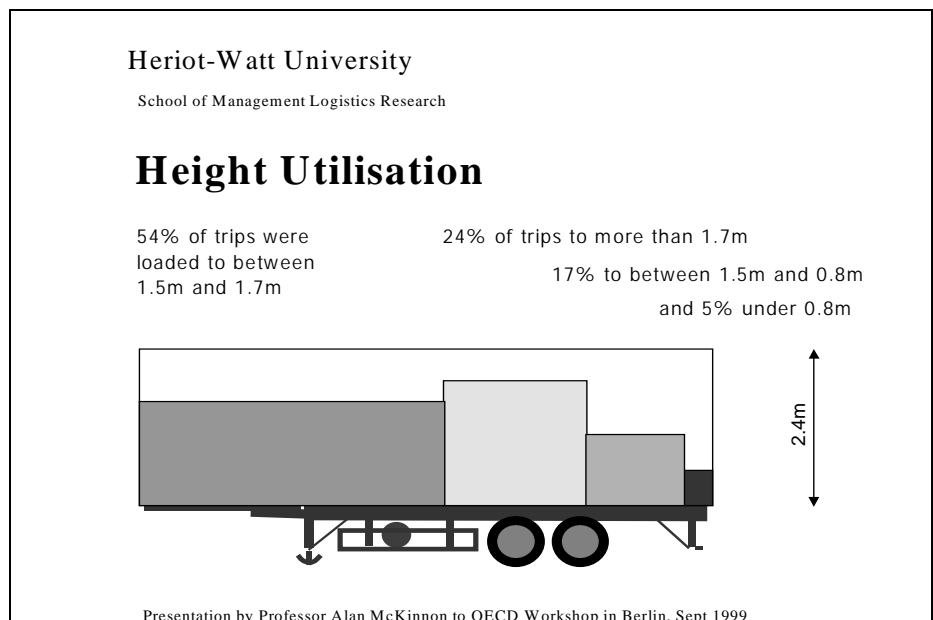
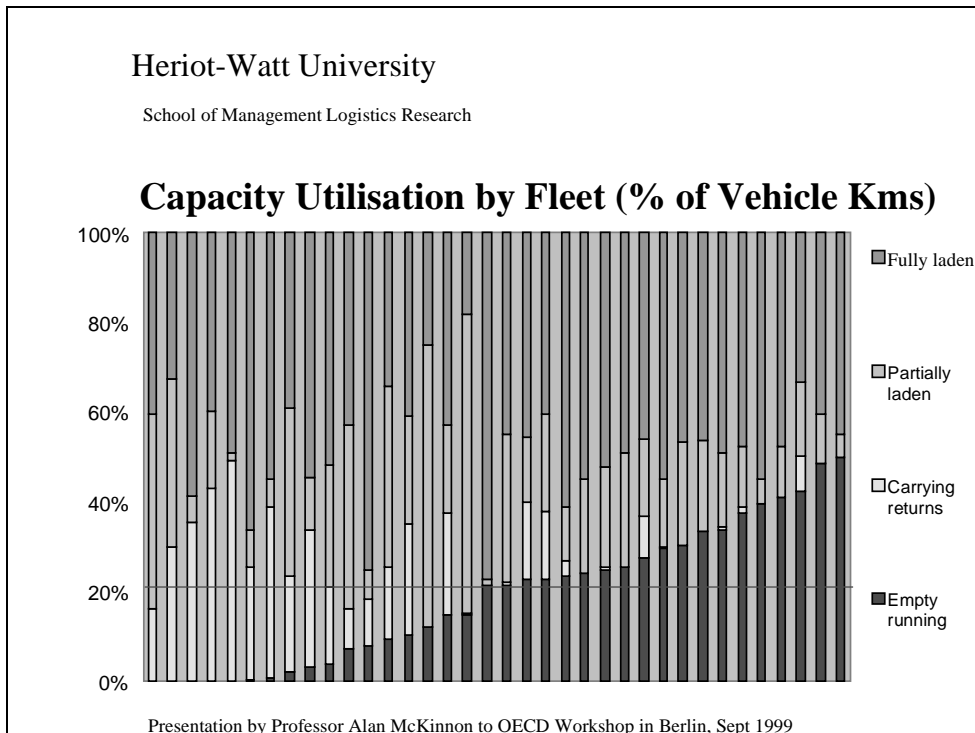


Figure 9: UK Road Freight Transport -- Capacity Utilisation by Fleet



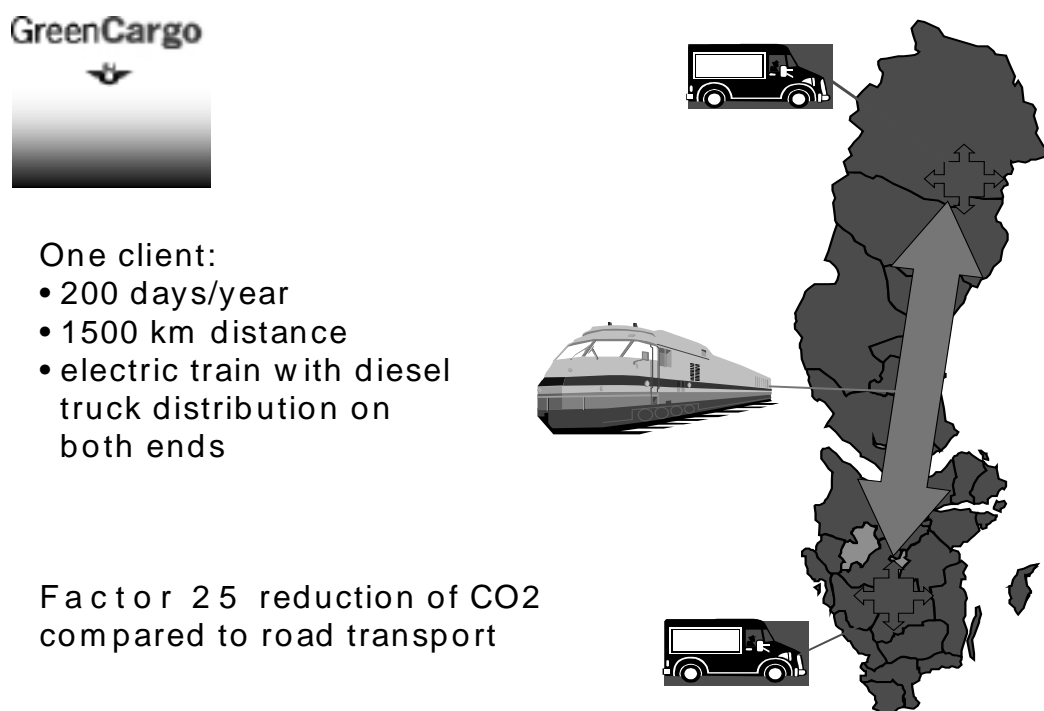
- The studies of freight operators in the UK have revealed a great variability in the environmental performance of current lorry fleets (for details see presentation by A. McKinnon in Part III of this report.). Indeed, if those fleets operating below the mean performance were to achieve mean performance levels, an overall reduction 9% of CO₂ could be achieved. However, if fleets operating below the mean performance of the top 1/3 fleets were to achieve the mean performance of the latter, a 30% reduction of CO₂ emissions could be realised. The study notes that much of the best practice improvements concern vehicle operation and logistics rather than vehicle technology and fuel types.
- The role of governments to create the right framework conditions for EST was underlined by the case of Berlin's post-reunification reconstruction of the Potsdammer Platz area (see project profile by W. Maier in Part II of this report.). In order to avoid massive and destabilising lorry traffic associated with the construction sites, the city government required that production of concrete is done on-site, the bulk of building materials be transported by rail and barge, and that the bulk of materials displaced by the construction be removed by rail. This created the right pre-conditions for a logistics company to be set up to co-ordinate the construction-related transport activity. The resulting avoidance of

50 000 lorry kilometres per day and the completion of work 6 months ahead of schedule due to avoided congestion delays confirmed the need for such schemes at other sites. Since then, logistics co-ordination for construction has become mandatory for large construction sites in Germany and has become a profitable export service for those companies involved in other European operations.

4.2.2 *Session 5: EST and day-to-day life - Businesses*

The discussions in this session centred on the critical question of whether or not firms could reconcile practical concerns regarding competitiveness with less environmentally harmful goods transport. The participants investigated some options that businesses have at their disposal to decouple profitability from the resource and energy intensity of freight transport. The discussion focused on the practical experience of firms that have faced and attempted to answer these and other related questions and led to these conclusions, among others:

- As the experience of the German mail-order retailer Otto-Versand (Hamburg) underscored, there remain tremendous opportunities for reducing the impact of goods transport even for long-distance international sourcing. Advance planning and bundling of consignments by ship and then by air, rather than by air alone, have allowed the company to make important progress towards its voluntary goal of a 45% reduction in CO₂ emissions to be achieved by 2005 compared to 1995 levels. Also, the practice of staggering long distance consignments early in the season and supplementing these with more locally produced goods as shortages manifest themselves has also contributed to an overall drop in emissions (see project profile on Otto-Versand in Part II of this report).
- Competitive rail-based alternatives to services traditionally associated with road and airfreight transport can be developed given adequate public maintenance of the necessary infrastructure. For example, Swedish Rail has developed a small yet growing overnight parcel delivery service (GreenCargo) that offers the same time-based guarantees as other air/road based services yet results in reduced environmental impacts because of its reliance on rail for much of the parcel's voyage. Early feedback indicates that the environmental savings are a factor in sales to businesses (see project profile on GreenCargo in Part II of this report.)(Figure 10).

Figure 10: CO₂ savings: GreenCargo vs. Truck transport

4.2.3 Session 6: Technology, innovation and EST - Freight Transport

As in session 3, this session covered the use of improved existing technologies (natural gas buses, railway), new technologies and new uses for existing technologies for less environmentally harmful freight transport.

Conclusions from the discussion include the following:

- The different EST scenarios developed by the participating country teams are generally characterised by a net increase in rail activity. While rail freight at high load factors is certainly and environmentally preferable option to lorry-based transport, it is not completely devoid of problems -- the first of these being noise levels. Indeed, in order to bring these into conformity with generally accepted levels, passenger rail operations would have to reduce noise by 10 dB(A) and freight rail by 20 dB(A). Best available bogey and railcar technology can already meet these levels. Further, reducing noise from rail has ancillary benefits as less energy is required to move lighter (and therefore less noisy) cars and better loading and co-ordination contributes to reduced empty running. In order to speed the adoption of best available low noise bogeys, one might envisage noise-related track pricing (M. Hecht, TU, Berlin).

- Initiatives to reduce the environmental impacts stemming from the use of diesel engines will focus on improvements in exhaust gas treatments through the use of particle filters and oxidation catalysts. Natural gas vehicles on the other hand will likely see the development of increased combustion efficiency through mixed-burn technologies. Current best available technology results in CO₂ emissions of 110 g/km for diesel and 120 g/km for natural gas (CNG). A further improvement of 30% is possible (see K-V. Schaller, MAN project profile in Part II and presentation in Part III of the project.). However no technological solution will be able to prevent an overall rise in CO₂ emissions from road freight given the projected rise in traffic volumes.
- Lighter-than-air craft, like the Zeppelin rigid framed-airships, represent a potential solution for moving oversized shipments such as transformers, large gas turbines, construction elements, wind turbines, oil rigs, mobile hospitals, etc. (approximately 10% of the overall freight market). Because they require little motive power and minimal ground facilities, they stand to greatly reduce environmental impacts associated with these freight movements. However, some questions remain as to the overall life-cycle benefits as helium production is fairly energy intensive. This technology is as of yet undeployed but, if the lifecycle impacts are reduced, could contribute to the achievement of EST (see project profile on CargoLifter in Part II of this report.).

5. Closing Session: Conclusions

The workshop ended on a positive note as many participants, including early critics of the EST project, voiced optimism that the range and scale of changes outlined in the EST project could indeed be met through wider implementation of existing (albeit sometimes marginal) practices, technologies and policies. The final closing comments re-iterated a recurrent observation -- namely that achieving EST did not rely on "science-fiction" scenarios and responses but rather, on further spreading *current* best practice.

In hindsight, the word "impossible" in the transport/environment policy debate is often synonymous with "not yet experienced". Speakers repeatedly pointed out that within one generation, a number of so-called "impossible" events have occurred and have become completely banalised. For instance, the scale of emission reductions achieved for sulphur, lead, CFC and most of the conventional pollutants emitted by motor vehicles (reduction of more than 90% compared to pre-1980 levels) were all deemed "impossible" in their time. Even as recently as a decade ago, the societal and economic changes accompanying the spread of the internet were hardly conceivable, let alone seen as impossible. Therefore, speakers cautioned that the current debate around structural changes in the provision of transport and the "impossibility"

of achieving significant reductions in CO₂ emissions and noise levels should not prevent any policy action.

While EST is the acronym for “Environmentally Sustainable Transport”, one general conclusion emerging from the two days of discussion was that “Environmentally Sustainable Transport” is synonymous with “Efficient, Sufficient Transport”. Participants stressed that great gains in the *efficiency* (as measured in energy and/or reduction of environmental impacts) of providing access and mobility could and should be realised using existing technologies and current best practices. Furthermore, a significant amount of transport activity is duplicative and/or wasteful (e.g. empty running, low load factors, etc.). Work initiated by firms shows the wide scope for eliminating some transport activity altogether while realising economic gains -- hence a call for examining how much transport is *sufficient* to meet the needs of transport users. This call, it was stressed, does not preclude the examination of market failures which lead to excess transport activity.

Overall, Environmentally Sustainable Transport is a positive outcome of a trade-off between different societal goals. There emerged a consensus that people would not be worse-off or, in some cases, even better off under the types of scenarios outlined in the EST project. Indeed many felt that the increases in the efficiency of accessing people, goods and services, and the corresponding reduction of environmental impacts would leave people generally much better off than in a “business-as-usual” scenario.

PART II: WORKSHOP ORGANISATION

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1. Workshop Programme: Innovation for EST, 27-28 September 1999

Welcome

Umweltbundesamt and OECD

Passenger Transport

Session 1:

Integrated mobility services
Eric Britton, Ecoplan, France (moderator)

Panelists:

Andreas Lieberum, Ecolo Bremen, Germany
Sassa Franke, Choice GmbH, Germany
Heiner Schmeck, Daimler-Chrysler AG, Germany
Sabine Ziegler, Mobility Carsharing, Switzerland
Ernst Reinhardt, EcoProcess, Switzerland

Session 2:

Environmentally sustainable transport (EST)
and day-to-day life: Households
Helmut Holzapfel, University of Kassel, Germany
(moderator)

Panelists:

Nikolaus Huhn, Carfree Life! Association, Germany
Rens Meijkamp, Carsharing Analyst, the Netherlands
Sue Zielinski, City of Toronto, Canada

Session 3:

Technology, innovation and EST: passenger
travel
Axel Friedrich, Umweltbundesamt, Germany
(moderator)

Panelists:

Matthias Altmann Ludwig-Bölkow Systemtechnik,
Germany
Wolfgang Lohbeck, Greenpeace, Germany
Reinhard Kolke, UBA, Germany
Francois Kuonen, CityCar Martigny, Switzerland
M. Germanier, CityCar Martigny, Switzerland

Freight Transport

Session 4:

Organisation and logistics: innovative forms
of goods distribution
Markus Hesse, Institute for Spatial Planning and
Infrastructure Organisation, Germany (moderator)

Panelists:

Alan McKinnon, Heriot Watt University, Scotland
Josie Schnitzeler, Ministry of Transport, the
Netherlands
Wilhelm Maier, Baulogistik, Germany
Heike Flämig, Institute for Environmental Economics,
Germany

Session 5:

EST and day-to-day life: businesses
Gunther Ellwanger, International Railway Union,
France (moderator)

Panelists:

Lars Johansson, Swedish Rail, Sweden
Jonas Strömberg, Swedish Rail, Sweden
Michael Arretz, Otto-Versand, Germany

Session 6:

Technology, innovation and EST: freight
transport
Jürgen Siegmann, TU Berlin, Germany (moderator)

Panelists:

Markus Hecht, TU Berlin, Germany
Karl-Victor Schaller, MAN, Germany
Jan Hinrich Glahr, CargoLifter GmbH, Germany

Closing Session

Conclusions

Udo Becker, University of Dresden, Germany
(moderator)

Panelists:

Eric Britton, Ecoplan, Paris
Helmut Holzapfel, University of Kassel, Germany
Axel Friedrich, Umweltbundesamt, Berlin
Markus Hesse, Institute for Spatial Planning and
Infrastructure Organisation, Berlin
Gunther Ellwanger, International Railway Union, Paris
Jürgen Siegmann, TU Berlin, Germany

2. Selected Project Profiles

2.1 Passenger Transport

Session 1: Integrated Mobility Services

Ms. Sassa Franke
Choice GmbH.
Germany
www.choice.de



More about Choice GmbH.:

In order to ease traffic in areas of conurbation, a pilot project combining public transport and an economically attractive leasing offer (cash car) is being developed in Berlin which will be extended to Munich and Hamburg. The Social Science Research Centre Berlin (WZB) which is launching the project called choice together with Audi Inc., the local car-sharing firm StattAuto Ltd. and Deutsche Bahn Inc., received a sponsoring recommendation from the German Ministry for Education, Science, Research and Technology (BMBF). An independent jury chose five projects - among them cash car from Berlin (WZB) together with MOBINET from the Munich area - from over 150 proposed projects and recommended them to the German Ministry of Education and Research as being worthy of sponsoring. Sociological research carried out at the WZB as part of cash car's widespread fieldwork experiment will largely concentrate on the question as to whether a semantic change can be brought about in the automobile from private car to something jointly used.

Individual transport is on the verge of collapse in urban areas, especially in inner cities. A countermeasure could be to develop integrated transport facilities in order to combine the use of public transport with an economically attractive leasing opportunity (cash car) for car drivers. As well as having a car at their complete disposal, interested parties are given the additional option of putting this car at the disposal of a local car sharing fleet whenever it is not in use and receiving a bonus. The co-operation of cash car and car sharing means that for the first time, a module is available that has the "built-in" possibility to change the preferred means of transport on demand. The main element of a completely new transport service is thus defined. Until now, it was impossible to establish an integrated solution due to the fact that the combination of different systems was desirable for ecological reasons but could not be effectuated because every transport authority pursues their own optimization strategies.

Products:

Cash car... is a model of use which does away with the car's two weak points: long parking periods and high maintenance costs. We will provide you with a car of your choice with full service leasing, and additionally with a 15% discount on a VBB season ticket and a BahnCard. Should you not need the car, we will put it at the disposal of StattAuto AG customers, and you will receive 50% of the rental costs. Cash car enables you to use car sharing cars in over 50 cities and urban areas across Europe. All these events are listed on your monthly bill, so you never lose track of how much your mobility really costs you. At the same time, this provides a statement for the Inland Revenue.

Winter Car: Ideal for people who prefer to travel by motorbike or bicycle in the summer and only need a car in the winter. From the 1st of October till the 31st of March we give you special priced full Service Leasing car.

Job Car: You sign a full service leasing contract for a vehicle of your choice. You are granted access to the vehicle, by way of a chip card and a safety deposit key. You park your car there on Friday evening. Over the weekend, you can travel as usual using your BahnPlus ticket mobil or rent a car of your choice from the StattAuto carpool at the reduced partner rate. On Monday morning, your is ready and waiting for you again. It is returned to you in a clean and technically faultless state; if not, you are entitled to a replacement vehicle.

Passenger Transport

Session 1: Integrated Mobility Services

Ms. Sabine Ziegler
Mobility CarSharing
Switzerland

www.mobility.ch



More about Mobility CarSharing Switzerland:

1200 cars at 700 locations in 330 communities for 29000 customers. (August 99)

Mobility is a service-based approach to daily transport needs. It begins where efficient public transportation ends. By providing for easy, flexible and hassle-free use of automobiles in a short-term rental fleet, Mobility obviates the need to own a car and thus closes the cycle among tram, bus, train and "car on call". Mobility seamlessly allows you to benefit from car use when necessary without having to give up more affordable and desirable public transport usage.

Mobility CarSharing is diversified. Mobility cars are used wherever public transportation can't reach, where it takes too long or whenever it is inconvenient – it complements public transport by allowing clients to go beyond the range of public transport networks or to travel at times when there is little or no public transport service. Mobility works in three easy steps:

1. Reserve. By means of Mobility's personally and automatically operated call centre or via internet, customers can reserve a Mobility car throughout Switzerland 24 hours a day, 7 days a week. The customer is immediately informed if a car is free at the nearest location.
2. Driving. Using the personal electronic Mobility chip card, customers have access to their reserved car and can drive it for as long as they have booked. At the end of their trip they enter the driven kilometres in the log book. This data will be transferred into our accounting system.
3. Billing. Mobility customers receive a detailed monthly invoice.

Passenger Transport

Session 1: Integrated Mobility Services

Mr. Ernst E. Reinhardt
Ecoprocess-Energy 2000
Switzerland



www.energie2000.ch
www.mobilmanager.ch
www.mobiltaet-e2000.ch

More about Energy 2000 and Carsharing:

The Energy 2000 action program has been actively promoting CarSharing since 1992, by introducing a variety of measures aimed at supporting its organisational progress, inciting and promoting learning processes, and providing incentives for organisers to make their own significant contributions towards its success. In this way, the Motor fuels Section of Energy 2000 has triggered a number of innovations and accelerated the level of collaboration between the various mobility partners. This resulted in the introduction of "züri mobil" in 1995 as a first service of this type, which - as another première - subsequently received recognition within the scope of the "Designpreis97" awards. On the basis of this successful innovation, in 1998 Swiss Federal Railways and "Mobility CarSharing Switzerland" created a nation-wide combined service for railway users and car drivers. An on-board computer which simplifies co-ordination with public transport was another innovation to come from Switzerland. 900 vehicles are now available in 300 municipalities and at over 200 railway stations. A strong emphasis has been placed on compliance with important utilisation standards relating to energy and transport policy, with the aim of simplifying the transition from personal to public transport.

With the aid of studies and evaluations carried out within the Energy 2000 program, for the first time we now possess sound quantitative and qualitative information concerning customer profiles, mobility behaviour and impacts on the environment, as well as about the assessments by representatives from the fields of politics and economics with respect to car sharing. The ways in which Energy 2000 has contributed to the development of CarSharing have also been studied. We will be using these findings for drawing up the follow-up program for the period after 2000.

Passenger TransportSession 2: *est!* and day-to-day life: households

Mr. Nikolaus Huhn
 Carfree Life! Association
 Germany

www.autofrei.de

**More about the London Carfree Life! Conference:**

The first UK conference of car-free citizens will not dwell on the disadvantages of private car use to health and the environment. Some information about that is already available to the public. But it will concentrate on the sometimes strenuous and often pleasant world of carless living.

It seems worthwhile to try to be, in Richard Evans' words, "a part of the solution", as well as experiencing the freedom, financial economy and sheer joy of living without a car. In a society where owning at least one car seems to be almost obligatory, living without a car begins to look more and more like an act of civil disobedience. It certainly provides a strong signal of disagreement with the path of our civilisation... or perhaps it would be more accurate to say: with it's "motor way". Of course the private car is not the only problem in our world but it is a very obvious and significant one. And unlike many political "big issues", the private car question gives almost every adult in the 'advanced' world the opportunity to take responsibility and to meet the environmental challenge.

Can we afford to wait like children until the government (or global circumstances) force us to reduce our consumption of fossil fuel and the dependence on the car - which is likely to happen within the coming decades. We should be prepared to give a significant message of personal readiness for an incisive change to the politicians in charge. Otherwise democratically elected leaders will hardly be able to gain the freedom to take decisive action. They are squeezed under the overwhelming pressure of the daily "petrol station plebiscite". Consciously car-free people are invited to meet, exchange ideas and spin their individual threads and experiences into a strong message which will appeal to society and its leaders. One of the key aims of this meeting is to facilitate encounter and exchange of experience between carfree people and those who are considering such a step.

Passenger Transport

Session 2: est! and day-to-day life: households

Mr. Rens Meijkamp
B&A Groep
the Netherlands

More about Carsharing in the Netherlands:

Car Sharing has become a serious development in the Dutch landscape of innovative mobility services over the last decade. From small scale and non-professional initiative it has developed into a commercial concept that is promising for business. Car Sharing opens up new markets, contributes to the quality improvements in Dutch cities and receives interests from policy for its potential to contribute to policy aims. Recently the Dutch minister of transport has confirmed publicly that Car Sharing is one of the important instruments of transport policy.

In 1999, the amount of participating consumers in commercial systems has risen to about 25.000 people. In more than 100 communities about 20 various Car Sharing systems are offered at more than 500 outlets. Especially the development and growth of the schemes of AutoDelen and GreenWheels, is remarkable. With a timeframe of three years they have been able to build up a new network of about 60 new outlets.

Since the presentation of the „Nota Milieu en Economie“ (Policy Plan on the Environment and the Economy) in 1997, Car Sharing has become a policy instrument in Dutch transportation policy. It is stated in the Policy Plan on Environment and Economy that through Car Sharing service car ownership is no longer a necessary condition to be able to use a car“.

According to the Policy Plan on Environment and Economy for various reasons Car Sharing can be held relevant for Dutch (transport) policy. It is concluded in this policy plan that Car Sharing both contributes to the improvement of the natural environment, as well as to accessibility of crowded inner cities:

In response to the political endorsement of Car Sharing as a useful policy instrument, a growing amount of policy measurements have been taken. Over the past couple of years the government has been involved in initiating Car Sharing services through the creation of a general stimulating environment for entrepreneurs to develop and implement new Car Sharing services, without subsidising the operation of these services. In the beginning, the ministry of transportation has taken rather unconventional policy initiatives: through the organization of meetings and workshops with various entrepreneurs an exchange of ideas, experiences and enthusiasm was facilitated. Above all these workshops revealed what kind of problems had to be overcome for the implementation of Car Sharing service in practice. Later on the coordinating role has been passed over to a new foundation for the stimulation of Car Sharing in the Netherlands („Stichting voor Gedeeld Autogebruik“, founded in 1995). This foundation, financed by the ministry of transportation, has been given the task to communicate Car Sharing to the public and the press, to advise starting entrepreneurs and to advise the authorities in their policy making with regard to Car Sharing. In addition to the work of the foundation, the advisory and research department of the ministry of transportation (AVV) has been monitoring and documenting the development of Car Sharing. Through the development of knowledge, AVV facilitated the policy making process and the decision making on how to further stimulate Car Sharing in practice.

Passenger Transport

Session 2: *est!* and day-to-day life: households

Ms. Sue Zielinski
City of Toronto
Canada

www.city.toronto.on.ca/mte/



More about Moving the Economy:

Moving the Economy (MTE) is an evolving and expanding partnership dedicated to promoting, attracting investment to, and creating jobs in the sustainable transportation sector in the Toronto Region and beyond.

How does MTE do this?

A) Through Information and Analysis

"MTE On-Line": The Internet- based international inventory of economic case studies in sustainable transportation, and one of the best sources of contacts in the field.

The 1998 Moving the Economy Conference, and the Conference Proceedings: The conference showcased hundreds of examples of the positive contributions sustainable transportation can make to a healthy economy.

Detour Publications: A one-stop source for the broadest selection of books, reports, magazines, and other essentials on sustainable transportation and urban ecology.

B) By Building on Success with Innovative Partnerships and Initiatives

The Sector Development Strategy: From the 200 concrete examples showcased in the Moving the Economy Conference Proceedings, a few have been selected and shaped into a Sector Development Strategy for the Toronto region. The Strategy makes the case that growing the sustainable transportation sector is a wise business investment, and it outlines two specific initiatives that together will contribute to the development of Toronto as a hub of sustainable transportation sector development.

OUR GOALS:

Planning for Sustainable Transportation

Economic Revitalization

Developing Innovative Solutions

Building on Success

Forging Creative Partnerships

Thinking Locally and Globally

Passenger Transport

Session 3: Technology, Innovation and *est!*: Passenger travel

Mr. Matthias Altmann
Project Manager
L-B-Systemtechnik GmbH
Germany

www.hydrogen.org/lbst/

Bio:

Mr. Altmann is currently Project Manager at L-B-Systemtechnik GmbH. His activities at L-B-Systemtechnik have centred on the use of hydrogen as an alternative energy source. In particular, he has carried out the following activities:

1999: Survey of alternative fuels in Europe

1999: Hydrogen cost study

1998/99: Study on Wind-Hydrogen Systems for electricity supply of remote consumers

1998/99: Study on the build-up of a renewable LH2 filling infrastructure in Germany

1997/98: Hydrogen acceptance study

1997 on: Leader of subtask C „Fuel supply systems“ of IEA Implementing Agreement 026 Annex X „Fuel Cell Systems for Transportation“

1996 on: HyWeb the Hydrogen and Fuel Cell Information System in the Internet

1996: Organisation of an industry workshop „Clean Transportation“ in Mexico City

1994: London city transport emission reduction study

1994 on: Bavarian Fuel Cell Bus Project

Passenger Transport

Session 3: Technology, innovation and est!: passenger travel

Mr. Wolfgang Lohbeck
Greenpeace
Germany

www.greenpeace.org/~climate/smile/

**More about the SmILE car:**

In 1994, the obvious contradiction between the threat to the climate on the one hand and the failure to implement technically feasible measures to reduce consumption on the part of the automobile industry on the other induced GREENPEACE to initiate the "SmILE" project. If there had to be such a thing as a car, then it should be small, intelligent, light and efficient. In less than two years, a standard Renault Twingo was taken as an example of how consumption can be optimised with the means available today and with a view to possible series production. The result of this project shows that it is possible to give first aid to the climate rapidly - halving consumption is feasible.

What is the car going to cost ?

The Twingo SmILE and all other cars built according to the SmILE idea will not be significantly more expensive than the respective original models. The final price naturally depends in the final analysis upon mass production. It is important that all parts of the Twingo SmILE as well as the necessary know-how are known and customary in the industry. The novel and consistent combination of consumption-reducing measures which are practically ready for series production, is the main innovation. The manufacturing costs of the engine should be lower in series production than those of the previous engines, because the new engine consists of fewer parts and the material expense is lower. Nevertheless, supercharging costs more, also the wheels and the wheel suspension made of aluminium. The production facilities will not be more expensive, since the designs are indeed different, but require in principle no new tools and operations.

What has been changed compared with the original Twingo ?

Twingo SmILE is lighter:

Twingo SmILE has less air resistance:

Twingo SmILE has a smaller and more efficient engine:

What features have been retained?

Performance and safety, among others. The performance data of the WENKO engine and the improvements in weight and aerodynamics result in the same or better performance parameters, such as maximum speed, elasticity and acceleration. Just as the Twingo, the Twingo SmILE is also equipped with an airbag and has lateral collision protection. No safety relevant interventions were made in the subsequent design changes. Every steel member with safety or rigidity functions remains "as per Renault". The safety level of a Twingo SmILE produced in series production will thus be comparable with that of the original car.

2.2 Freight Transport

Session 4: Organisation and logistics: innovative forms of goods distribution

Mr. Alan McKinnon
Heriot-Watt University
Scotland
www.hw.ac.uk/somwww/

Bio:

Alan McKinnon is Professor of Logistics in the School of Management at Heriot-Watt University, Edinburgh. A graduate of the universities of Aberdeen, British Columbia and London, Alan has been researching and teaching in the field of logistics for almost twenty years and has published widely on the subject. He has conducted studies on a range of topics including distribution strategies of manufacturers and retailers, the restructuring of logistics systems, freight traffic growth, energy efficiency in freight transport and the environmental impact of logistical activity. He has been a consultant to numerous public and private sector organisations on a variety of logistics and transport issues and an adviser to several UK government departments and committees. He is a former European Editor of the International Journal of Physical Distribution and Logistics Management and a fellow of the UK Institute of Logistics and Transport.

He has recently been involved in auditing and benchmarking the utilisation and energy efficiency of 36 vehicle fleets in the UK grocery sector, comprising a total of 2400 trucks. This survey, which was sponsored by the UK government and done in association with the Cold Storage and Distribution Federation, was one of the largest of this type and has permitted detailed analysis of energy intensity in road freight transport. This reveals that there are significant opportunities for improving vehicle fill and cutting energy consumption.

Freight Transport

Session 4: Organisation and logistics: innovative forms of goods distribution

Ms. Josje Schnitzeler
 Ministry of Transport, Public Works and Water
 Management
 the Netherlands

www.minvenw.nl

Stichting Natuur en Milieu SNM (The Netherlands Society for Nature and Environment) is introducing a new concept: transport prevention, meaning achieving the same economic growth with less transport. Just like concepts such as waste prevention and energy saving, transport prevention might turn out to be a promising opportunity. SNM commissioned Bakkenist consultancy to explore the opportunities.

So far, economic growth has always caused freight transport to grow as well. Consumers purchase more goods, which all need to be transported, so the amount of goods moved increases. What exactly is the relationship between economic growth and growth in freight transport? Straightforward traffic counts show that freight transport tends to grow faster than the economy does. Apparently products are being moved over increasingly longer distances." According to the Dutch Centrum voor energiebesparing en schone technologie (CE, Centre for Energy Conservation and Clean Technology, a leading Dutch consultancy) in a consultation paper, the average length of trips is growing at about 3.5 per cent annually. Eighteen months ago this caused the Transport Ministry to raise the question of how exactly economic growth and transport growth are related.

Earlier Stichting Natuur en Milieu suggested the idea of exploring opportunities for transport prevention: the same economic growth coupled with less transport. The reason for this was simple: CO₂-emissions from road transport will, if no extra measures are taken, exceed the government target by 25% in 2010. "And this in spite of cleaner lorries and great effort from all parties involved to increase the efficiency of transport and logistics. Transport growth is offsetting all the benefits from these efforts", says Ms Clasien Slebos of SNM. Their study on Transport Prevention shows that it is possible to break the link between economic growth and growth in transport. We have laid the foundation for the concept of transport prevention, starting from the narrow angle of transport in the supply and delivery (production and consumption) chain. Fourteen categories of transport prevention measures have been identified.

The most promising alternatives are brand-independent distribution, brand-independent production and reductions in the transportation of water and air; Obviously, in the assessment of the alternatives there are several other factors that play a role as well. Connections between them are complex and could not be analysed thoroughly within the scope of this study.

- Transport prevention may often lead to a win-win situation, benefiting both commercial and environmental aspects. As transport is often a blind spot, these opportunities often fail to be recognised.
- When there is no win-win situation, transport prevention often fails to be implemented, as direct costs and revenues are liable to overrule environmental considerations.
- An analysis of constraints, actors and trends offers scope for changing current ways of thinking.
- Social and logistical trends may be used to implement transport prevention. Realising transport prevention measures is a matter for all parties concerned: industry and public sectors, producers and consumers.
- Assessment of the potential impact of transport prevention has in this study been restricted to qualitative estimates. Quantified estimates would require further study.
- The practical realisation of the potential impact requires that the concept of transport prevention is developed and the integrated approach to transport promoted.

Freight Transport

Session 4: Organisation and logistics

Wilhelm Maier, Baulogistik, Berlin

Logistics Centre South – city friendly construction logistics for the Potsdamer Platz building site complex:

Potsdamer Platz is a striking reflection of Berlin's political and urban development history. Until it was destroyed in the Second World War it was the intersection point between the historic centre of Berlin and the city's modern suburbs. In the 20s it suffered the dramatic fate of becoming Europe's busiest square: it was a traffic junction, but also a place for shopping and leisure, working and living. What the Second World War had failed to destroy was laid waste by demolition when the Wall was built. Potsdamer Platz was caught between the walls, and reduced to the status of no-mans land. After the fall of the Wall in 1989 there was room for visions again. Potsdamer Platz, with all its mantle of history, was to become an urban centre of the future.

By the year 2002 the investors, Daimler-Benz InterServices GmbH, Sony Berlin GmbH, Asea Brown Boveri, Deutsche Bahn AG (German railway company) and Land Berlin (federal state of Berlin) will have realised extensive building projects in and around Potsdamer Platz, with an investment volume of around DM 8 billion marks. These include office, commercial and residential buildings, a theatre for musicals, department stores, hotels, transport facilities in the central area with long distance and regional railways and the Tiergarten road tunnel, parks and a great deal more besides.

The fact that the individual building projects are so closely linked in terms of space, construction and function creates more than merely technical problems. The logistical side of this major project also requires particular attention. By the year 2002 about 6 million tons of excavated soil and 200,000 tons of building refuse among other things have to be transported away from the site and about 1.7 million m³ of concrete and about 2 million tons of general cargo delivered. Conventional transport of these gigantic quantities would inevitably cause a traffic seizure in central Berlin. External constraints have had unusual effects. The private and public sectors mentioned above decided to approach the logistical solution to their problems jointly and established **Baustellenlogistik Potsdamer Platz GmbH (baulog)** especially for this purpose in August 1993. Given the enormous time pressure baulog commissioned experienced experts from the Berlin engineering firm Emch+Berger to provide technical management services. They had already delivered a preliminary feasibility study on "Building Logistics in the Central Area". Thus they were in a position to act without delay on an unconventional logistics concept for Potsdamer Platz: the giant building site was to be supplied and cleared almost exclusively by rail and water. The aim is above all to guarantee supplies, but also to manage the logistics in an economically and environmentally sound manner.

The nub of this concept is a logistics centre, which is to be built on the site of two good stations (Anhalter and Potsdamer that have been deserted since the Second World War. They are immediately adjacent to the Potsdamer Platz building sites. To this end an extensive basic infrastructure with about 5 km of rail facilities, a 2.5 km long, internal transport road, 5 bridges etc. had to be built. A bridge over the Landwehrkanal connects the logistics centre directly with the building sites. There are no links with public transport. The Potsdamer Platz building site can be reached only via the logistics centre, like an island by a ferry, an encapsulated organism connected to the outside world almost exclusively to the outside world almost exclusively by rail and water.

baulog has established various service facilities on the Logistics centre South site for the firms buildings in Potsdamer Platz. It does not provide these services itself; it has employed specialist firms, its so-called contracted entrepreneurs, which were identified by international tenders. In detail, the logistics centre provides the following services:

1. Acceptance of all excavated material from the companies involved, removal by rail or water to be re-used or dumped
2. Manufacture and delivery of ready mixed concrete to the companies involved; cement and aggregates are brought to the concrete factory by rail
3. Organisation of the delivery of general cargo by rail, transfer and transport to the building sites by lorry
4. Collection of sorted building refuse, transfer and rail transport out
5. Acceptance and discharge (draining off or reinfiltration) of all ground water from the excavation pits of the companies involved, including ground water management

A consortium contract has committed the investors and thus their suppliers and general contractors and executing companies to the exclusive use of *baulog's* logistic facilities. The Federal Anti-Trust-Authority has sanctioned this. Now that the basic infrastructure and identification of contracted firms are complete, *baulog's* principal task is above all in the realm of capacity and requirement planning, conflict management in the case of supply bottlenecks, continuous adaptation of the basic infrastructure to the building process and information and coordination between building sites and the contracted firms of the logistics centre.

Freight Transport

Session 5: EST and day-to-day life: Businesses

Mr. Lars B Johansson
 Mr Jonas Strömberg
 Swedish State Railways
 Sweden

www.sjgods.sj.se

www.greencargo.com



GreenCargo



Main accomplishments at SJ include:

- ◆ the introduction of an environmental management strategy (EMS) and ongoing environmental certification under ISO 14001,
- ◆ the development of SJ environmental information and its use in marketing SJ transport services
- ◆ an educational programme
- ◆ an ongoing system of environmental reporting
- ◆ the creation of an environmental analysis programme (SJ Miljödata) used to calculate emissions and social costs of transportation
- ◆ the creation of sustainable freight transport chains
- ◆ market demand for environmentally adapted freight transport and market reactions to SJ's "GreenCargo" product.

More about SJ Cargo Group and "GreenCargo":

SJ Cargo Group is a provider of rail-based door-to-door transport solutions. The base market is Sweden, but SJCG also provides services to various parts of Europe. There are 12 member companies in the group, all specialised in some kind of transportation or logistics service. SJCG profiles itself as the most environmentally friendly transporter on the market. The recently launched service "GreenCargo" is the first eco-labelled nation-wide door-to-door transport service on the market. The service includes an environmental analysis, a time guarantee and overnight delivery.

Freight Transport

Session 5: EST and day-to-day life: Businesses

Mr. Michael Arretz
Otto - Versand
Germany

www.otto-versand.de

In 1993, the international procurement of goods and materials for the German mail-order retailer Otto's product lines caused more than 184,000 tonnes of CO₂ emissions. To lower these CO₂ emissions, Otto developed a four-pronged strategy. Beside testing and using alternative fuels to establish low or zero emission systems, the main aim has been to optimise transportation technically and logistically and to shift consignments to other means of transport. From 1993 to 1999, annual CO₂ emissions were reduced by some 40% thanks to a large number of measures. By 1999, CO₂ emissions from the international transportation of incoming goods had thus been reduced to 104,000 tonnes per year. At the same time, the eco-efficiency factors for incoming goods transport were raised from 0.45 tonnes of merchandise per tonne of CO₂ emissions to 0.78.

One central element of the Green Supply Chain Management project involves shifting consignments from high-emission means of transport such as planes and trucks to lower-emission means of transport such as sea-going ships. This means that new logistics chains have to be established.

For the Turkish market, some 5% of consignments were transferred from truck to ship. This led to a saving of 0.16 tonnes of CO₂ and DM 300.00 per tonne of merchandise. At the same time, handling was greatly simplified. In 2000 the share of sea-going ship transportation should be increased to 20%.

For the Hong Kong market a total of 8% of pure air consignments were shifted to combined sea-air transportation. As a result, CO₂ emissions were cut by 2.8 tonnes and costs by DM 1,800.00 per tonne of merchandise. In 2000 the share of sea-air transportation should be increased to 12%.

The measures clearly show that, even in times of "just in time" and "quick response", a reduction in emissions, handling effort and transport costs can be achieved by the establishment of new logistics chains and the use of low-energy and low-emission means of transport such as sea-going ships.

Freight Transport

Session 6: Technology, innovation and est: freight transport

Mr. Jan-Hinrich Glahr
CargoLifter AG.
Germany



www.cargolifter.com

More about Cargolifter:

Headquartered in Frankfurt, Germany, CargoLifter AG and its subsidiaries will build and operate a global fleet of giant airships to carry cargo throughout the world. CargoLifter AG was founded in 1996 and has since grown to over 150 full time employees and more than 5,100 shareholders. Manufacturing facilities and operating bases are planned for Europe and the United States, with eventual expansion to Latin America, Asia and the Pacific Rim. CargoLifter's North American subsidiary, CargoLifter Inc., began operations in the spring of 1998. The U.S. firm is headed by Charles H. W. Edwards, a 25-year veteran in logistics, airline and air cargo operations.

CargoLifter is a skilful blend of the old and new. The project combines lighter-than-air (LTA) principles, modern crane technology and sophisticated world-wide communications to give birth to an entirely new mode of transportation. The CargoLifter system will be the world's first point-to-point network, permitting the movement of extremely heavy or large payloads from a source site to final destinations almost anywhere in the world – all in one, seamless shipment. Whether long-haul trips of up to 6,000 miles, or short-haul shuttles, the CargoLifter is ideally suited for today's transport market. CargoLifter airships do away with the need for road, bridge and railroad repairs, for example. There is no need for large airfields, since loading and unloading is accomplished using a patented crane-like load frame while the airship remains in the air. Thanks to low fuel consumption, these ships will be economical to operate and ecologically friendly. And, due to their simplicity, CL 160's will be highly reliable.

The core of the CargoLifter system will be a world-wide network of bases – some for the simple loading and unloading of cargo; others for refuelling, maintenance and repair; and still others for building the airships. These bases will be located in areas meeting a number of important criteria, including proximity to major cargo shipping points and/or logistical operations, availability of connecting transportation lines (such as major ports or rail heads), ample skilled labour, favourable climatic conditions, and so on. Presently, CargoLifter is actively considering a variety of potential sites throughout the world, including North America, Europe and Latin America

2.3 Closing Session

Panel

Mr. Eric Britton
Ecoplan International
France

www.ecoplan.org
www.the-commons.org

Eric Britton founded EcoPlan in 1966 to provide an independent international forum of observation, reflection and counsel on issues involving technological change as it effects people in their daily lives. A common theme in all his work is the strategic adaptation of technologies, business procedures, human practices, and institutional structures to changing technological, resource and environmental requirements. And to changes in perceptions and values. Because he has been utterly flummoxed by the situation of a world with some many bright and able people, and such mediocre public policies and practices (he refers to this as the "brains on the knee syndrome"), he has spent quite a lot of time working to create problem-solving networks, including some mediated by electronic means. The Commons is one example of how he thinks this might be made to work.

His best print performance to date is not a book but a rough "thinking exercise" initiated for the European Commission in 1993, Rethinking Work: New Ways to Work in a Knowledge Society, which subsequently kicked off the @ Work on the Web program here.

Eric Britton persists in his claim that the main Instruments of the transition to sustainability are three: technology, children and culture. The first, despite being the thing which for the most part has been the cause for much of the present problems, is now an absolutely indispensable central element of the solution path. As to children, he claims that our goal must not only be to make the future fair to and safe for them, but that we must also understand that they are the ones who are going to be most involved in making the necessary transition. In undoing some of the stupid things we have done in our time, and in doing others which we lacked the courage or foresight to deal with. Thus we must find ways to integrate them from earliest childhood into the solution process, including through such things as school programs, children's books, media events and happenings of sorts. Culture? Well, culture is the collective understanding and instrument of all that is important and worth preserving in our society, as well as the means for getting this message across.

Closing Session

Panel

Mr. Markus Hesse
Inst. For Regional Development & Structural
Planning
Germany

Mr. Hesse is a Senior Researcher at the IRS/Institute for Regional Development and Structural Planning where he is responsible for the integrated research project "Space-time-structures, mobility and transport in the process of modernization". His major topics of research cover: Transportation and mobility research, i.e. freight transport in city regions; urban and regional development; spatial aspects of structural change; U.S. transportation and land use policies. He holds degrees in Geography from the University of Muenster (1979-1985) and a Ph.D. in Regional Planning from the University of Dortmund (1997).

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1. ALTERNATIVE AND ADVANCED PROPULSION SYSTEMS FROM THE ENVIRONMENTAL POINT OF VIEW

by Reinhard Kolke, Umweltbundesamt

Presented at the Global Powertrain Congress 1998
October, 6-8 1998, Detroit, Michigan, U.S.A.

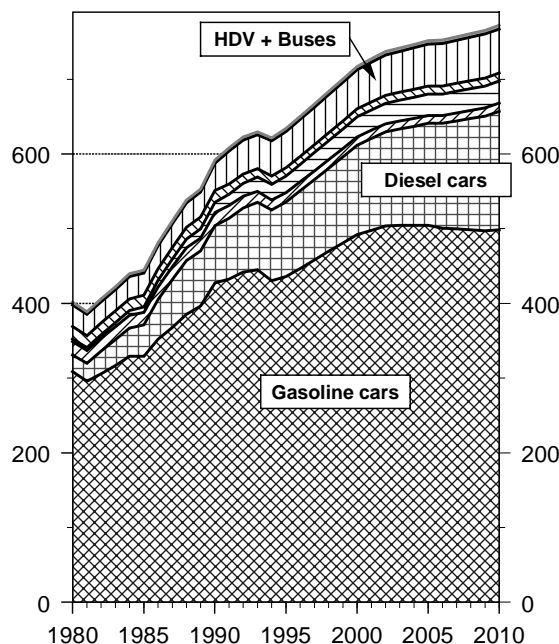
The Federal Environmental Agency (UBA) has elaborated several reports about Environmentally Sustainable Transport (EST) where criteria for EST were discussed and different scenarios with new and environmentally friendly technologies for the traffic sector were considered. This paper will give an overview about alternative propulsion systems for motor vehicles in traffic in comparison with the current and the best available conventional technologies with internal combustion engines.

Introduction

Figure 1: Mileage Trends in Germany

Consumption of gasoline and diesel fuels by motor vehicle traffic and the in-Road Traffic in Germany 1980 - 2010 (in kt)

Mileage Trends (in billion vehicle-km)



Notes: Calculations using the "Data and calculation model", version 8. 2. 1996; actual figures until 1995, thereafter trend scenario; mileage based on scenario H' of German General Federal Transportation Plan; vehicle categories from bottom to top: - gasoline cars, - diesel cars, - light commercial vehicles (gasoline), - light commercial vehicles (diesel), - motorised two-wheelers, - heavy duty vehicles (including buses).

Sources: Various basic data; IFEU calculations using the "Data and calculation model: Pollutant emissions by transport in Germany" (UFOPLAN No. 105 06 057); IFEU Heidelberg 6.6.96

Consumption of gasoline and diesel fuels by motor vehicle traffic and the increase of mileage is currently one of the main problems of road traffic (Figure 1). Not only does this make the sector one of the biggest consumers of petroleum products with the corresponding CO₂-emissions, but its emissions due to evaporation and combustion also make a sizeable contribution to atmospheric pollution.

From the environmental point of view, the main need in transport is to

avoid transports and to

shift transports

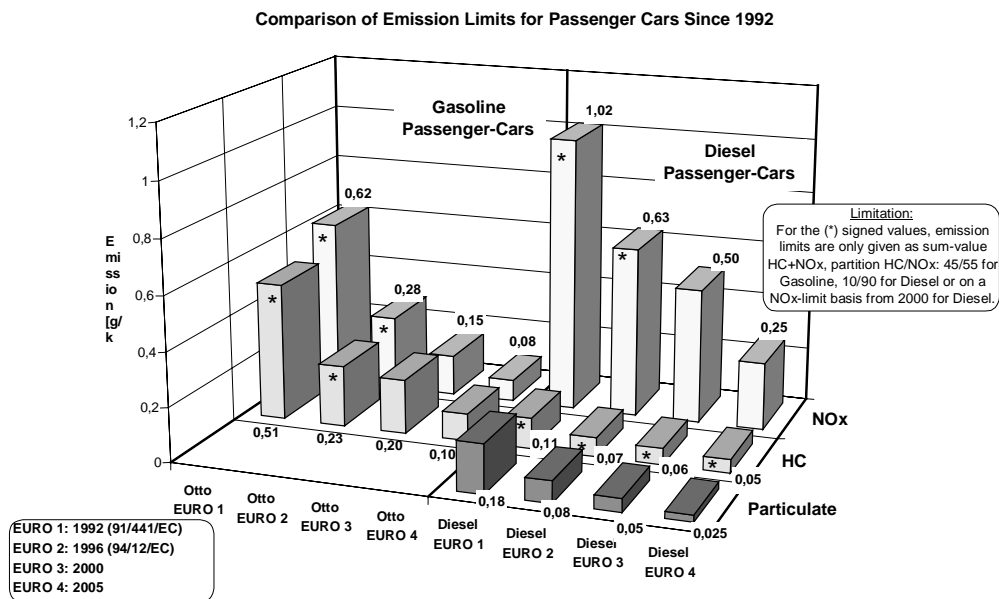
from road transport back to more environmentally friendly means like rail or waterways, as this strategy offers the main potential of a sustainable reduction of the environmental impacts from road transport. Another possibility to reduce negative environmental effects from transportation can be the

technological improvement of transport systems as well as

advanced and alternative propulsion.

It has to be considered, that each alternative propulsion has to be compared to its competitor, the advanced developed available technologies for passenger cars (Gasoline engines) and heavy duty vehicles (Diesel engines). These systems still have a large potential for reducing emissions, up to 80-90 % in comparison to today's technology (Figure 2).

In a first conclusion the main question to answer is, whether advanced and alternative propulsions with zero emissions (Zero-Emission-Vehicle - ZEV) are needed for some vehicles (this means an emission reduction by some cars, which may cause disproportionate high private costs) or whether it would be better to reduce the emissions of all cars by a sustainable reduction of 80-90 % in comparison to a current standard, with comparable incremental costs, as for the above mentioned small ZEV-fleet.

Figure 2: Comparison of European Emission Limits for Passenger Cars since 1992

From an environmental point of view for the comparison of technological improvements of motor vehicles and advanced and alternative propulsions the following steps have to be examined:

Identification of the environmental impacts by road traffic today and in the foreseeable future,

Identification of key criteria for what might be an environmentally sustainable transport on the basis of the environmental impacts, which are met by technical (alternative and advanced propulsions) and non-technical (mobility management) means,

Definition of technical and non-technical means,

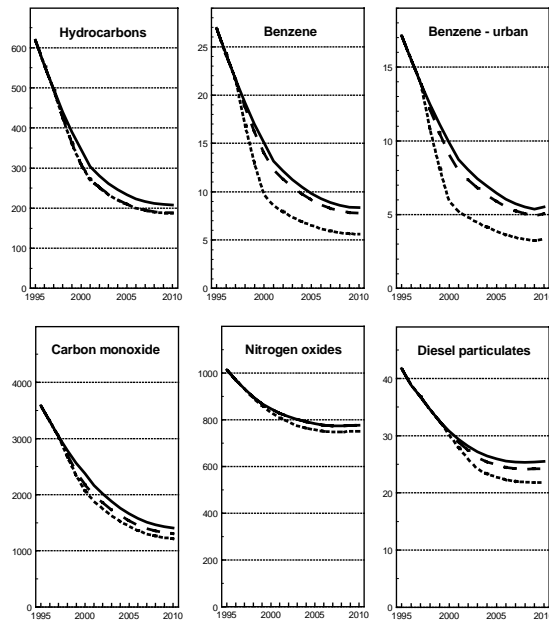
Evaluation of the main means which reach the environmental key criteria in the most cost-effective way.

Environmental Impacts Today And In The Foreseeable Future

Road Transport in Germany is - as in other developed countries - characterised by an enormous increase of mileage of traffic (Figure 1), which results in an increase of CO₂-emissions because of the burning of fossil fuels.

Figure 3: Road Traffic Emissions With Modified Fuels (TAPPE et al., 1996)

Road Traffic Emissions in Germany 1995 - 2010 (in kt)
 EURO 2 v. Modified Fuels - All Vehicles



Notes: Direct emissions by motorised road traffic in Germany in the years 1995 to 2010; trend scenario on the assumption that there is no further lightening of limit values over and above the legislation already passed ("EURO 2"); introduction of improved fuels in the years 1998 to 2000 (gasoline) and 2000 to 2003 (diesel fuels) solid line: base scenario using present day fuels dashed line: Commission proposal (put forward by EU commission) - dotted line: UBA proposal (put forward by the German Federal Environmental Agency) Hydrocarbons and benzene emissions include emissions due to evaporation

Sources: IFEU calculations using the "Data and calculation model: Pollutant emissions by transport in Germany" (UFOPLAN No. 105 06 057); variations in fuel quality and emission factors by UBA IFEU Heidelberg 6.6.96

Today, the shares of total German emissions accounted for by traffic induced emissions are around 60 % for NO_x, 35 % for NMVOC, 80 % for benzene and over 90 % for diesel particulate. The introduction of the European emission legislation for passenger cars since 1992 (Figure 2) in combination with reformulated fuels will result in a drastically reduction of pollution levels. The reason being, that the combination of fuel modifications and vehicle technology can take effect quickly and have a particularly marked impact in the case of existing vehicles on the road (Figure 3).

One important aspect when considering reformulated fuels is the change in CO₂ emissions in the entire chain. According to US American and Scandinavian data reformulated gasoline as a whole results in a decline in CO₂ emissions, since the C to H ratio in the fuel is improved by the reduction in aromatics and by the addition of oxygen-containing compounds. Thanks to changes in refinery structure and different input materials for fuel production - less crude oil and use of residual oils for fuel and hydrogen production, natural gas and LPG as basic materials for MTBE and ETBE production - the CO₂ balance proves slightly favourable.

Key Criteria For Environmentally Sustainable Transport

There are two studies about the definition and use of key criteria for Environmentally Sustainable Transport (EST) under discussion, which are discussed in the following.

UBA-Study Sustainable Germany

The UBA published a study about "Sustainable Germany, Towards an Environmentally Sound Development", in November 1997 (UBA, 1997a), where criteria for a sustainable development in transport are discussed.

The purpose in defining environmental policy action targets was not to mark a final and absolute goal, but to initiate a process. In the study the environmental policy action targets relating to transport are discussed in detail for the problematic areas

- climate protection, CO₂ abatement,
- summer smog (ground level ozone),
- carcinogenic substances,
- nitrogen oxides (NO_x) and volatile organic compounds (VOC),
- noise,
- waste and waste disposal,
- conservation of nature and landscape protection and
- residential surroundings / urban compatibility.

In this first UBA study "Sustainable Germany" (UBA, 1997a), a "business as usual scenario" was compared with an "efficiency scenario" and an "efficiency + cost compensation scenario" in 2005 and 2010. All scenarios did only take the 1996 EURO 2 emission standard into account. The new standards for EURO 3 (2000) and EURO 4 (2005) were not considered for this study.

The result for 2010 proved that the exploitation of current technological possibilities to the full could generate considerable emission reductions. A number of targets for air pollutant emissions could be achieved. The target of a reduction of transport-related CO₂ emissions cannot be achieved with technological measures alone. Given that the volume of traffic will continue to increase, CO₂ emissions will exceed those of 1990 in the years 2005 and 2010, despite substantial reductions in fuel consumption. The goal of preventing cancer risks from benzene and diesel particulate matters cannot be achieved with these measures alone. In the case of road traffic noise in urban areas, little improvement is likely using current technological potential. A large proportion of the population will still be exposed to noise levels damaging to health.

As the volume of traffic is not affected, technical solutions are unsuitable for attaining the targets for residential surroundings, nature conservation and landscape protection. Besides activities for improving technological efficiency, policy action for sustainable mobility must therefore include measures for limiting the growth of traffic and for reducing the environmental stresses caused by traffic in urban areas.

German Case Study for Environmentally Sustainable Transport

The second study was made by UBA for the Pollution Prevention and Control Group of the OECD, which was established in 1994 as a Task Force on Transport to look into ways and means to significantly reduce the environmental impact of transportation. Starting from December 1994 an Expert Group met several times to prepare a proposal and to start work on a project on Environmentally Sustainable Transport (EST).

Table 1: EST Criteria For The German Case Study

Parameters	Criterion	Specification
CO ₂	- 80 %	all areas
NO _x	- 90 %	
VOC	- 90 %	
PM	- 99 %	
Noise	<= 65 dB(A) <= 55 dB(A) at daytime <= 45 dB(A) at night	all areas residential areas
Land Use	criteria has to be developed no extension of transport infrastructure	urban areas rural areas

The considerations for choosing the criteria for EST have been described in the report on phase 1 of the EST project (OECD, 1996). In addition to the EST criteria for CO₂, NO_x and VOC which have been agreed upon by all participating countries, criteria were also quantified for particulate matter and noise in the German case study as summarised in Table 1 (UBA, 1997b). As far as land use for transport purposes is concerned some suggestions are made, but further elaboration is needed to develop a reliable quantification.

The study examined different scenarios to reach the discussed EST criteria. For technological improvements of motor vehicles and advanced and alternative propulsions the best available technologies have to meet the given criteria in the most cost effective way.

In the following a number of advanced and alternative propulsion systems is discussed in relation to the EST criteria, i.e. CO₂-reduction, saving of primary energy and fossil sources, emissions reduction of precursors for summer smog (NO_x, VOC), reduction of carcinogenic substances and reduction of noise. The comparison of waste disposal, natural and landscape protection needs and residential environment conditions / urban compatibility is because of missing data or on the basis of a vehicle to vehicle comparison still impossible. The contribution of advanced and alternative propulsion systems to this criteria is also negligible.

The following summarised comparisons of alternative and advanced propulsion systems is an introduction to the current UBA work.

Natural Gas (NG)

NG can be used compressed at 200 bar (2,900 psi) as Compressed Natural Gas (CNG) or liquefied at -162° C (260° F) as Liquefied Natural Gas (LNG). In Germany the fuels have to be compressed at the fuelling station or have to be transported as LNG to the fuelling stations. Because the production of CNG is technologically easier for fleet applications, cheaper and with lower fuel consumption than LNG, all applications in Germany for NG are CNG vehicles.

Europe has a distribution net for the fuel, and the technology to use natural gas as an alternative fuel is available. Pipeline quality natural gas, with its high methane content - corresponding to high octane rating - is an ideal fuel for spark-ignited engines.

Greenhouse Gases, Limited Emissions, Noise

Natural gas resources will reach up to the year 2050 and beyond. World-wide, large quantities of natural gas are burnt off and therefore wasted. In the case of using NG, which would be flared in the refinery or wasted otherwise, the greenhouse gas reduction can be up to 100 % in comparison with using any other fossil-based fuel, such as gasoline or diesel, which can be saved in that case.

The comparison of the primary energy use for the production processes of CNG and gasoline shows that the primary energy consumption for both fuels is comparable. In its demonstration project for CNG-usage UBA considered a scenario of 10 % NG heavy duty vehicles in Germany and calculated a slight increase of equivalent greenhouse gas emissions of +0,07 % It can be concluded, that the use of NG in heavy duty vehicles will not result in a significant increase of greenhouse gases.

The main advantages of natural gas are very low emissions of NO_x and PM. Using NG in local bus fleets results in a 85 % reduction of NO_x (1 g/kWh in European 13-Mode-Test). The particulate matter (PM) emission is below the detection limit (i.e. 0.02 g/kWh in European 13-Mode-Test). NO_x and PM are the main and problematic emissions of diesel buses.

Furthermore the noise emission of NG buses is in the order of 3 to 5 dB(A) lower, while the subjective annoyance is much lower at the same time, because the gas engine is running much smoother.

The use of NG in passenger cars can result in a Ultra Low Emission Vehicle (ULEV) standard, as the first ULEV has been a NG vehicle.

Costs, Other Restrictions

It must be noted that the implementation of CNG into a heavy duty vehicle is more than just converting and installing a gas-powered engine.

Refuelling and storage of the gas must be carefully considered to meet the operational and safety requirements. For storing compressed natural gas at 200 bar pressure, a large tank is needed. The kind of heavy-duty vehicle for which the use of natural gas has the most advantages is the urban bus where the tank is usually installed on the roof. But heavy-duty vehicles have also been fitted with underfloor installations. Using CNG in passenger cars can result in a reduction of useful space inside the vehicle because of the storage tank.

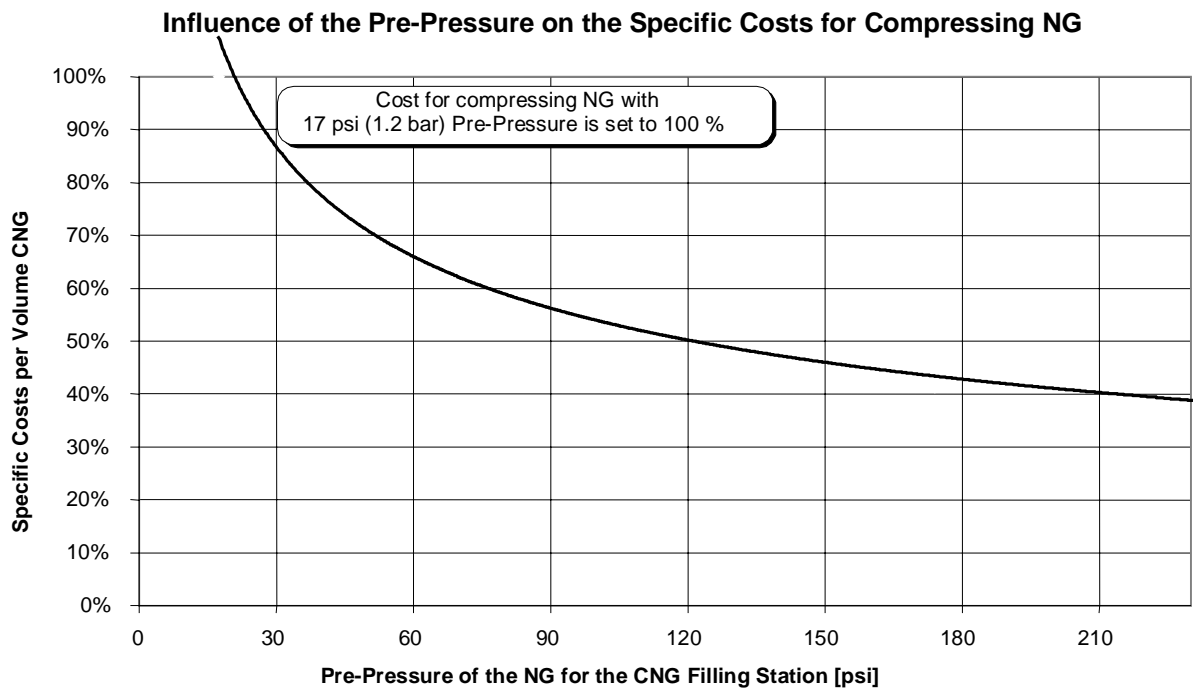
Natural gas engines cause additional capital costs for the vehicle's engine and the storage tank system and further cost for the compression of natural gas, covering investment, operation and maintenance of the filling station. The present additional retail prices for heavy-duty vehicles with natural gas engines and storage system (e.g. buses for urban transportation), are between 40,000 and 70,000 DM (22,000 to 39,000 US\$). In comparison to the total prices for an urban bus (440,000 to 500,000 DM; 244,000 to 280,000 US\$) the additional price for the natural gas application causes an increase of the retail price of 8-16 % for a heavy-duty vehicle with natural gas engine.

As a conservative estimate, a further reduction in extra investment costs for natural gas busses (in comparison to diesel busses) from a current 40,000 to 70,000 DM per bus to about 25,000 DM (14,000 US\$) per bus can be expected through the dissemination of the technology in new markets in the next 10 years. Further markets for natural gas busses in addition to Germany and the Netherlands are, among others, France, Australia, Sweden, Eastern Europe, China, Mexico and further applications in Italy.

In order to achieve comparable environmental relief in regard to PM and NO_x with the same investment costs, the extra costs of any alternative and advanced propulsion system for buses with comparable low emissions of NO_x and PM should not be higher than 14,000 US\$ or 25,000 DM at the most and thus be not more expensive than the future natural gas busses. The emission reduction with NG buses is sufficient in comparison to today's use of diesel buses, as NG buses can contribute to the improvement of the urban air quality.

The additional costs for the fuel in Germany are affected by the fuel tax for diesel fuel and natural gas. The UBA calculated the fuel costs for a typical urban bus with diesel engine and with natural gas engine for Germany. Current NG buses have a typical additional fuel consumption of 25 %. On the basis of the present German fuel tax on natural gas (since October 1995), natural gas buses cause 22 % lower fuel costs than a comparable diesel bus. In further consideration of the European minimum fuel tax (92/81/EEC), the saving in fuel costs for natural gas could be increased by another 4 % from 22 % to 26 % in comparison to diesel fuel in Germany.

To store natural gas, it has to be compressed to 200 bar (2,900 psi) at the filling station. The configuration of the filling station according to the individual demands of the customer is of great importance to minimise the costs. The quality of the natural gas and the pre-pressure of the supply is an important factor. A high pre-pressure reduces the necessary compression power and the operating costs. In Figure 4 the influence of the pre-pressure of a filling station to the ratio of the specific costs per volume of compressed natural gas are compared. The costs were calculated by WAHL (1995) for a basic compressor station with 100,000 DM (55,000 US\$). The gas energy consumption of an urban bus was calculated with 52 Nm³/100 km.

Figure 4: Influence of Pre-Pressure on the Specific Costs for Compressing NG

The additional costs of NG bus fleets were calculated in the *THERMIE (1997)* project with 7 % including all costs for additional staff, filling station, etc..

To smooth the way for gas power technology into series production through fleet testing and verification of fitness for use under practical conditions, the German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety and the UBA take promotion measures in the form of investment projects providing for considerable grants to be paid out to operators of new NG vehicles to compensate them for the extra cost they incur compared to diesel fuelled vehicles. An overview is given in *RODT et al. (1998)*.

In Germany, about 80 natural gas filling stations are available now. NG vehicles are therefore operated mainly in fleets which are based close to filling stations.

In connection with the above-mentioned investment project "Model operation of NG vehicles" the UBA drew up a list based on information provided by the manufacturers. This list shows the NG Vehicles available in all categories which satisfy the emission requirements for the vehicles taking part (Table 2).

When looking at the project from the environmental aspect, the promotion of gas-powered vehicles is particularly important wherever they help in our cities to reduce both the particulate emissions hazardous to health and the nitrogen oxide emissions which contribute to the formation of summer smog (ozone), i.e. wherever vehicles with diesel engines are replaced. This affects mainly city busses and light-duty commercial vehicles (e.g. delivery vans). Promoting gas-

powered passenger cars seems to make sense also where diesel-fuelled cars are concerned which cover great distances throughout the year like for instance taxis do.

Table 2: Overview of NG Vehicles available which meet the requirements of the Investment Project "Model Operation of NG Vehicles" (2/1998)

	New Vehicles				Retrofitted	
	Cars	Light-duty vehicles	Trucks	Busses	Cars	Light-duty vehicles
Manufacturers	6	5	5	3	2	1
Types	18	15	9	7	13	6
Rated power in kW	44 - 95	44 - 105	75 - 175	140 - 228	44 - 85	51 - 95
Maximum permissible weight in t	1.4 - 2,8	1.6 - 3.5	4.3 - 26	11.5 - 28	1.4 - 2.0	2.8 - 3.5
Mixture formation: $\lambda=1$	18	15	7	3	13	6
Lean burn	-	-	2	4	-	-
Operation: Monovalent	1	1	9	7	4	4
bivalent	5	1	-	-	-	-
optional	12	13	-	-	9	2
Extra costs in DM thousands	2.3 - 9.7	5.8 - 13.2	10 - 92	70 - 94	5.5 - 12.5	5.9 - 6.5
Extra costs in US\$ thousands	1.3 - 5.4	3.2 - 7.3	5.5 - 51.0	38.8 - 52.0	3.1 - 6.9	3.3 - 3.6

Liquefied Petroleum Gas (LPG)

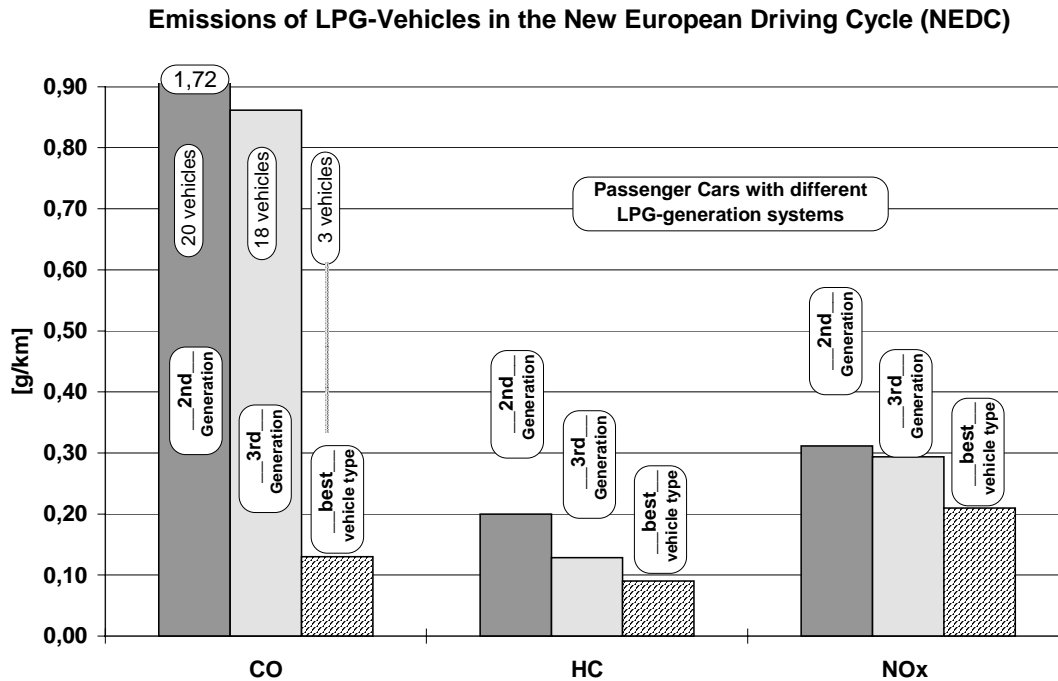
In principle, LPG can be used in the same engines as NG. In contrast to NG, which is stored under high pressure (200 bar, 2,900 psi), LPG can be used at much lower pressures (max. 10 bar, 145 psi). Therefore, from UBA's point of view, LPG should not only be used in heavy duty vehicles, where the space needed for the tank is not as problematic as in passenger cars. LPG should also be used in passenger cars.

Greenhouse Gases, Limited Emissions, Noise

Liquefied Petroleum Gas (LPG) is a by-product from crude oil. It occurs with the exploitation of crude oil and has to be separated from the crude for transport, or is a by-product in refineries. Each metric ton of crude oil results in 2 to 4 kilograms of LPG. Even, if it is just an energy loss of 0.2 to 0.4 % of the exploited crude oil, it is one of the easiest possibilities to save fossil fuels in the energy chain. LPG is also produced in the refinery. 60 % of the world LPG production stem from the crude oil exploitation and 40 % from the refinery processes (GLÖCKEL, 1997).

Using LPG in transport instead of burning it as a waste gas at the oil fields or in the refinery will save other fossil fuels immediately. The use of LPG results in comparable energy efficiency for the energy chain of exploitation, refinery and use as gasoline and diesel.

Figure 5: Emissions Of Dedicated LPG-Vehicles In The New European Driving Cycle (RIJKEBOER, BINKHORST, 1998)



The emissions during use of LPG in the vehicles are comparable to the emissions of gasoline engines. In the Netherlands In-Use-Compliance tests were made for LPG passenger cars (RIJKEBOER, BINKHORST, 1998). In conclusion, the maintenance situation for the vehicles tested was in fact very good. LPG-vehicles complied with the current limits without any problems. The engine technologies are already in their third generation, which are described in the In-Use-Compliance Programme as following:

- 1st generation: Mechanical system with mechanical control of the metering; no closed loop.
- 2nd generation (analogue): Mechanical system with mechanical control. Additional closed loop control by means of a lambda sensor. This closed-loop control works relatively slowly.
- 2nd generation (digital): System whereby the flow takes place as previously via the venturi, but whereby the metering is regulated by a microprocessor with pre-programmed „engine maps“. Here the closed loop control is also by means of a lambda sensor. The control can be more accurate, but the closed-loop is still relatively slowly.
- 3rd generation: This system distinguishes itself from the 2nd generation in that it is a self-adaptive system. Observed deviations in the air/fuel ratio are stored in the memory and processed in the digital control metering. In practice these are often multi-point injections.

The emissions of the different generations of LPG systems are given in Figure 5.

Table 3: Emissions In The 13-Mode Test For A 7.4 Litre LPG Engine Running With An Aged Catalyst ($\lambda = 1$)

g/kWh		HC	CO	NO _x	PM
LPG		0,5	1,8	0,5	-
Emission Limits for Diesel Engines					
EURO 1	1992	1,25	5	9	0,4
EURO 2	1996	1,1	4	7	0,15
EURO 3	2000	0,6	2	5	0,1

The emissions of LPG in heavy duty vehicle engines are far below the emission standards for EURO 3 heavy duty vehicles, which are discussed in Europe for the year 2000. *NYLUND, EKLUND (1994)* published data of a LPG-vehicle built in 1990.

The heavy-duty vehicle was equipped with a closed-loop fuel system and a 3-way catalyst. The 6 cylinder, 135 kW engine with stoichiometric mixture and natural aspiration has a compression ratio of 10:1. The maximum engine efficiency is high, ranging from 33 to 37 % at full load. Over the 13 mode test the engine shows favourable emission values with an aged catalyst (30,000 km) as summarised in Table 3.

The authors describe that with a more sophisticated fuel system (for example electronically controlled fuel injection) there is still a potential for further emission reductions.

Costs, Other Restrictions

At the moment most LPG passenger cars are dedicated concepts, which can run on gasoline fuel and LPG. Heavy duty vehicles and buses are optimised to LPG use only.

The biggest fleet of LPG buses is running in Vienna. *VAGT (1995)* calculated the additional costs for a bus with liquefied gas (LPG) engine with 40,000 DM (22,000 US\$), which means additional costs of 9 % compared to a standard diesel bus and in comparison to the 40,000 to 70,000 DM for a natural gas engine.

For the use of LPG there are no higher additional costs for the filling station in comparison to a filling station for diesel fuel, as needed for a bus fleet (*VAGT, 1995*). The author calculated for a German diesel fleet of 40 buses overall costs of 3.13 DM/km (1.08 US\$/mile), with regard to the costs of the vehicles, operational costs and fuel station costs. For a comparable fleet with vehicles running on liquefied gas overall costs of 3.14 DM/km, which are additional costs of +0,3 % only, were calculated.

LPG can turn the additional costs in the same way as NG into an effective investment, because the low emissions of gas vehicles contribute significantly to the improvement of air quality in comparison to the usually used diesel engines in heavy duty vehicles.

Hydrogen (H₂)

Hydrogen is usually used as compressed hydrogen (CH₂) with 200 bar or liquefied hydrogen (LH₂) at -252° C (422° F). H₂ is a secondary energy, which means that it has to be produced from other fossil or non-fossil energy sources.

Greenhouse Gases, Limited Emissions, Noise

It is often proposed to use hydrogen in road transport instead of carbon containing gases because of the CO₂ advantage. Evaluating the total fuel life cycle shows that using other fossil primary energy for the production of H₂ does not result in a net advantage (Figure 6). Hydrogen is either produced from natural gas with efficiency losses and higher CO₂ emissions than the direct use of methane for automotive propulsion or by using hydroelectric power where again the electricity could be used directly more efficiently.

Hydrogen as a fuel for road applications will have its main advantages when producing it with renewable resources, such as electricity from renewable energy or from biomass.

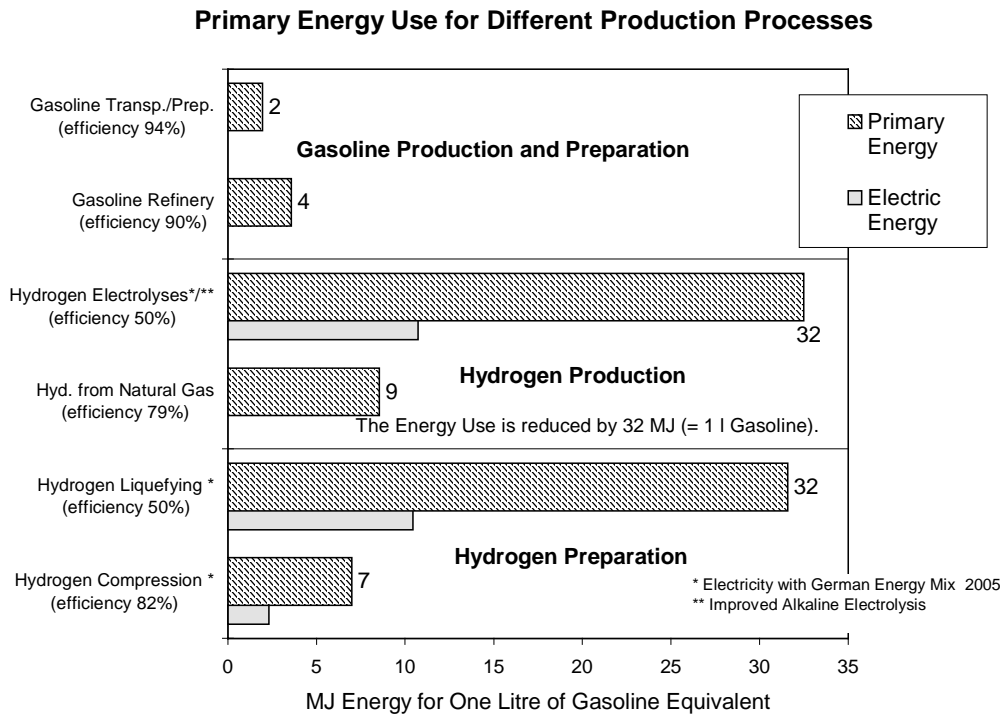
It is true, that from the environmental point of view there is an urgent need to introduce technologies using renewable power sources for producing heat and electricity. *NITSCH et al. (1997)* examined all current studies, and summarised the development of solar energy systems and the role of hydrogen for the German example. They concluded that from the environmental point of view - also taking into account that the developed and industrial countries have to reduce their greenhouse gases by up to 80 % until 2030 - there is no necessity for the rushed market introduction of hydrogen within the framework of an efficient climate policy. The main steps toward a sustainable use of energy are the

efficient use of energy and a

local use of renewable energy sources

with highest priority. Efficient technologies and the local use of renewable (thermal and electric) energy can produce more energy services or higher CO₂ emission reductions with the same monetary expenditure. In this regard the first priority is to promote fuel efficiency technologies and to improve and produce cheaper solar thermal and photovoltaic systems than the current production.

Figure 6: Comparison Of The Primary Energy Expenditure For The Production And Processing Of Gasoline And Hydrogen (KOLKE 1998)



The adaptation of the electricity demand to the solar supply with differentiated price structures according to the supply and with special intermediate storage systems (e.g. cooling equipment, disconnectable heating pumps) can reduce the solar surplus during day time. This will allow to use the energy produced on sunny days or during windy periods in periods of missing offer of the renewable energy. It was also concluded, that the production of hydrogen from solar power can only be of interest from the environmental point of view, if the solar share of the fossil and the renewable electricity generation reaches more than 40-50 %.

Hydrogen can be used in internal combustion engines or fuel cells. If hydrogen is used in an engine, emissions of CNG-engines are comparable to hydrogen engines, regarding the exhaust emissions of the relevant NO_x and PM emissions. Instead of using a combustion engine research efforts are made to use hydrogen fuelled fuel cells in vehicles which can be in principle more efficient than using methanol in a fuel cell.

Costs, Other Restrictions

Hydrogen from renewable sources will have additional costs in comparison to the costs needed to generate renewable electricity. The energy content of gaseous hydrogen is reduced to 65 % of the solar production electricity. The costs including transport will be twice the costs of the solar electricity. Using liquefied hydrogen results in a 50 % reduction of the solar electricity and causes more than 4 times of the costs of solar electricity. (NITSCH *et al.*, 1997)

It can be concluded, that the use of electricity from renewable sources (e.g. photovoltaics, wind power) should be used directly, which is cheaper and has more environmental benefits than the production of hydrogen from this electricity.

If hydrogen is produced or available it can be used for the production of reformulated gasoline and diesel fuels in refineries and can result in an overall emission reduction for the whole vehicle fleet running on reformulated gasoline.

Electric Vehicles (EV)

The most comprehensive field test study about EV's was made with about 60 vehicles on the German Baltic island Rügen. The comparative eco-balance was performed by the German ifeu - Institute for Energy and Environmental Research Heidelberg. The following passages are a short summary from *DAUG (1996)*:

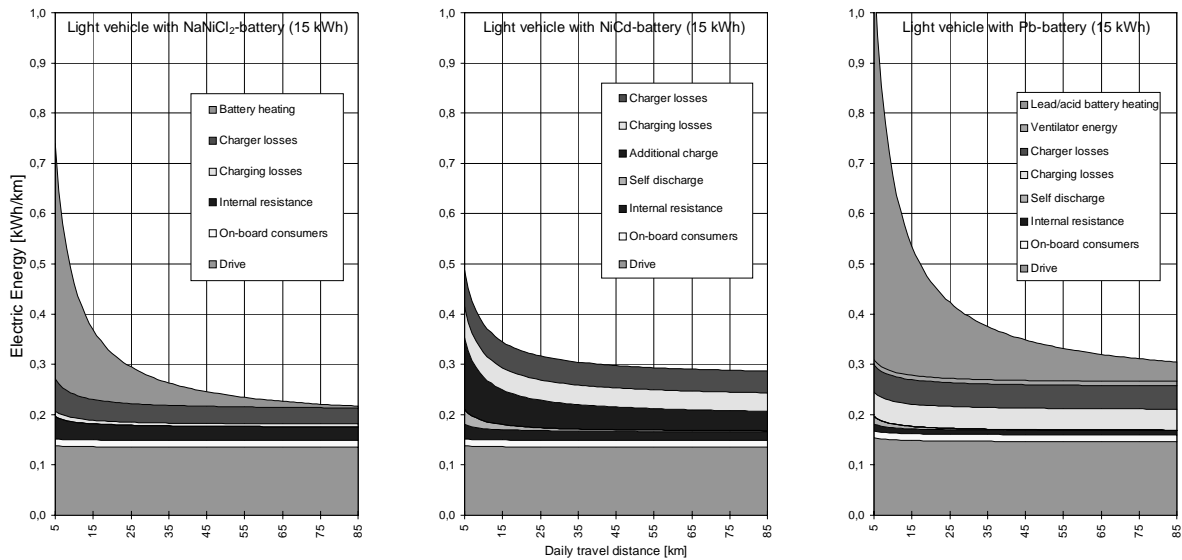
Greenhouse Gases, Limited Emissions, Noise

Energy consumption and emissions of the vehicles depend on a large number of parameters. The most important of these energy consumption parameters are the driving energy, the battery consumption (internal resistance consumption, battery heating, recharging energy, efficiency of charging, self-discharge), the secondary energy consumption (charging converter) and the additional heating, as summarised in Figure 7 for different battery systems.

The comparison of electric motorcars with conventional cars are for EV's very dependent on the electricity generation in each country and did not even produce a uniform picture in Germany 1996 (Figure 8). In 2005 more than 50 % of the electricity will be generated by coal power plants and around 5 % of the electricity will be renewable.

The advantages of the electric motorcar over the conventional car include that the electric car does not generate emissions which are toxic to humans and which damage physical assets directly at the site of deployment. The electric cars generate less noise and contribute to a lesser degree to summer smog and nitrogen input into soils and water bodies. The disadvantages of the electric motorcar include that it has a higher acidification potential and a stronger climatic impact. These disadvantages increase with decreasing daily kilometre performance and can only be compensated under special conditions of deployment such as very frequent short distance drives.

Figure 7: Specific Power Consumption of Light Electric Cars as a function of the daily driven distance when equipped with 15 kWh electric storage of the systems NaNiCl₂, NiCd (Economic Charging Behaviour), Pb-Gel (all without standstill day, annual mean)



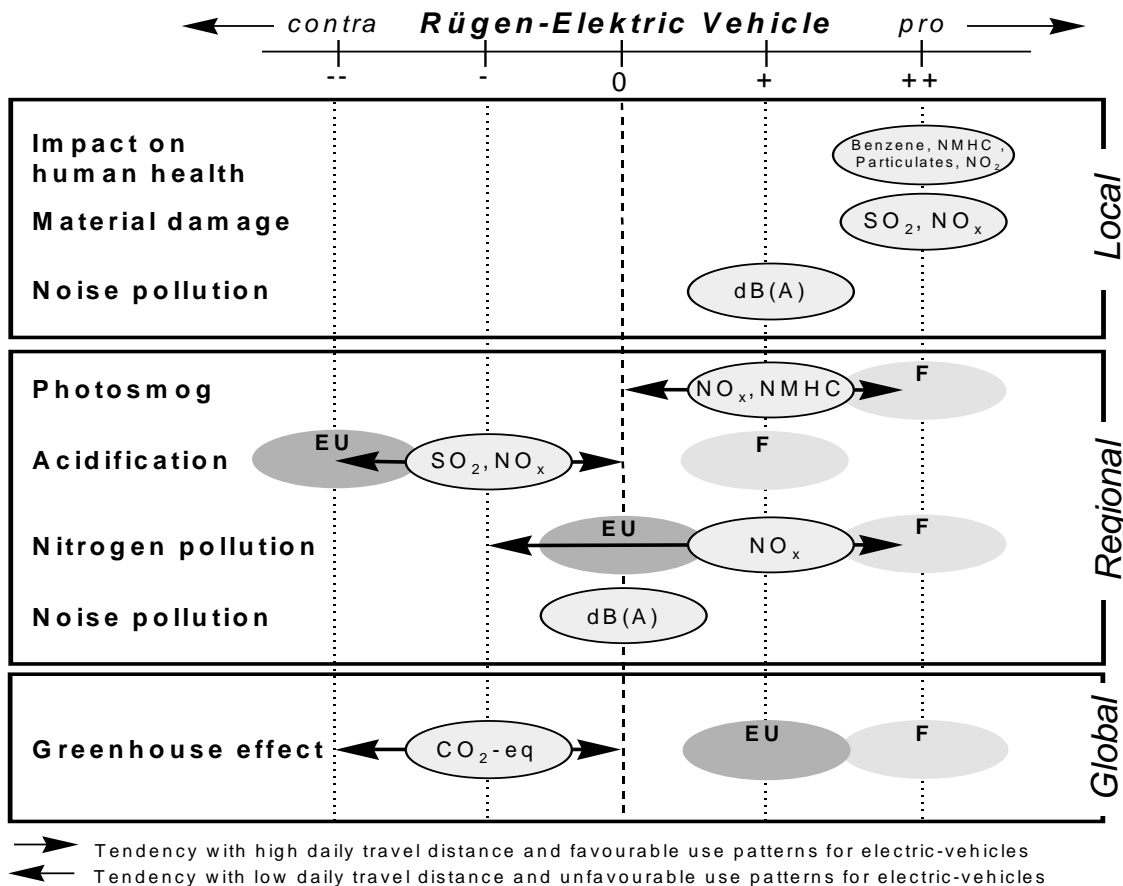
Costs, Other Restrictions

From the UBA's point of view, the EV has to be compared with the best available technology of internal combustion engines. Because of the EV's advantage of local zero emission, the comparisons are made between the additional costs of an EV, which are dominated by the battery costs, and the additional costs for an Ultra Low Emission Vehicle (ULEV-) standard, in comparison to a current TIER I emission standard vehicle. The additional incremental cost of an ULEV are between 84 US\$ and 200 US\$, depending on the size of the engine (CARB, 1996). The battery costs for the EV are calculated with the development goals, given by CARB (1994). The incremental costs are 2.7 to 5.3 cent/mile for the battery depending on the type and specific costs of the battery. KOLKE (1995) calculated from this data costs of 2,700 to 6,400 US\$ for the additional incremental lifetime cost of the battery for an EV.

It can be concluded that on the basis of a TIER I vehicle for the additional incremental cost of only one electric vehicle the additional incremental costs for the ULEV technology of up to 75 vehicles can be financed. From the environmental point of view the cost effectiveness of a complete introduction of a ULEV standard for all vehicles is higher than having some 10 % of EV's, 15 % of ULEV and 75 % of Transitional-Low-Emission Vehicle (TLEV).

Figure 8: Schematic Representation Of Environmental Impacts Of Electric Motorcars, Deployed In The Rügen Test, Compared With Conventional Cars In Germany In 1996; Variants For France (F) And Europe (EU) In 1996

Electric motorcars (involved in the Rügen test) and cars with internal combustion engines in Germany in 1996 : Local, regional and global impact of pollutant emissions and noise in a schematic comparison - Variants of power generation in France and Europe in 1996



Reading example: Based on the criterion "Formation of **summer smog** by emissions of NO_x and NMHC", in contrast to the conventional car, the Rügen test electric motorcar is to be evaluated as follows: in Germany in 1996: positive; when using electric power generated in France: very positive; when using European power (EU covered by Germany): positive. The advantage decreases with decreasing kilometre performance.

Schematic representation of environmental impacts of electric motorcars, deployed in the Rügen test, compared with cars with combustion engines according to selected criteria on the basis of the results of the project entitled "Testing of electric vehicles of the latest generation on Rügen Island". The comparison is based on:

Data measured in the Rügen test on vehicles of the firms Adam Opel, BMW, Mercedes-Benz, NEOPLAN, and Volkswagen. The batteries were supplied by the firms AEG Anglo Batteries, ABB Hochenergiebatterie, DAUG-HOPPECKE and Varta.

Computation from raw energy delivery to final energy utilisation. Additionally, the energy required for the components which differ in electric motorcars and cars with combustion engines were considered.

Otto and diesel cars meet the EURO-II-limit-values. Reference area and year: Germany, 1996; Variants (not encircled) for the use of electric motorcars in France in 1996 and in Europe in 1996

Specific total emissions, summarised for site of generation and impact, based on the use pattern: 4 drives daily of 5 km each per day inside communities, 1 standstill day per week, annual mean of temperature impacts.

IFEU Heidelberg 1996

The use of EV's make sense in ecological sensitive areas or enclosed indoor facilities which have a proven need for zero emissions. In typical road traffic situations, highest priority should be given to the introduction of stringent emission limits, such as the ULEV standard or the EURO 4 standard for gasoline vehicles.

Fuel Cells (FC)

At the moment, FC vehicles are discussed as one of the most promising technologies for the future. Hydrogen, methanol and even gasoline are discussed as fuels for the vehicles. Further differentiation must be done for the different possibility of producing the fuel.

From UBA's point of view, the first step of a R&D-programme must be the detailed and realistic estimation of the environmental effects and the costs for the applications in comparison to the best available technology. Only in the case, that a transparent analysis will show a cost competitiveness of fuel cells, assuming that they reach a sustainable emission reduction, the fuel cell application could be an alternative technological and realistic solution for reducing emissions in road transport.

Greenhouse Gases, Limited Emissions, Noise

The efficiency of the fuel cell vehicle and their costs will be one of the main problems on its way to become the car of the future. The UBA did investigations for different cars of the future, based on the assumption of a likely development. The comparisons were made relative to a competitive fuel efficient vehicle with gasoline engine, which is available as a prototype, the *SMILE* Concept developed with help from *GREENPEACE* (1996). This car has room for four passengers, a curb weight of 650 kg, a fuel consumption of 3.25 l/100km (72 mpg) and can reach an ULEV emission level. The calculations of the incremental costs were made for the efficient ULEV with a 40 kW engine and for a fuel cell vehicle with a mechanical power of 15 kW, a nominal engine power of about 18 kW (peak about 32 kW) and a fuel cell power of 40 kW. Two types of vehicle were examined,

the fuel cell vehicle with compressed hydrogen storage and

the fuel cell vehicle with methanol and reformer.

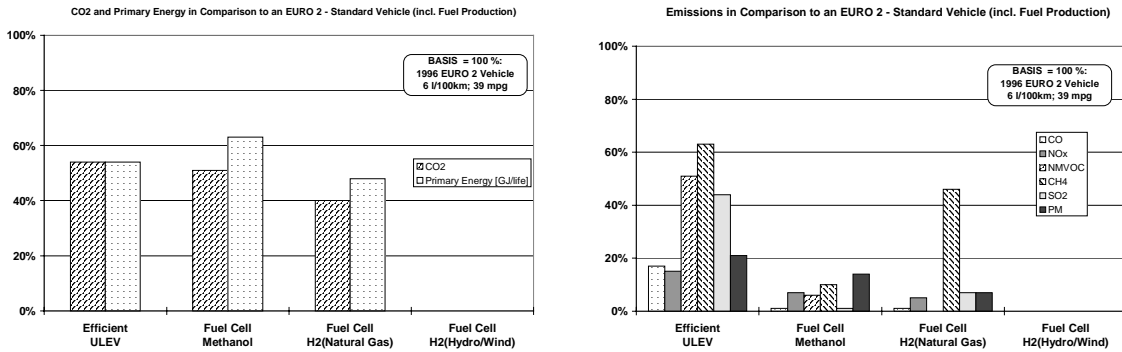
The calculations showed, that the weight for the storage system and the propulsion components (engine, fuel cell, reformer, etc.) will be between 2 and 3 times higher than for the gasoline fuelled car of the future.

The main advantage of the fuel cell vehicle are the very low emissions. UBA calculated the emissions of the efficient ULEV and the fuel cell vehicles under consideration of the emissions for fuel production, and compared them to a 1996 EURO 2 gasoline vehicle (fuel consumption 6 l/100km or 39 mpg). The fuel consumption data for the fuel cell vehicles were given by *DAIMLER* (1997) with 20 kWh/100km and 26 kWh/100km (hydrogen, methanol) for a 730 kg vehicle.

The efficient ULEV gives already noticeable emission reductions of about 50 %, up to 85 %. The reduction of the direct emissions is sufficient for achieving the air quality targets in Germany. A further reduction of the direct emissions will not be necessary, if all vehicles will comply with this or a comparable emission standard. Comparing the directly and indirectly caused emissions, the

fuel cell vehicles with very optimistic fuel consumption data can reduce emissions further in all cases (Figure 9).

Figure 9: Emission Of Different Vehicle Types In Comparison To A Vehicle Available Today (EURO 2)

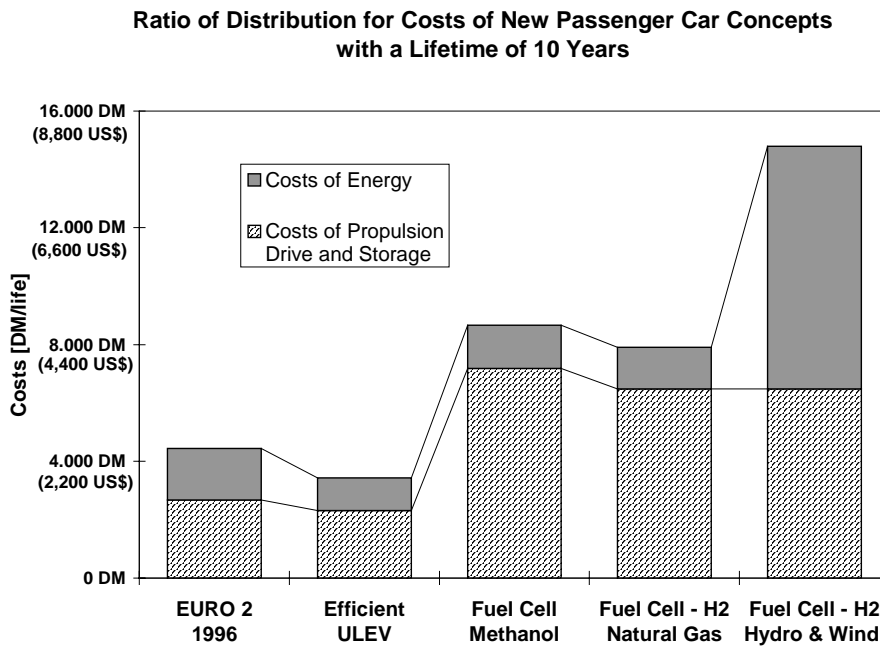


The main rating parameter will be given by the relation of the additional costs for the new technologies to the benefit, which is the reduction of emissions and primary energy use in comparison to a vehicle available today (1996, EURO 2, 39 mpg). These parameters will describe the specific avoidance costs. A summary of the additional calculations are given in the following chapter.

Costs, Other Restrictions

To calculate the avoidance costs for passenger cars in comparison to a today available EURO 2 standard vehicle, the emission reductions are compared to the vehicle extra costs in order to determine the relationship between benefits for the environment and costs. The vehicle extra costs are composed of various cost components which contain for the most part the drives and storage costs as well as energy costs for operation. The determination of the extra costs for the drives is carried out on the basis of an analysis and calculation of the specific costs. Figure 10 shows the basis of the calculation of the cost distribution with fuel cell costs of 100 DM/kW. Further calculation are summarised below.

Figure 10: Ratio Distribution Of Costs For Passenger Car Concepts



As in the long term the most important necessity will lie in the reduction of greenhouse-relevant CO₂ emissions, the following results summarise the calculations for the reduction of greenhouse gases. UBA also took the further US-target data for fuel cell technology into account, which are characterised by the costs published in the Ford/DOE-programme and summarised in *SIMS (1997)* with 18-24 US\$/kW (≈32-42 DM/kW) manufactured costs for the FC-stack. Another calculation was made with the development goal of 50 US\$/kW (≈88 DM/kW) for an implementation strategy for the whole FC propulsion drive.

Table 4 proves that even with the most successful development of fuel cell technology for transport (88 DM/kW_{FC Drive Line}), the costs for avoidance of the greenhouse gas CO₂ can rise up to 200 US\$ per metric ton. The avoidance costs are at least 150 DM (83 US\$) per metric ton of CO₂ more than the avoidance costs of an efficient vehicle with internal combustion gasoline engine and ultra low emissions.

UBA made further comparisons of the costs and the possible emission reductions of fuel cell buses, which will be driven with hydrogen, and buses with internal combustion engine and natural gas (NG). While the first system can reduce the critical emission components of NO_x and particulate matter (PM) in comparison to a diesel bus completely, the natural gas bus can reduce NO_x for 85 % and PM more than 99 %. The cost comparison shows that fuel cell technology is not a technology for public busses in the foreseeable future. FC buses have to contribute to a comprehensive reduction of exhaust gas pollution at comparable costs to the best available technology (i.e. NG buses).

As there are no real data for the future costs of FC buses available, the comparison has to be made on the basis of the best available competitive technology, which is the NG bus. The production-ready and available NG technology has additional costs of 40,000 to 70,000 DM today (22,000-39,000 US\$) which can be reduced to 25,000 DM (14,000 US\$) in the next 10

years. A reduction of pollutant emission of busses beyond the exhaust gas reduction of a natural gas bus with three-way catalytic converter and λ control is not necessary from today's view of air pollution abatement.

Table 4 : Analysis of Incremental Costs and CO₂ Avoidance Costs for various Drive Line Systems under consideration of Drive Line and energy costs and varying boundary conditions

Drive variant	Boundary conditions	Incremental Costs for Drive-Line and Energy compared to EURO 2 (10 years, 13,000 km/year)	CO ₂ Avoidance Costs
Compact car			
highly efficient ULEV	<ul style="list-style-type: none"> ULEV Drive Line: 58 DM/kW (32 US\$/kW) energy costs: 0.27 DM/l 	-23 %	-110 DM/metric ton 61 US\$/metric ton
Fuel cell-methanol 180DM; 100US\$ /kW _{FC Drive}	<ul style="list-style-type: none"> FC Stack: 100 DM/kW (55 US\$/kW) energy costs: 0.19 DM/l_{methanol} 0.17 DM/Nm³_{H2/natural gas} 0.96 DM/Nm³_{H2/renewable} 	+95 %	420 DM/metric ton 233 US\$/metric ton
Fuel cell-H₂-natural gas 162 DM; 90US\$ /kW _{FC Drive}		+78 %	280 DM/metric ton 155 US\$/metric ton
Fuel cell-H₂-renewable 162 DM; 90US\$ /kW _{FC Drive}		+233 %	500 DM/metric ton 278 US\$/metric ton
Fuel cell-methanol 119 DM; 66US\$ /kW _{FC Drive}	<ul style="list-style-type: none"> FC Stack: 42 DM/kW (24 US\$/kW) energy costs: 0.19 DM/l_{methanol} 0.17 DM/Nm³_{H2/natural gas} 0.96 DM/Nm³_{H2/renewable} 	+43 %	190 DM/metric ton 105 US\$/metric ton
Fuel cell-H₂-natural gas 94 DM; 52US\$ /kW _{FC Drive}		+26 %	90 DM/metric ton 50 US\$/metric ton
Fuel cell-H₂-renewable 94 DM; 52US\$ /kW _{FC Drive}		+181 %	390 DM/metric ton 216 US\$/metric ton
Fuel cell-methanol 109 DM; 60US\$ /kW _{FC Drive}	<ul style="list-style-type: none"> FC Stack: 32 DM/kW (18 US\$/kW) energy costs: 0.19 DM/l_{methanol} 0.17 DM/Nm³_{H2/natural gas} 0.96 DM/Nm³_{H2/renewable} 	+34 %	150 DM/metric ton 83 US\$/metric ton
Fuel cell-H₂-natural gas 84 DM; 47US\$ /kW _{FC Drive}		+17 %	60 DM/metric ton 33 US\$/metric ton
Fuel cell-H₂-renewable 84 DM; 47US\$ /kW _{FC Drive}		+172 %	370 DM/metric ton 205 US\$/metric ton
Fuel cell-methanol 88 DM; 50US\$ /kW _{FC Drive}	<ul style="list-style-type: none"> FC Drive Line: 88 DM/kW (50 US\$/kW) energy costs: 0.19 DM/l_{methanol} 0.17 DM/Nm³_{H2/natural gas} 0.96 DM/Nm³_{H2/renewable} 	+12 %	50 DM/metric ton 28 US\$/metric ton
Fuel cell-H₂-natural gas 88 DM ; 50US\$ /kW _{FC Drive}		+11 %	40 DM/metric ton 22 US\$/metric ton
Fuel cell-H₂-renewable 88 DM; 50US\$ /kW _{FC Drive}		+166 %	360 DM/metric ton 200 US\$/metric ton
<ul style="list-style-type: none"> System costs DM/kW_{FC Drive Line} related to the fuel cell power output of 40 kW, contains costs of all components (drive, fuel cell, etc.) 			

However, fuel cell technology is a promising future technology. But a differentiated look at the use of fuel cells is required from an environmental point of view, according to the energy services which they are going to provide and the available or foreseeable alternatives in each case. The FC use in the stationary area appears to be sensible and capable of development, since they can

already convert fossil energy sources (e.g. natural gas) into electricity and heat or coupled with cooling production much more efficiently than previous power-plants or heat producers.

Main Options To Reach The Environmental Targets

The main results of the scenario construction in the German Case Study of the OECD Project on Environmentally Sustainable Transport (EST), summarised in *UBA, (1997b)* has been, that environmentally sustainable transport as defined by the EST criteria will not be possible to achieve without **managing traffic growth**.

With respect to everyday personal travel, changes in land use and infrastructure supply which allow for more densely populated and mixed use settlement patterns will result in lower transport needs and shorter trips. Regarding vacation and leisure trips the appeal of locations closer to home should be increased.

This does not mean that the necessary technological innovations will be introduced easily, but the main technologies discussed in the context of the scenarios (e.g. fuel efficient ULEV-technology, EURO 4-technology, natural gas engines, lean burn engines, direct injection gasoline engines) are already available in principle or in the near future, while coping with traffic growth requires new policies.

In order to further reduce the emission of pollutants from passenger cars with conventional Otto engines, **fuel efficient passenger cars and light duty vehicle with ULEV or EURO 4 (Gasoline)** standard are the best options for the necessary reductions of emissions in order to meet air quality targets in the transport sector. The extra costs in comparison to a current car are low in comparison to other alternative propulsions. In addition, at least a halving of the fuel consumption of today's vehicles is possible through technical engine and vehicle-related improvements.

For **heavy duty vehicles and public busses**, pollutant emission can be drastically reduced today by the use of **natural gas** and the typical problem of nitrogen oxide and particles emitted by diesel vehicles in cities can thus be solved. Further research is required however in order to reduce the consumption of natural gas engines and thus their emission of greenhouse gases.

The use of **hydrogen** in transport is not to be supported because of the high energy losses in production and processing of the energy source. In contrast, the direct use of natural gas as opposed to the production of **methanol** is to be preferred for a sustainable use of resources. Even in the case of a possible use of **renewable energy** in transport, the replacement of fossil-powered power-plants by renewable energy (solar power, wind energy, water power) makes more sense than the replacement of gasoline powered vehicles with internal combustion engines by hydrogen drives. Cable-connected means of transport are available for the direct use of renewable energy in transport (trolley bus, tram, railway).

The use of **electric vehicles** only makes sense in ecological sensitive areas or indoor facilities which have a proven need for a zero emission.

There is a necessity to protect the limited fossil resources. The most efficient protection of resources is **energy saving**. A halving of today's fuel use would mean a doubling of resource efficiency. In addition, renewable energy sources should be supported in those places where they can be used in an energy-efficient and - in the foreseeable future - a cost-effective manner.

The processing and production of fuels from renewable energies with large losses is therefore not to be supported precisely for reasons of resource protection.

What is most important about the discussion on Environmentally Sustainable Transport, however, is to stimulate public discussion on sustainable transport. This discussion is a necessary condition for achieving a common understanding of the problems. Environmentally Sustainable Transport means more than the definition of environmental criteria and the only use of alternative and advanced propulsions. A vision must be developed which shows the attractiveness of sustainable transport furthering a consensus on the concept and acceptance of a variety of measures to be taken.

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2. CITYCAR MARTIGNY SWITZERLAND

by François Kuonen, CityCar Martigny

1. Préambule

1.1 Description

L'accroissement anarchique du trafic en milieu urbain est une menace pour les villes. Pollution, bruit, détérioration de l'environnement et de la qualité de vie sont autant de problèmes qu'elles doivent maîtriser. Beaucoup d'entre elles réagissent en encourageant l'usage de transports innovants, peu gourmands en énergie et favorables à l'environnement. C'est le cas de la ville de Martigny qui expérimente le projet pilote **CityCar**.

CityCar est un système de transport constitué d'une flotte de 30 micro-voitures Ligier Ambra électriques (2 places) à usage individuel en libre-service. Ces voitures sont réparties dans 20 stations implantées dans divers lieux de la ville. **CityCar** vise à offrir une alternative aux déplacements en voiture individuelle privée en proposant la même souplesse d'utilisation, mais en réduisant les problèmes de stationnement.

La plus importante entreprise de transports routiers de Suisse, **Car postal**, en collaboration notamment avec

la Commune de Martigny,

le service de l'énergie du canton du Valais,

le forum de l'air du canton du Valais,

l'office fédéral de l'énergie,

le programme de recherche européen UTOPIA,

a décidé de relever le défi de réaliser cette expérimentation. Dans ce but, un contrat de partenariat, pour une durée de 3 ans, a été signé, en date du 6 février 1998, entre Car Postal et la Ville de Martigny, site de l'expérimentation-pilote.

1.2 Objectifs du projet

Le projet **CityCar** a pour but d'évaluer le potentiel de marché ainsi que le comportement de la clientèle par rapport à des concepts novateurs de systèmes de transports dans les centres villes.

De plus, il permettra de tester, de mettre au point et de faire évoluer les composantes du système qui sont principalement :

- des **véhicules** automobiles compacts (flotte de 30 unités), électriques, adaptés à l'autopartage et au libre-service, ainsi qu'un service de minibus électriques à la demande ;
- un **système de gestion et de contrôle** en temps réel ainsi que des équipements électroniques faisant appel aux dernières connaissances en matière de transmission, de localisation par satellite et de télématique ;
- des **mesures d'accompagnement** à mettre en place afin de garantir un fonctionnement optimal et la rentabilité du système selon les caractéristiques du site d'implantation de la flotte.

2. Organisation et fonctionnement du projet

Le **CityCar accueil**, situé dans le centre-ville, permet la gestion administrative ainsi que le suivi des véhicules. Il est composé d'une partie administrative (administration, secrétariat, évaluation) et d'une partie technique (garage).

2.1 Partie Administrative

CityCar accueil



2.1.1. *Administration*

Ce secteur s'occupe notamment du contact avec la clientèle, de la planification des horaires du personnel, de la fourniture d'explications et démonstrations du concept aux personnes et groupes intéressés ainsi que de la facturation.

2.1.2. *Secrétariat*

Ce secteur s'occupe notamment de l'accueil des clients, de la saisie informatique des données recueillies dans les véhicules, de la correspondance ainsi que de la réservation des véhicules.

2.1.3. *Evaluation*

Ce secteur s'occupe de planifier, au fur et à mesure de l'avancement du projet, un certain nombre d'étapes d'évaluation, dans le but d'apporter les modifications nécessaires, d'améliorer régulièrement le système et de déterminer une éventuelle commercialisation.

2.2 **Partie technique**

2.2.1. *Atelier mécanique*

Dans l'atelier mécanique, les véhicules sont réceptionnés et équipés du système de gestion du véhicule. Ils y subissent régulièrement une analyse complète des équipements électroniques ainsi que le relevé des données concernant les batteries. Le personnel de l'atelier mécanique s'occupe également de la mise en charge des véhicules et de l'équilibrage des stations.

Garage



2.2.2. *Données techniques des véhicules*

Moteur	Type asynchrone
Batteries de traction	Puissance : 12 KW ou 18 KW Type : plomb-acide-gel (sans entretien)
Véhicule léger	Tension : 168 V (14 batteries) Capacités : 12 V, 50 à 90 A/h 2 places Roues avants motrices et directrices Vitesse maximale : 55 Km/h Changement de vitesse automatique Autonomie : 100 km

3. Avancement du projet

3.1 Etapes marquantes 1998-1999

➤ **Janvier – juillet 1998**

Cette période a été consacrée à la finalisation du projet, à l'obtention des soutiens nécessaires, aux prises de décisions formelles et à la mise sur pied de l'organisation de base (engagement des collaborateurs, recherche des locaux, séances techniques, etc.).

➤ **Août - septembre 1998**

Durant cette période a eu lieu le démarrage effectif de la phase d'expérimentation avec le test des prototypes de véhicules et la commande de l'ensemble de la flotte. L'installation des locaux du **CityCar accueil** a également été effectuée durant ces deux mois. En outre, les travaux liés à la numérisation de la ville et à l'essai du système de gestion ont été conduits.

➤ **Octobre 1998**

Le mois d'octobre a été marqué essentiellement par la présentation du projet à la population de Martigny. L'engagement des collaborateurs chargés du recrutement des pilotes d'essai, ainsi que la mise à disposition des 5 premiers véhicules, ont permis d'enregistrer d'emblée près de 300 inscriptions. Les 19 premiers pilotes ont également reçu les instructions relatives à l'utilisation des véhicules.

➤ **Novembre – décembre 1998**

Ces deux mois ont été marqués par le début effectif de l'expérimentation pilote, avec la mise en circulation des véhicules conduits par 19 pilotes. Cette mise en service a toutefois dû être opérée de façon progressive et sans le concours du système de gestion dont le développement n'avait pas atteint, à cette date, le stade opérationnel. Les enseignements tirés de cette première phase

devaient permettre, en 1999, de corriger les problèmes rencontrés et d'étendre l'expérimentation aux autres pilotes.

➤ **Janvier – février 1999**

Durant cette période, des séances d'information ainsi que le test du véhicule ont été organisés pour l'ensemble des pilotes. La livraison des véhicules a suivi son cours normal et les derniers véhicules ont été opérationnels à la fin du premier trimestre 1999.

➤ **Mars – avril 1999**

Cette période est marquée par la mise en place du système informatique de gestion des véhicules. Celle-ci permet le déroulement en grandeur nature de l'expérimentation.

3.2. Situation au 31 octobre 1999

A cette date, 440 pilotes d'essai ont été recrutés pour l'utilisation gratuite du véhicule. Le panel de pilotes est constitué des catégories suivantes :

Classes d'âge

18 – 25 ans	9.3 %
25 – 35 ans	28.6 %
35 – 50 ans	40.4 %
50 ans et plus	21.7 %

Secteurs d'activité

Primaire	0.0 %
Secondaire	18.1 %
Tertiaire	66.1 %
Etudiants	2.2 %
Retraités	13.6 %

Un questionnaire d'évaluation a été élaboré et envoyé aux pilotes en septembre dernier. Les résultats de ces investigations seront connus d'ici la fin du mois de novembre. Dans le détail, ce questionnaire porte sur les sujets suivants :

1) Transports

- densité des stations
- emplacement des stations
- capacité de la station
- nombre de véhicules par station
- potentiel de clients par station
- disponibilité des véhicules
- flotte de véhicules nécessaires (effet d'échelle)
- taux d'utilisation des véhicules
- fréquence des pannes

- longueur du trajet
 - temps d'utilisation
 - motif d'utilisation
 - tarification en relation avec la rentabilité
 - public-cible
- 2) Exploitation/gestion**
- électronique du véhicule
 - électronique de gestion/transmission
 - électronique du contrôle d'accès
 - électronique d'identification/paiement
 - logiciel de gestion
- 3) Energie**
- énergie nécessaire à la recharge
 - recharge par induction
 - batteries (longévité, fiabilité)
- 4) Clients**
- attractivité du système
 - disponibilité des véhicules
 - tarification
 - appréciation du véhicule
 - horaires d'ouverture
 - accueil
 - emplacement des stations
 - densité des stations
- 5) Environnement**
- écobilan

D'autre part, durant le mois de novembre 1999, un test de tarification sera organisé en collaboration avec les pilotes dans le but de mesurer l'acceptation d'une tarification déterminée. Ce test permettra d'adopter une tarification pour l'année 2000.

3.3 Perspectives 2000

De nouveaux standards pour une mobilité qui respecte l'environnement

Si le projet pilote **CityCar** devait être couronné de succès, sa commercialisation serait prévue dans la foulée. L'introduction généralisée du système **CityCar** posera de nouveaux jalons dans le domaine de la mobilité intégrée, respectueuse de l'environnement et à faible consommation d'énergie.

Adresse	La Poste Suisse CityCar Av. de la Gare 46 1920 Martigny
Téléphone	+41 27 723 58 78

3. TRANSPORT PREVENTION IN THE NETHERLANDS

by Ms. Josje Schnitzeler, Ministry of Transport, Public Works and Water Management

The subject I would like to address is transport prevention. I work for the Dutch Ministry of Transport. Within the Freight Transport division I am responsible for policy subjects concerning environment and spatial planning.

Transport prevention will be a part of new transport policy. First I will talk a bit about our current transport policy and then I will go in to the new subject.

Freight transport in the Netherlands is continually growing. Policy in the last decade consisted of trying to cope with this growth as best we could. We tried to limit the negative consequences of freight transport, without limiting freight transport itself. Freight transport policy concentrated on improving efficiency of road transport, decreasing emissions and shifting road transport towards barge and train transport.

Limitation of freight transport itself was out of the question because we always assumed that economic growth leads automatically to transport growth. Limiting or trying to limit transport growth would hurt economic growth.

This preposition about the link between growth in transport and economic growth was recently challenged by a major green lobbying group in the Netherlands. They wanted to investigate whether a company could deliver the same product with less transport. At the same time statistical analysis showed that growth in transport was caused by growth in kilometres, not growth in tonnes. In other words: we are transporting the same goods over growing distances.

The study we did together with the green lobby proved that it is indeed possible to reduce transport without economical damage. The concept thus invented was called Transport prevention. Transport prevention can be defined as a number of measures aimed at preventing transport to occur. Transport prevention is not increasing efficiency in logistics. Of course efficiency in logistics is helpful in solving the problems we are talking about and it is a strategy that is very much promoted and supported by the ministry. But transport prevention is a fundamentally different approach.

Transport prevention is trying to do the same job or produce the same product with less need of transport. In general in order to realise transport prevention a company needs to reconsider all or parts of its production process.

So far three categories of transport prevention have been defined:

1. Reducing the volume and/or weight to be moved. For example: companies in the US sell fruit juice concentrates to which water is added at home. Thus reducing the transport of water by up to 80%. An other example of reducing volume to be moved is electronic transport rather than physical transport of international newspapers.

2. Reducing the distance travelled. For example: production for the local market or local suppliers. Another example is especially important to the government : Preventing cross-boundary transport ensuing from legislation and regulations. The best known example is that of the Parma ham. Pigs from the Netherlands are transported to Parma in Italy to be transformed in to hams. The hams are consequently exported to the Netherlands. Of course the regulation that cause this has a very valid reason, but the consequence for transport are strange.
3. The third category is the limitation of return flows. Just in time delivery especially of perishable goods such as flowers can be very helpful in reducing the need of return transport.

At the moment the Dutch ministry of transport is developing a policy of transport prevention with instruments that incite companies to look into the possibilities of transport prevention.

1. Context : Why transport prevention

Mission

The mission of the Ministry of Transport in the Netherlands and especially of the department of freight transport is to provide a good functioning freight transport system. This freight transport system serves the growing economy of the Netherlands. However there are essential limiting conditions. These are environment, use of space and safety.

Policy

The policy of the last decade has concentrated on efficient and clean road transport and modal shift. thus we worked on limiting the negative consequences that freight transport has. This policy has been successful. Emissions per tonne / kilometre have been drastically reduced. Intermodal freight transport is growing. Especially transport of containers per inland vessel is growing fast.

But the success of these policies dwarfs as a consequences of the ever growing freight transport. (double in 20 years check)

We had to look further.

Invention of transport prevention

The question that a major green lobbying group in the Netherlands posed us was:

can we limit freight transport itself ?

To us that was a new point of view. We have always accepted that economic growth and transport growth were inextricably bound. And since economic growth is a major objective, we never consider limiting transport growth, but we tried to cope with it as best we could.

But what if the link between economic growth and transport growth wasn't automatic ? There was some proof for this. In statistics it seemed that growth wasn't in tonnes but in kilometres. Distances travelled by the same goods were increasing.

In a study conducted in 1998 this question was researched: is it possible to limit transport without economical damage. The result was positive. In this study the concept of transport prevention was invented.

2. What is transport prevention?

The study we did proved that transport prevention was possible without economic damage.

- I Reducing the volume and/or weight to be moved.
- II Reducing the distance travelled.
- III Return flows

It gave us a lot of examples of companies that already were working on transport prevention. The incentive for these companies was invariably: money: reduction of costs

Transport prevention is one step further than logistic solutions.

This study has approached the organisation of production and consumption (supply and delivery) chains from the special angle of transport. Opportunities were sought for reducing, within such chains, the volume or tonnage of freight to be moved, and for reducing distances to be travelled, without loss to the quality of the final product.

3. What's next?

What can companies do?

Step one for companies is a different view of transport, no longer treat it as the last item on the list but as an integral part of the production cycle. Integrate transport prevention as a valuable aim in the company policy.

To check several categories such as:

- I Reducing the volume and/or weight to be moved. ex: soap concentrate instead of soap, gel instead of water, on site cleaning of polluted soil
- II Reducing the distance travelled.: using local suppliers and outlets, swapping production
- III Return flows

What can the government do?

In the Netherlands Transport prevention as a new term is successful. It is used regularly by the media and members of parliament. It is a term that needs little explanation. The idea of limiting transport is becoming accepted. During our studies we experienced that a large number of companies works on transport prevention; although they don't use this name. But to the business

community as a whole transport prevention is new. We need to get it accepted as an objective or rather as a mean to reduce environmental pressure and traffic congestion.

New Policy on transport prevention

A real policy on transport prevention has not yet been developed. As a ministry of transport we find ourselves on unfamiliar ground. Suddenly our main partners are producers not transporters. We need the support of other parts of the government such as the ministry of environment and the ministry of economic affairs. We are unable to do this on our own. We need to co operate with all the parties involved. Establishing this collaboration is the task we will be working on in the coming period.

Measures

Our steps in the near future are a subsidy scheme, strengthen the ties with our colleges in the other ministries, set up of a communication plan, use of policy already in practice to provide incentives

The subsidy scheme combined with good communication is mean of showing the business community that it is possible to reduce transport without negative consequences for the economic viability of their companies.

New policies will be developed in co-operation with the ministry of environment and the ministry of economic affairs.

We hope to develop instruments that can be helpful to companies in their quest for transport prevention. Communication is of course a very important mean

Link with other subjects

Spatial planning can be a mean of preventing transport. However the short-term impact is probably very limited. As most of the world of today will still be there in 2030. In the long term it is essential to avoid costly errors. But my gut feeling is that spatial planning will do more for efficiency and modal shift than for transport prevention. We as a government can not decide what the location is that will have the least transport kilometres for a certain company. However we can try to influence companies so that they think about it.

Pricing is of course a very efficient mean of preventing transport and it is certainly a subject that has our attention. But there are no easy solutions on this front.

International: transport prevention has an international side. For transport prevention to work we need to consider the whole chain of production. The chain of production rarely is entirely on Dutch territory.

What interest for the company?

Money and image. One of the conclusions of our study into transport prevention was that many companies are already working on transport prevention because it saves them money. Another reason is image. A green image is attractive to consumers.

Barriers

- Mind set of companies has to change: a large number of companies still thinks of transport as the least of their problems and does not really treat it as an important or strategic subject.
- From a government point a view it is not easy to develop a set of instruments to promote transport prevention. Because it deeply touches the way companies operate.
- For the government there is a similar problem; the legislation that causes transport is in itself good legislation. But again transport is considered a minor subject.
- Transport is cheap and has always been possible.

Other research

We have done two further studies into transport prevention. The question we asked was why is freight transport growing ? One study concentrated on the role of supply. Due to the increasing volume and quality of infrastructure it has become cheaper to transport. Thus it has become possible to sell grapes from Greece at a competitive price. Increasing prices or limiting infrastructure could be very effective. But these measures need to be considered extremely carefully in order to stick to the objective of not damaging economic growth.

The other study focused on the role of demand. Why is there more demand for transport?

Efficiency in transport and looking for opportunities for modal shift are also very important.

Examples***I Reducing the volume and/or weight to be moved.***

1. Redesigning products;
2. Reducing the transportation of water and air;
3. Local sourcing;
4. Brand-independent assembly;
5. Use of targeted mailing;
6. Distribution of infrastructure via electronic infrastructures.

II Reducing the distance travelled.

7. Preventing cross-boundary transport ensuing from legislation and regulations;
8. Improving spatial organisation of the overall production process;
9. Using local suppliers and outlets;
10. Virtualising links in the supply and delivery chain;
11. Brand-independent production;
12. Consolidated deliveries, combining goods of different manufacturing brands;

III Return flows.

13. Reducing unmarketable products;
14. Comprehensive approach to recycling (balancing pro's and contra's).

ANNEX: TRANSPORT PREVENTION : A NEW CONCEPT IN LOGISTICS IN THE NETHERLANDS¹

by Wim Heiko Houtsma

presented by Ton Sledsens,

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Stichting Natuur en Milieu SNM (The Netherlands Society for Nature and Environment) is introducing a new concept: transport prevention, meaning achieving the same economic growth with less transport. Just like concepts such as waste prevention and energy saving, transport prevention might turn out to be a promising opportunity. SNM commissioned Bakkenist consultancy to explore the opportunities.

So far, economic growth has always caused freight transport to grow as well. Consumers purchase more goods, which all need to be transported, so the amount of goods moved increases. In the national debates in the Netherlands on large infra structural projects such as the expansion of Amsterdam Airport (Schiphol), the building of a new large-scale industrial zone south of Rotterdam (Maasvlakte) and the construction of a new freight railway from Rotterdam to Germany (Betuwelijn), there is the implicit assumption that the opposite relation holds true as well: an increase in freight transport produces economic growth. What exactly is the relationship between economic growth and growth in freight transport?

Straightforward traffic counts show that freight transport tends to grow faster than the economy does. Ms Josje Schnitzeler, responsible for environmental policies and for physical planning at the Transport and Economy Strategies Department of the Dutch Transport Ministry, comments: "The number of kilometres travelled by lorries is growing much faster than production does. Apparently products are being moved over increasingly longer distances." According to the Dutch Centrum voor energiebesparing en schone technologie (CE, Centre for Energy Conservation and Clean Technology, a leading Dutch consultancy) in a consultation paper, the average length of trips is growing at about 3.5 per cent annually. Eighteen months ago this caused the Transport Ministry to raise the question of how exactly economic growth and transport growth are related.

Earlier Stichting Natuur en Milieu suggested the idea of exploring opportunities for transport prevention: the same economic growth coupled with less transport. The reason for this was simple: CO₂-emissions from road transport will, if no extra measures are taken, exceed the government target by 25% in 2010. "And this in spite of cleaner lorries and great effort from all

¹ The following is a translation of an article from our magazine "natuur en Milieu" which describes the project leading to the publication of the report "Transportpreventie: Een nieuw concept in logistiek Nederland" (Transport prevention : a new concept in logistics in the Netherlands). The English summary of the report is enclosed after this article.

parties involved to increase the efficiency of transport and logistics. Transport growth is offsetting all the benefits from these efforts", says Ms Clasien Slebos of SNM.

Excessive transports

There is ample reason to examine whether all this transport is really necessary. According to Ms Slebos, the parties concerned, when looking for solutions to the environmental problem of the transport industry, have always looked to cleaner engines, cleaner transport modes (modal shift, for instance from lorry to ship; SNM initiated a major pilot project in this area) and a better utilisation of transport vehicles (higher load factors).

Excessive forms of transport are often mentioned in the anecdotal sphere. Ms Slebos mentions a few examples which are well-known in the Netherlands: Parma ham (Dutch pigs are transported to Parma, in Italy, to be processed into ham, which is then brought back to the Netherlands to be sold there) and Dutch shrimps, which are peeled in Morocco because of the low labour costs there, and then sold in the Netherlands. "These examples tend to be laughed off as being freak cases, but nothing is done about them. Therefore we want to deal with this problem systematically: how could transport levels be reduced without loss of quality to the product?"

The Dutch Transport and Environment Ministries, together with World Wildlife Fund in the Netherlands, provided the funding for the study initiated by SNM. Bakkenist Management Consultants was commissioned to explore all the opportunities for transport prevention. It is not the transport industry itself which is the real subject of the study. According to Ms Slebos, the study actually focuses on producers: what options do they have to organise the production and consumption (supply and delivery) chain differently, so that the demand for transport is reduced? Ms Schnitzeler (Transport Ministry): "Up till now we have said: it is all right for freight transport to grow, but how can we break the link between this growth and an increased environmental impact? We are now beginning to realise that this also means that we have to try and break its link with economic growth".

Transportation of air and water

The Bakkenist researchers have found fourteen categories of opportunities for transport prevention, and subdivided them into three main categories.

The first category reduces the volume and/or tonnage of products. This may be done by redesigning the product, but also by cutting down on the amount of water and air that is transported. The report mentions fruit juices that are diluted at home by the consumers, and the transport of (plastic) pipes, the transportation of which involves a lot of air. By manufacturing these pipes close to the site where they are to be used, it is only the raw materials that need to be transported. Thus, plastic pipes manufacturer Wavin, in the eastern part of the Netherlands, has built up a network of production sites in order to cut transport costs. This firm also produces 'linings' for existing pipe systems; a soft hose is brought into a pipe, for instance a sewer pipe, and then inflated, so that it is pressed against the inside of the pipe's wall, with the pipe's wall working as a mould. Production takes place on site, so there is no unnecessary transportation of air at all.

A second category of opportunities to be explored by manufacturers reduces distances travelled. This may be done by carrying out manufacturing processes close to the production site, but also by sourcing from local suppliers. Another possible option is to 'virtualise' certain links in the supply and delivery chain. One firm which is currently investigating this option is Bloemenveiling (Flower Auction) Holland at Naaldwijk. Instead of the present situation, in which flowers or vegetables go from the grower to the purchaser via the auction, they can be transported directly to the purchasers. If proper arrangements can be made about the quality of the products supplied, growers need only report to the auction the number and quality of the flowers or vegetables they are bringing up. The products are moved only 'virtually', viz. in the form of information. Buyers will have the products sent to them straight from the grower, so that all these kilograms need not be carried via the roundabout way of the auction.

Sun tomatoes or greenhouse ones?

The last category identified by Bakkenist is that of reductions in waste and return flows. Supermarkets and selling points at petrol stations, for instance, tend to have difficulty making correct estimates of the demand for flowers and plants. They often have to dispose of considerable proportions of their supplies, which makes their transportation unnecessary. Here, too, the report mentions Bloemenveiling Holland, which, in a study of flower outlets in England, has shown that better predictions of the demand in combination with frequent deliveries has caused a considerable drop in flowers and plants being thrown away. Ms Slebos indicates, by the way, that this example has a drawback as well, as frequent deliveries generate more transport.

According to her, transport prevention alone does not always lead to reductions in environmental damage. "One has to balance, for instance, the effects of importing tomatoes from warm countries, where they are grown outside in the sun, against growing them in greenhouses in the Netherlands. The latter obviously requires less transport, but it remains doubtful whether it is better in terms of energy consumption. As the issue is relatively new, we had to start by exploring the opportunities for transport prevention in isolation. A final choice for or against it can only be made after it is clear whether it is actually better for the environment."

Producers' 'blind spot'

Are the cases discussed in the report attractive to other companies as well? Not too many of them seem to show much interest as long as the government does not come up with appropriate measures. Jetze Tjalma, executive secretary responsible for combined and rail transport of the Dutch Ondernemersorganisatie voor logistiek en transport EVO (Dutch Association of Transport Users), observes that companies tend to be especially interested in changes in areas where they can reduce their costs.

According to Ms Slebos the Bakkenist report shows that there are two possible situations. The first is that a producer benefits from transport prevention: a win-win situation. This may occur when, as is frequently the case, he has a 'blind spot' for transport. According to Ms Schnitzeler transport prevention is rarely on a Board's agenda. Frequently it is the warehouse assistant who has to organise transport, as a kind of afterthought. The reason is simple: transport costs account for only a small proportion of the total production costs. This is confirmed by Tjalma: "Transport does not have any priority because to our members it is a derived aspect of a company's core business: industrial activities or trade. Only when logistical problems occur or when logistics are a competitive factor, transport will be higher on the agenda."

Commercially, there is much scope for improvements in terms of transport, as is shown by two pilot projects initiated by the Dutch Transport Ministry. In these projects, companies are assisted in improving their energy efficiency by realising efficiency gains in their road transport (Transaction project) and by switching to combined transport (Modal Shift Scan project) respectively. Some companies end up saving hundreds of thousands of Dutch guilders on transport. The new concept of transport prevention could add extra savings.

European regulations

A different situation arises when transport does not deliver a win-win situation. As Tjalma observed, companies are especially keen on policy changes that can cut costs, and this is not always the case. When transport prevention does not produce financial gains, there will always be someone who will suffer when it is adopted. For instance, some trips are made to the German or Belgian border especially to collect BTW (VAT) receipts. This provides fiscal benefits and is therefore financially attractive to the employer, although in terms of the environment it is obviously nonsense transport. When such trips are stopped because of transport prevention measures, it means a financial loss to the producer. Ms Slebos: "We speak of unnecessary, not of nonsense transport. There is always at least one person to whom the way in which a company has organised its production chain makes sense. The example of the BTW receipts illustrates this."

Another example of a non-win-win situation is when reductions in transport volumes require large investments. These costs may be a barrier. A third case arises when government policy is counteracts traffic prevention. Bakkenist researchers describe e.g. Dutch fishermen who buy British fishing boats in order to get the accompanying fishing quotas. European regulations, however, stipulate that such ships have to pay regular calls to ports in the country to which the quotas were allocated. These fishermen will therefore frequently sail to and from a British port empty; transport prevention is impossible here due to EU policies.

According to Ms Slebos, in situations like these producers can not be expected to opt for transport prevention of their own accord. Innovative steps requires incentives, including government measures. "Government policies often have unforeseen transport effects. Thus, since the EU has ruled that only cheese from Greece may be called feta, serving all consumers in Europe wishing to eat feta requires a huge transport fleet."

Environmental logistics management system

According to a report by the Centrum voor Energiebesparing en Schone Technologie it is theoretically possible to reduce transport levels by 7 to 20 per cent by implementing transport prevention measures (although the study does not mention the term). After SNM's presentation of its study into transport prevention, the Dutch Transport Ministry has decided to initiate a follow-up study. This new study will focus on how policies may make it more attractive to companies to consider the amount of transport they generate. Ms Schnitzeler: "The SNM study is a survey of the initiatives taken by individual companies. This in itself is not a basis for policy: first we need to find structural aspects. In order to do this, we have to look, e.g., at opportunities at industry sector level."

The crucial point is, however, that it is made attractive for companies to take account of transport. Tjalma points at the Scandinavian approach, where a number of companies are considering the environmental impacts of freight transport along with other environmental aspects, for instance because their customers demand it. According to Tjalma it is especially the food, drinks and tobacco industries and the chemical industry who are interested in transport matters.

Although within current environmental management systems transport has always been a factor to be taken into account, the attention it is receiving has been rather scant. Transport prevention may change this. Ms Schnitzeler suggests that the Dutch Transport Ministry is actually thinking of making companies set up logistics management schemes. Transport must be given due attention by companies, but this attention should be integrated. Transport prevention is no panacea: it needs to be accompanied by other measures, including the choice for cleaner modes. However, one conclusion may already be drawn from the SNM and Bakkenist study: there are certainly situations in which the link between transport growth and economic growth can be broken.

Brand-independent production

One way of reducing transport volumes is brand-independent production. The basic idea is that manufacturers do not only produce their own brand, but also - under strict quality conditions - brands of others. Animal fodder company Cehave Voeders at Veghel came up with this idea during a brainstorming session. The firm has calculated that all deliveries within a radius of 100 kilometres from the production site are cost effective, whereas outside this area transport costs tend to be considerably higher.

Cehave suggested the possibility of engaging animal fodder producers close to these less cost effective areas, who might be employed to produce - on the basis of strict specifications - animal fodder for Cehave. Customers would receive fodder of their own familiar brand, but from a local supplier.

By thus bringing production closer to the customer, 31% of transport might be prevented. According to Toine van Toor, manager of outbound transport for Cehave, transport accounts for nearly a quarter of operational costs. "When we were looking for cost savings, transport was an obvious target. There is some support for the idea of exchanging production with competitors within our sector, as it would benefit both parties. We are not sure, however, of customers' reactions. It is still only an idea, but we might start a preliminary study into it shortly."

Another example mentioned by Bakkenist consultants is that of newspapers and magazines. Thus Limburgs Dagblad (a regional daily newspaper in the south of the Netherlands) prints not only its own paper, but also 7,000 copies of the Japanese newspapers Assahi Shimbun and Nihon Keizai Shimbun for distribution within Europe. In addition, it prints between 12,000 and 25,000 copies of El Pais, to be distributed in Western Europe and Scandinavia. The printing firm has texts and pictures sent to it by the editors of these papers digitally, by electronic mail. The reason for using these independent printing presses, incidentally, is not only to cut costs, but also to provide readers with their papers as fast as possible.

EXECUTIVE SUMMARY OF THE REPORT "TRANSPORT PREVENTION: A NEW CONCEPT IN LOGISTICS IN THE NETHERLANDS"

by Bakkenist Management Consultants

Published: Stichting Natuur en Milieu, Utrecht, 10 August 1998

Stichting Natuur en Milieu (The Netherlands Society for Nature and Environment) has commissioned Bakkenist Management Consultants to carry out a pilot study into opportunities for transport prevention. This study was financed by the Dutch Transport and Environment Ministries, and from the Dutch branch of World Wildlife Fund.

The starting point for this study was the assumption that economic growth does not necessarily entail growth in freight transport, provided that companies work and think from an integrated chain approach. Breaking the link between transport growth and economic growth is important in order to check the adverse impacts on the environment, in the form of emissions, nuisance, energy consumption, road safety problems and demands on space. Its aim is to use its findings to promote the broader social debate on transport issues.

This report describes the findings and results of the search for opportunities to reduce transport levels without affecting the quality of the final product.

Problem definition

The questions formulated for this study are:

- a. What possibilities for transport prevention are theoretically conceivable?
- b. What practical examples are there and what are their opportunities and limitations?
- c. What is the (quantified) potential for transport prevention?

This study has approached the organisation of production and consumption (supply and delivery) chains from the special angle of transport. Opportunities were sought for reducing, within such chains, the volume or tonnage of freight to be moved, and for reducing distances to be travelled, without loss to the quality of the final product.

Opportunities for transport prevention

We have traced fourteen categories of opportunities for transport prevention.

1 Reducing the volume and/or weight to be moved.

1. Redesigning products;
2. Reducing the transportation of water and air;
3. Local sourcing;
4. Brand-independent assembly;
5. Use of targeted mailing;

6. Distribution of infrastructure via electronic infrastructures.

II Reducing the distance travelled.

7. Preventing cross-boundary transport ensuing from legislation and regulations;
8. Improving spatial organisation of the overall production process;
9. Using local suppliers and outlets;
10. Virtualising links in the supply and delivery chain;
11. Brand-independent production;
12. Consolidated deliveries, combining goods of different manufacturing brands;

III Return flows.

13. Reducing incurrent products;
14. Comprehensive approach to recycling (balancing pro's and contra's).

The report describes the categories and illustrates them by case studies.

Transport prevention in practice

Seven of the categories have been illustrated by fourteen cases. These cases partly concern examples of transport prevention that were successfully implemented in practice, partly they suggest conceivable adjustments. They illustrate that, with an integrated approach to the supply and delivery (production and consumption) chain, there are numerous opportunities for transport prevention. Many of them are commercially attractive, producing a win-win situation, with improvements both for the economy and the environment.

That these opportunities for transport prevention are not (yet) being used in practice on a large scale is due to a number of factors. The main reason is that considerations of transport weigh considerably less than commercial ones. Transport is often a 'blind spot'. Generally speaking, in current thinking commercial considerations dominate most others. If transport prevention measures do not lead to a win-win situation, these arguments may be a constraint on their implementation. In addition, there are legal, technological and socio-psychological barriers to be overcome as well. Comprehensive weighing of all aspects, including environmental impacts of transport, is not yet an integral part of the decision-making process..

Potential and feasibility

In this report the establishment of possible impacts (at a category level) is restricted to qualitative estimates. An indication has been made of the relative impacts of the various categories; any quantifiable estimates would require further study.

Opportunities

Both logistical and social trends offer scope for change. Major opportunities for transport prevention include:

- making use of increased possibilities of information and communication technology (ICT);
- taking advantage of growing consumer awareness of high-quality goods;

- taking advantage of the fact that businesses are increasingly expected to be accountable for what they do and do not do from a social point of view;
- taking advantage of external developments that are undermining smooth and cheap transport: congestion, road pricing, strict enforcement etc.;
- taking advantage of the generally felt need for a less hectic lifestyle;
- making use of the relatively 'green' composition of the current Dutch parliament.

Starting points for change could be found with any party in the chain: industry and public sector, producers, consumers and logistical operators. All actors, each in their own way, can contribute to transport prevention and thus to reductions in environmental damage.

Conclusions

- * The study shows that it is possible to break the link between economic growth and growth in transport. We have laid the foundation for the concept of transport prevention, starting from the narrow angle of transport in the supply and delivery (production and consumption) chain. Fourteen categories of transport prevention measures have been identified.
- * The most promising alternatives are brand-independent distribution, brand-independent production and reductions in the transportation of water and air;
- * Obviously, in the assessment of the alternatives there are several other factors that play a role as well. Connections between them are complex and could not be analysed thoroughly within the scope of this study.
- * Transport prevention may often lead to a win-win situation, benefiting both commercial and environmental aspects. As transport is often a blind spot, these opportunities often fail to be recognised.
- * When there is no win-win situation, transport prevention often fails to be implemented, as direct costs and revenues are liable to overrule environmental considerations.
- * An analysis of constraints, actors and trends offers scope for changing current ways of thinking.
- * Social and logistical trends may be used to implement transport prevention. Realising transport prevention measures is a matter for all parties concerned: industry and public sectors, producers and consumers.
- * Assessment of the potential impact of transport prevention has in this study been restricted to qualitative estimates. Quantified estimates would require further study.
- * The practical realisation of the potential impact requires that the concept of transport prevention is developed and the integrated approach to transport promoted.

Translation: Els Vermij

4. GAIN MOBILITY BY NEW FORMS OF VEHICLE UTILISATION AND MOBILITY MANAGEMENT

by Conrad Wagner (Mobility Car Sharing Switzerland, Lucerne) and Heiner Schmeck [Micro Compact Car Ag (Smart)], Daimler Chrysler

Increased quality of life and added value by intermodality including all transport carriers.

Traffic and transport in urban areas is suffering from an increasing mobility demand. Transport carriers operate isolated and customer needs are not considered. City cars are expected to be part of the solution to weaknesses in present mobility.

Smart appears to be an ideal car to be interconnected with road, rail and airbound transportation.

Seamless travelling will provide the customer with a new experience on mobility from door to door. Owners and users will gain benefits from strong partnerships within the transportation business.

The effects of the increasing traffic on urban mobility appear to be similar. But solutions are determined by

- national and local economics

- political environment

- habits of the individual people concerned

- culture and education.

Future mobility solutions are to be designed and implemented with respect to the local particularities. Each urban environment requires "customised" mobility services in order to be well accepted and satisfying in terms of ecology and economy.

Mobility patterns

Regarding complaints, weaknesses and negative impacts caused by all means of traffic and transportation, it seems to be evident, that all parties involved in the mobility business have to find an „exit“ in the sense of new systems and services in order to gain customer benefits, considering the tendency of permanently growing mobility demand.

How can this be achieved despite increasing competition among car manufacturers, as well as service providers in the area of traffic and transportation ?

Thus, core competencies are more and more homogeneous, distinctions among products and services are increasingly difficult.

Profit in this competitive environment can be achieved through:

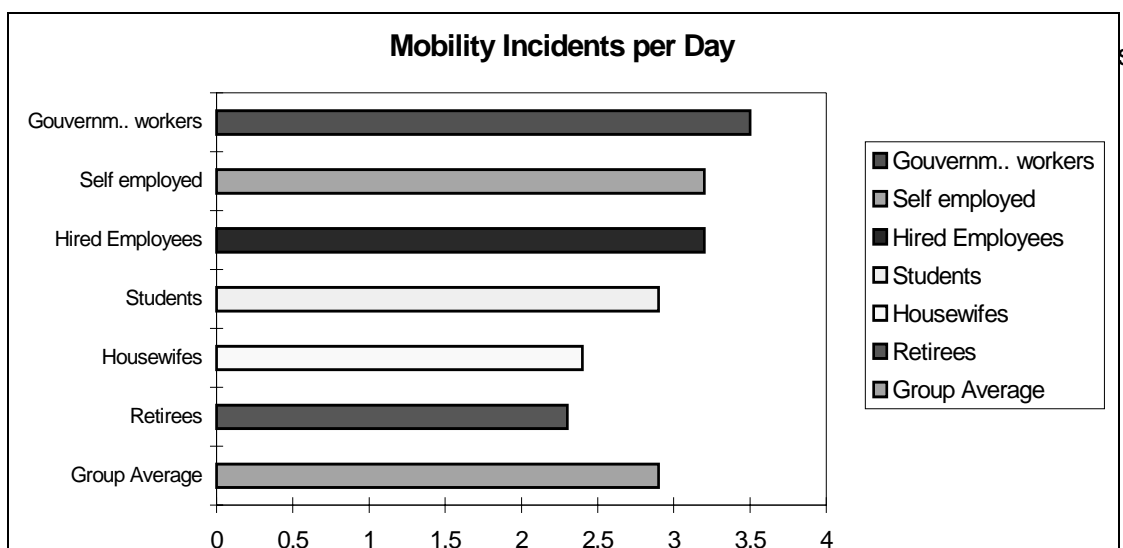
- a) Price
- b) Innovation
- c) Additional services, providing a positive image to a new or existing brand and strengthening customer relations.

Automobiles as individual transportation systems are the given standards concerning flexibility, comfort, efficiency and self determination, that alternative mobility services have to be measured against.

The following figures give some directions and leverage points for service design and implementation. Factors which are of major interest: who are mobile humans,

- where do people require mobility solutions,
- what is the purpose of daily mobility
- at what stages of life do people mainly have mobility demands.

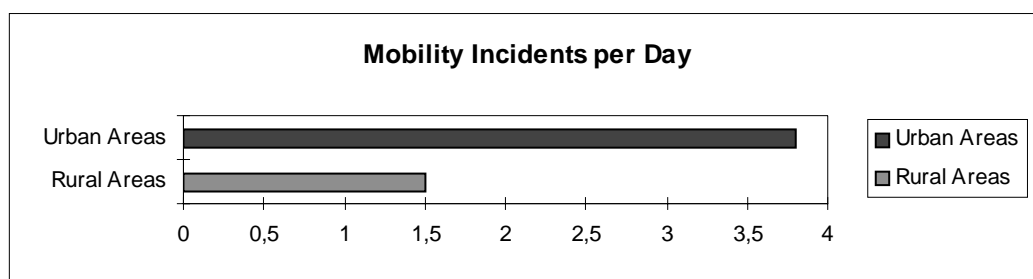
Figure 1



Self-employed, hired employees and government workers are most mobile among the groups shown in Figure 1.

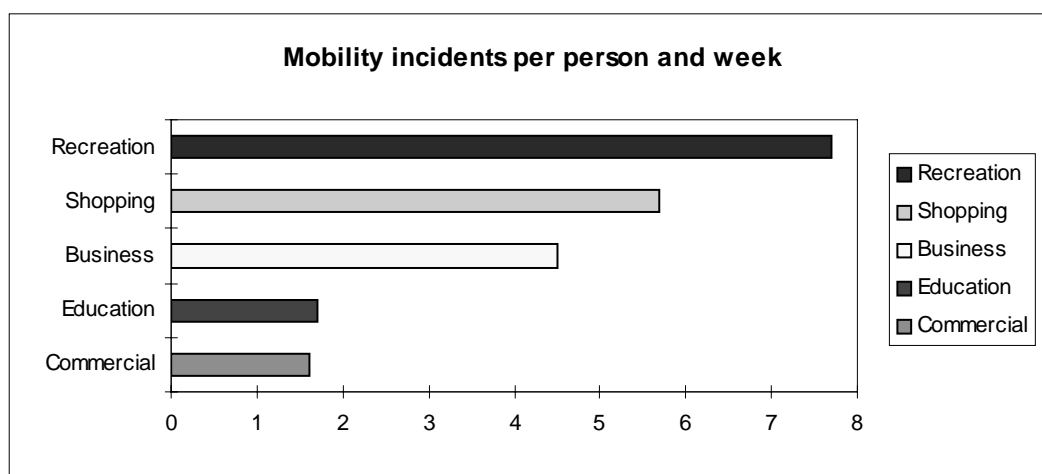
These groups are slightly above the average value of 2.9 trips per day. As far as dedicated positions in life and habits are considered, these values seem to be self-evident.

Figure 2: Significant difference between rural and urban areas



Mobility patterns in urban and rural areas are significantly different. As Figure 2 shows, the number of mobility events per day varies from 1.5 within rural to 3.8 within urban areas. Settlement structures and the increasing number of one-person- households in European cities might be one explanation for this reality.

Figure 3: People mainly are mobile for business, purchase and leisure purposes

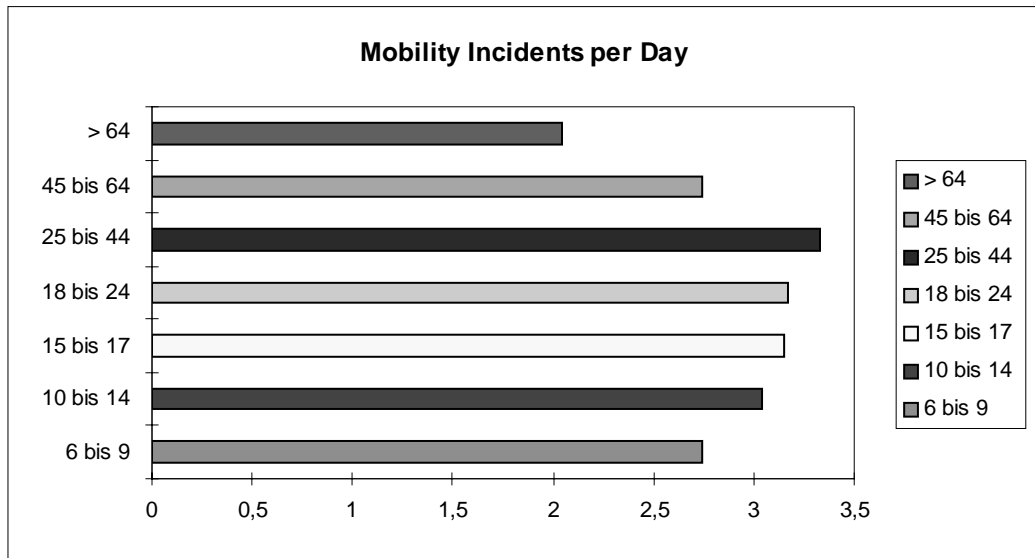


While society allows more room for leisure to individuals, most „movements“ (7.7 per week) can be observed for this purpose. Purchase and business reasons determine also a lot of traffic, on the contrary is the number of mobility events for the purpose of education and general commercial reasons (e.g. trips of craftsmen) comparatively low. With reference to figure 4 humans in the age between 25 and 44 seem to be most mobile. Differences are not that significant, even elderly people do not have particular strong demand on mobility, also very young kids are below the average of 2.9 trips per day.

In the forthcoming years the group of humans in the age between 45 and 64 might be of particular interest due to early retirements from 55 onwards. The effect on mobility services

cannot be finally derived yet, but obviously there will be a strong interest on recreation activities with the corresponding impact on mobility.

Figure 4: Humans in the age between 10 and 45 years are above the average of 2.9 trips per day



Short summary:

Most specific movements can be observed in urban areas.

People are mainly mobile for **business, shopping** and particularly for **recreation reasons**.

Students, hired employess, self-employed and gouvernment workers are „mobility consumers“ averaging above of 2.9 movements per day.

Slight differences concerning stage of life, strong mobility demand in the **age between 10 and 64**.

Particular consideration **of early retired people**.

Figure 5.

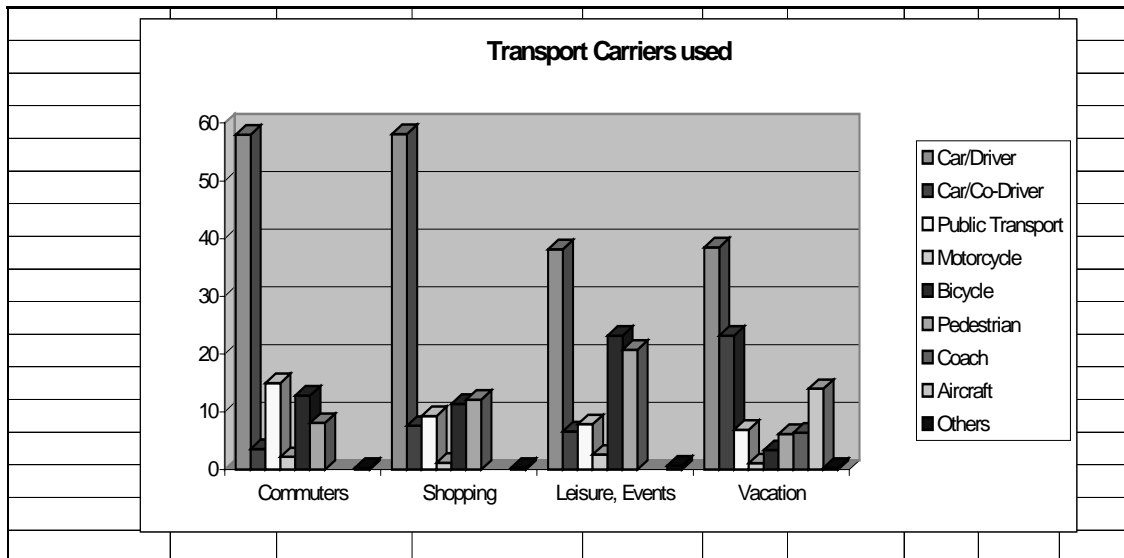


Figure 5 provides an overview about the choice of transport systems used versus transport purposes. From the realised mobility behaviour it can be concluded, that flexibility is the dominant parameter concerning the choice of a transportation system and mainly associated with individual cars. Thus, in designing new mobility services this aspect has to be considered the more to since „best costs“ and „ecological correctness“ seem not to be the decisive factors.

Moreover it should be considered that a once made decision upon a transport system will not be permanently questioned. There is a strong loyalty to the system or service respectively, which is applied for nearly all means of purposes. However, cars will remain the transport carriers mostly chosen in the future.

Definition of user groups

When working on new forms of vehicle utilisation and mobility management it is important to focus on the specification of potential target groups.

Internal studies, based on representative investigations on mobility needs in Germany found clusters of user groups, based on a certain mobility demand and attitude.

The following describes these groups briefly:

Open minded people concerning vehicle possession

This group consists of people who are flexible concerning vehicle possession. Generally they have a strong mobility demand, fun and action are appreciated.

From the demographic point of view persons within this cluster are relatively young, living in larger households, are students and have a high education level respectively.

Here we might have a potential target group for car-pooling and car-sharing applications.

People within this cluster represent approximately 25% of the total.

Open for alternatives concerning the mobility process

In comparison with the previous cluster, people within this group have finished their studies and are in the corresponding stage of life.

Fun and action are declined and replaced by purpose-oriented mobility behaviour.

Here we find the highest degree of education. Often these persons are part of families with young children.

A strong readiness to substitute or avoid mobility can be observed. Also an explicit affinity to car-sharing applications is seen.

People within this cluster represent approximately 9% of the total.

Flexibility orientation

This group expresses their needs as being mobile everywhere, and all the time and do not want to be dependent on transport systems that they cannot influence (such as public transport systems, offering schedule oriented services for instance). A majority express the need to own the car that they drive.

This cluster consists primarily of individuals, being mainly gainfully occupied. They are typically between the age of 35 and 50 and have a medium degree of education. People within this cluster represent approximately 13% of the total.

Oriented on recreation, fun and action

Persons within this cluster are above average in seeking to have fun. Cars are not purely understood as transportation carriers, but as synonyms for status and image.

In comparison with the first cluster this group has a higher share of gainful occupied people, but a lower share of higher degree education.

Further more it may be interesting, that we find the highest share of males and the lowest ages within this group.

This cluster represents approximately 9% of the total.

People with restrictions and handicaps

Typically numerous elderly and retired persons are classified within this group. They are rather cost conscious, while also agreeing to „having fun while being mobile“. This might generally be argued due to more available time for recreation activities.

It also reflects the increasing group of early retired persons which are „young at heart“, but have to live with financial or health restrictions.

This cluster represents approximately 11% of the total.

Strong affinity to vehicle possession

People within this group are characterised by strong consent to the item of owning the car that one is driving. The application of car-sharing is declined explicitly.

The importance of vehicle possession is not based on flexibility needs, but by a valuation of the own car as synonymous for status and image.

This cluster is represented by people belonging to the highest age-group with the lowest degree of education.

Within this group we find approximately 6% of the total.

Unconcerned people

The cluster is characterised by low consent to the items „fun“, „flexibility“, as well as the need for alternative or new forms of mobility.

Existing public transport services are seen as sufficient in order to fulfil the individual transportation requirements.

Persons in this group are suspicious about all new solutions and modern systems

This cluster represents approximately 8% of the total.

Short summary

High potential for new forms of mobility within the groups of people who are flexible regarding vehicle possession and mobility processes.

On the assumption that the „bridge“ between the different modes of transportation will be improved, a lot of customers from the group of flexibility oriented people (e.g. business travellers with high incomes) could be won over. For these users, the solution implies added value due to more efficient interfaces.

Finally the group of elderly, as well as the group of recreation and fun oriented people represent a certain potential, but the limited net income of these groups has to be taken into account.

Principles, Provisions, and Products

A number of concepts have appeared in the last few years that seek for increased attractiveness in the area of travel and transportation.

Generally all these ideas were introduced as experiments or pilot projects. These concepts were primarily realised through a co-operation between car rental companies and public transportation service providers.

Particularly from the customer's perspective most of these efforts did not prove very successful:

Technical systems were unreliable (e.g. electric powered vehicles)

„State-of-the-art-processes“ were merged together, thus not providing added value to the customer, which could result into less time to be spent for organisation and waiting while switching to another carrier

Tariff structures were rather complicated, confusing customers

Poorly trained and competent staff led to insufficient acceptance.

The findings from these experiments may be summarised as follows:

Innovative mobility solutions should not only be expensive marketing campaigns, but provide „**real life experience**“ to the customers.

New systems have to prove added value in terms of travel time, costs, improved interfaces (processes along the entire travel chain) and comfort.

Co-operation means almost „**Give & Take**“ between providers, implying a win-win partnership in order to establish **sustainable mobility** products.

Keep systems as simple as possible. Well adapted services in terms of organisation and/or technology meet the customer needs and will be positively accepted.

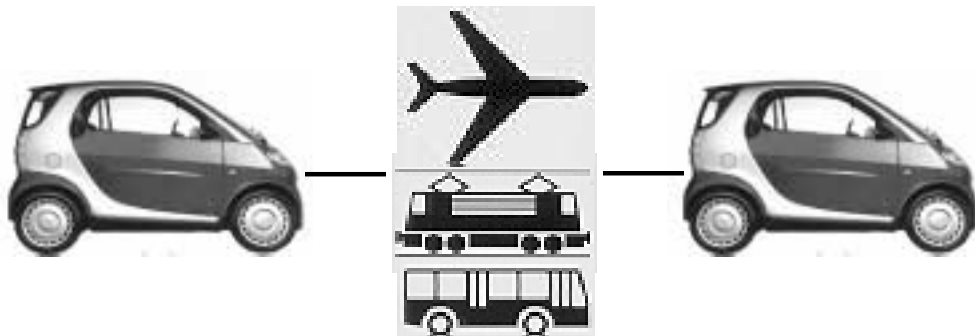
The individual car will remain a key element within future mobility systems.

Increased quality of life and added-value will be achieved by blending the competencies of the different transport systems.

Interconnections to passenger cars seem to be most beneficial:

- a) within urban areas particularly for „InnerCity Services“ and
- b) providing mobility services at the origin and destination of a long distance trip.

Figure 6



Inner-City mobility services

Public transport operators are increasingly faced with the necessity to work as profitable commercial enterprises due to less subsidies from municipal and governmental sources.

According to market dynamics competitive products must be developed.

Cars, once treated as „hostile“ within the environment of public transportation, become integrated elements of strategic product planning.

This may result in the following major business areas:

car-sharing applications,

increased coverage of public transit services, using cars at subway-stations and sub-urban train terminals,

providing mobility services for business purposes e.g. for large companies, trade unions, banks, insurance, municipal and governmental authorities, etc.

mobility services for specific suburban areas or parts of metropolitan areas (e.g. living without own car), where trams and busses cannot be operated on a profitable basis and insufficient space for parkings.

One success story concerning a fully integrated system can be found in the city of Zürich. Entitled with the brand „züri mobil“ the local public transport operator integrated a car-sharing application into the entire spectrum of services delivered.

Providing more than 250 cars at approx. 80 sites within the agglomeration, more than 3000 users could be won over during a nine month test period.

At the first glance the integration appears to be only given by the season ticket including membership in the car-sharing community. In addition the selection of car-pool sites, close to bus- and tram stops, the network density, as well as the availability of cars are important factors for successful and sustainable operation.

Door to door mobility service including rail and airbound transportation

Evidently individual cars should be interconnected to origin and destination of long distance trips.

For decades taxis, car rental companies and public transit operators cope with these service requirements.

Indeed there is a long history of service providers concerned. In fact they have developed their business quite isolated. Regarding the increasing demand on mobility it seems that they have reached their limits.

Railway operators, as well as airlines work on an extension of the particular product schemes. Seamless travelling is one of the key words concerned and it explicitly includes individual cars in order to realise door-to-door services.

The customer is setting the margins of new mobility products.

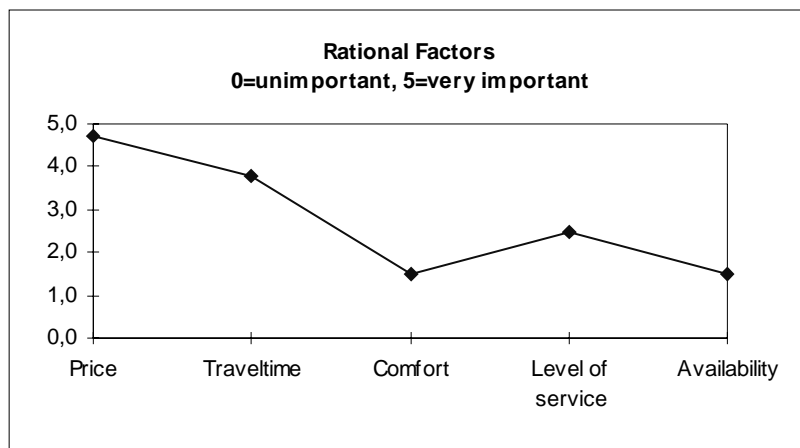
Figure 7 shows the rational factors which partly determine the choice for the individual transportation modes.

Price and travel time are the most influencing parameters while comfort and availability seem to be of secondary priority.

Thus intermodal transportation services have to prove added value concerning cost/benefit evaluation. Particularly the interfaces between the different modes of mobility influence the travel time. Cost efficient vehicles as well as the processes themselves support competitive tariff structures.

City cars like **smart** directly contribute to the requirements on cost efficient operation.

Figure 7



As complementary decisive elements, influencing the customer on an emotional level, should not left unconsidered.

Seat comfort and hygienic sanitary facilities, as far as public transportation systems are concerned, cause particular attendance. Furthermore flexibility (process) and a full services offer (e.g. one stop shopping) should be warranted by new modes of mobility.

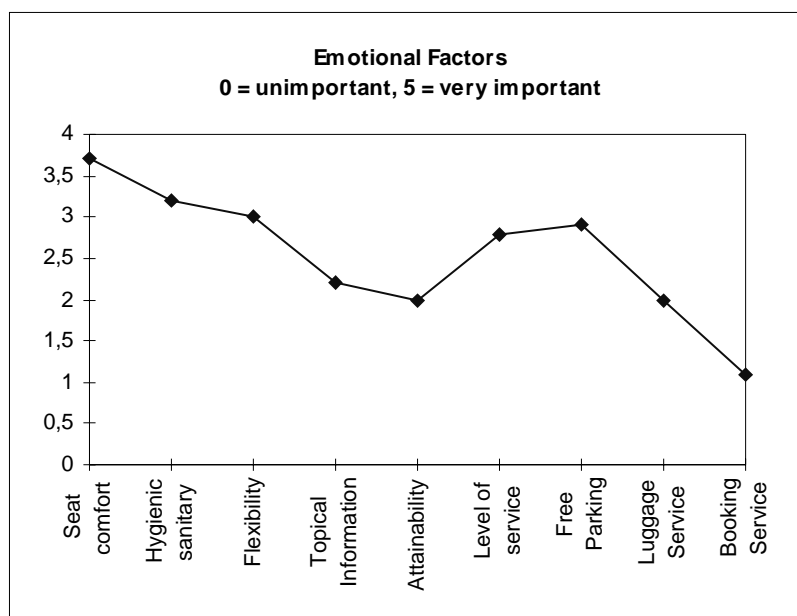
Finally parking is one of the big issues thinking about the interconnectivity of different transport carriers.

Free parking is expressed to be a prerequisite for modal split by the customers

Generally parking solutions are one of the „carrying pillars“ of intermodality.

Figure 8 provides an overview about the „emotional factors“.

Figure 8



Short summary:

The features of future integrated mobility services will be:

- different transport modes, one ticket
- one stop shopping
- easy and quick access to vehicles
- support through information and communication services
- suitable parking solution, taking into consideration the benefits of small city cars.

smart, the ideal city car for new urban mobility systems

With a total length of only 2.5 meter the two-seater **smart** is an ideal car to be interconnected with rail and airbound transportation. Being designed especially for urban areas, **smart** also copes with the requirements of public transit operators in terms of becoming an integrated part of the service scheme.

Very compact cars have significant advantages in urban areas. **smart** is the first city car for series production, without compromising safety and comfort, with interior space comparable to mid range limousines. Further advantages are easy parking, manoeuvrability (because of the small turning circle of approx. 8 meters), reduced fuel consumption with positive impact on the environmental pollution.

Particularly people living in agglomerations, may gain substantial benefits from the characteristics of the car, which has high potential to be embedded into attractive mobility services.

In conjunction with reasonable impact on the consumption of environmental resources **smart** provides extraordinary fun to the driver. Regarding the intention to establish accepted and sustainable mobility solutions, the compound of „fun and reason“ might be a suitable basis for profitable services. As already mentioned before, parking becomes one of the biggest issues in urban areas. Evidently **smart** provides significant advantages to this item, because the car requires approx. 60% of normal parking lots in terms of space.

Theoretically this could result in up to 40% more parking lots in existing parkings.

In general future mobility solutions have to cope with traffic and transport policies of city councils. The strategy of reducing traffic impacts, often shall be derived from a limitation of parkings within the inner-city areas. The conceptual benefits of **smart** contribute to the tendency providing more room for humans within European cities .

Figure 9: Size in terms of length in relation to other small cars and standardised parking lots

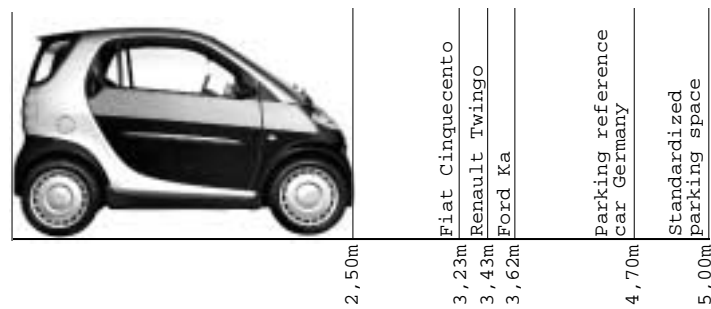


Figure 9 provides an impression about the size in terms of length compared with other small cars and standardised parking lots.

Telematic support

It is foreseen to equip the car with components, enabling the driver to get access to information services through mobile communication functions (GSM). Parking information for instance will be conveyed to the mobile system if they will be available.

Moreover assistance functions concerning

- route finding

- topical traffic information

- emergency and breakdown incidents

- general information about events and locations within the local area will be provided to the driver.

According to intermodal mobility solutions, the system is prepared to be interconnected with on-line services providing information about timetables, schedules, delays and of course, best-choice recommendations concerned.

The future becomes reality. A couple of European cities already implemented Mobility Centres where citizens can obtain advice. Telematic services are starting now on a commercial basis.

They will provide the glue of intermodality.

Car Sharing provides car usage with various options

Ten years ago the idea of car sharing was considered just daydream. Since then, however, car sharing has become increasingly successful, and today it is one of the most significant trends in the evolution of transport and mobility in Switzerland and the rest of Europe, even in some parts of the USA. More and more drivers are opting for car sharing because this offers them more advantages than running their own car. Mobility Management and Mobility Centers are integrating car sharing into their services and encourages the standardisation on a european level.

Basical insight into the concept of Car Sharing

Car Sharing is an innovative travel option for people who need only occasional access to a vehicle - typically once, twice or three times a week. Unlike auto rental agencies, Car Sharing vehicles are located in leased parking places close where members live and/or work, rather than in a central lot. Car sharing typically charges its customers by the hour and km for use of vehicles.

Car sharing provides customers who don't need a car every day with access to a car when they need it for less money and hassle. Pick up trucks, larger sedans and convertibles are added to the fleet to provide customers with access to a variety of vehicles. Since car sharing fees include all costs, car sharing will save money for people who drive less than 10,000 km per year. (This is because depreciation, insurance and other fixed costs of vehicle ownership become variable costs with car sharing.) Car sharing is also an attractive option as an alternative to owning a second or third car, since the insurance on the second and third vehicle alone may cost more than your car sharing usage fees.

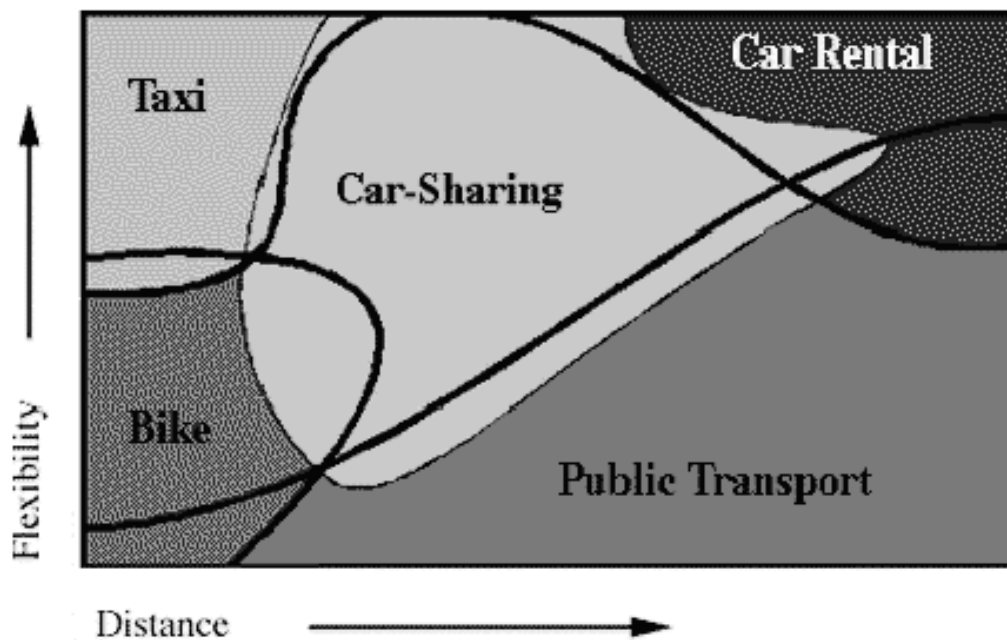
To reserve a vehicle, customers call the call center to schedule a vehicle for future use or see if one is available for immediate use. To use a vehicle customers go to the location, use their access key combined with a touchless smart card to open the car and drive away. All customers have access to all vehicles in the fleet. Before the end of the reservation, the vehicle is returned to the same location. For billing, customers fill out a simple use ticket with the beginning and ending trip mileage and time. In many places this procedure has been replaced by a specific dashboard computer leading customers for taking the correct vehicle at the location, ensuring identification and tracking data.

In Europe usage fees for Mobility CarSharing Switzerland are CHF 2.35 per hour + CHF -.50 per kilometer. The application fee of CHF 200.- is charged once. Members pay a CHF 1000.- deposit when joining the service, which is fully refunded if they leave the service. Instead of the deposit users may annually pay CHF 100.- (non-refundable) in order to have access to all cars and services. For longer lasting trips clients of Mobility may also rent cars from a contracted auto

rental agency which is Hertz and Europcar in Switzerland. Businesses and institutions can also become Mobility CarSharing Switzerland customer. It is anticipated that businesses will tend to use the vehicles more during the day and individual consumers more on evenings and weekends, this will provide a good balance for the service.

In the US usage fees for CarSharing e.g. in Portland, Oregon are \$1.50 per hour + 30c per mile. The usage fee which is charged to a customer's credit card, includes all costs, of vehicle insurance, gas, maintenance and repairs. An application fee of \$25 is charged to cover the cost of DMV 'Departement of Motor Vehicles' and credit check screening. Members pay a \$500 deposit when they joining the service, which is fully refunded if they leave the service. For trips lasting several days, customers will find that renting a car from a local auto rental agency will be less expensive, and worth the inconvenience of going to the central location.

Figure 10: Enriched Pattern of customer's behaviour: Travel blending



Source: The first time I saw this drawing was in 1973 in a pioneering study by the Urban Institute. This adaptation comes from the Bremen Web site.

In figure 10 you get an impression of the pattern in mobility behaviour of Car Sharing customers. Car Sharing complementarily fits into a system of various traffic modes chosen spontaneously by its customers. For longer distances you might enjoy the comfort of Public Transport or Car Rentals. For shorter distances you need the convenience of Bike and Taxi. All in between - like a 'mobility insurance' - you use Car Sharing to match your specific needs by various options (Travel Blending). You may compare this to a Shopping Center or accordingly to a Mobility Center where you get all products as an integrated service out of one hand.

Success for Swiss Scheme

We see the potential growth of a huge industry in providing such mobility, comparing it to the insurance industry, in which insurance companies provide coverage and brokers provide the service.

Car Sharing is booming in Switzerland, where mobility packages offering a combination of car sharing, regional public transport, car rental and taxis, have been introduced with great success. Supported by 'Energy 2000' - a Federal Action Programme promoting Sustainable Energy Partnerships - 'züri mobil' is a scheme in which the Zürich transport authorities and Mobility CarSharing Switzerland act as general contractors, creating a mobility bridge to other means of transportation. Mobility CarSharing Switzerland now operates from 500 locations, with almost 1'000 vehicles serving 18'000 households - a figure that is rising by 50% each year.

In Europe, companies associated with ECS European Car Sharing operate from as many as 700 locations, with 2'500 cars serving over 40'000 people.

Europe's oldest and largest car-sharing firm, Mobility Car Sharing Switzerland and European partners, are planning on taking the concept of mobility sales one step further. Negotiations are underway with the Federal Rail Operators and a number of other parties (transportation providers like taxi companies and mobility creators such as retail trade or banks/insurances) to offer a "mobil-card" allowing for smooth access and multi-modal travel. The smart card contains a computerised touchless chip that ultimately allows an individual to be billed monthly for travel by car, train, public transport, taxi and even by bicycle. Such a system, if widely adopted, might help level the playing field between single-owner cars and other means of transport and has the potential to reduce environmental impacts from passenger transport in urban areas.

In another innovative move, StattAuto Berlin as largest Car Sharing Organisation in Germany is investigating the implementation of a "return-lease" car hire programme called 'CashCar'. Under this scheme, participating private or institutional members lease their vehicle much as they might under a traditional leasing arrangement. However, at times when they have less need for a car (for example on week-ends or on holidays) they are able to return the vehicle to a pool of cars available for car sharing and have their monthly car lease-payments reduced accordingly.

Whether car-sharing could be successful in the USA is unknown yet. The Portland study, conducted for the DEQ Oregon Department of Environmental Quality, concluded about 11.7 percent of drivers over 21 would be likely to join a car-sharing club in their neighborhood if one were available. Many of the US cities are implementing first trials in 1998/1999. In the San Francisco Bay Area such a mobility system is composed of the following:

Users taking advantage of affordable, convenient, and user-friendly services;

Shared-use vehicles integrated with line-haul mass transit systems of urban/suburban area (BART, stations cars) and neighborhood and work-based car sharing organisation

Low-emission vehicles (CNG Compressed Natural Gas and Electric Cars)

An intelligent Communications/Reservation system of smart technologies bundled together to provide intelligent vehicle location, dispatching, and reservations via a telephone, PC, kiosk, or other user interfaces; and

private-sector firms providing vehicles and services

Car Sharing as part of Mobility Management

Joint-marketing to multiply the car sharing system

The future will see an extension in the field of co-operation in Car Sharing. As far as services are concerned, existing agreements with public transit operators will be expanded by co-operation with car retailers and with car industry as partners in distribution. As far as demand is concerned co-operation with municipal and governmental authorities will be intensified, with the object of energy-saving and air protection. Co-operation with mobility creators (e.g. large companies or retail trade) will bring about specially adapted mobility services (e.g. employee car sharing). Standards and multiplication by specific cooperation will bring new ventures and challenges to Car Sharing and New Integrated Mobility Services.

There is no sign of stagnation in the development of Car Sharing and Mobility Management: On the contrary its growth is increasing, thanks to new demand-oriented and market-proof mobility strategies.

The motto is: Gain more mobility - create less traffic or in other words 'reduce to the max'.

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Peters, Jane; Scott, Steven; Burkholder, Rex (1997): Market Feasibility and Business Planning Study: Car Sharing in Portland, Oregon USA, Oregon Department of Environmental Quality

In 1997 the Oregon Department of Environmental Quality conducted a Feasibility and Business Planning Study for Car Sharing Mobility Services in Portland, Oregon. The two major components of the study are a market feasibility study and a business planning study. Car Sharing Portland starts its market test in november 1997 to be evaluated in 1998. To compare results Car Sharing test markets shall be also implemented in the San Francisco Bay Area and some cities of Los Angeles early 1998.

Pfister, Urs (1997): The impact on future mobility and parking structures, EPA Congress, Barcelona, 1997

Shaheen, Susan (1998): Smart Car Sharing Markets in the San Francisco Bay Area: A Study of Behavioral Adaptation. UC Davis: Institute of Transportation Studies-Davis (ITS-Davis)

TRB Transportation Research Board, 77th. annual meeting 1998 Washington DC: Session title: Shared Cars, Chairman Prof. Daniel Sperling, UC Davis. Conrad Wagner: Car Sharing and Mobility Management - The Business, January 14th. 1998

Wagner, Conrad; De Tommasi Roberto (1998): MOMENTUM Mobility Management for the Urban Environment, EU-DG VII Verkehr and Swiss National Science Foundation, Research Council: Transport and Environment Nr. 41-A1, Bern:

'Mobility Management' is a global concept of various policies to ensure the efficient, sustainable satisfaction of mobility demands. The present project is intended to complement the EU project, MOMENTUM (EU Directorate General VII: Transport), by two Swiss case studies and a synthesis summarising the results of this project from a Swiss perspective.

What contribution can mobility management make towards sustainable mobility, and in which fields of application, with which instruments?

In which regions and for which types of users can mobility centres be implemented?

How can the acceptance of mobility management be improved?

Wagner, Conrad; Schad, Helmut (1998): NIM New, integrated Mobility Services, Swiss National Science Foundation, Research Council: Transport and Environment Nr. 41-A3, Bern:

'New, integrated mobility services' are flexible services offered by private and/or public enterprises, a combination of the characteristics of public and private transportation, such as city transports offering car rentals, car sharing, bus on demand, etc. The present project intends to study user demands and the potentials of such services.

What requirements do 'New Mobility Services' have to fulfil for current and potential users to consider them more attractive than private-owned cars ?

What are the current and future prerequisites to fulfil these requirements, i.e. for these services to be competitive (system design, feasibility) ?

What are the entrepreneurial contributions of 'New Mobility Services' ?

5. SUSTAINABLE DISTRIBUTION OF GOODS

by A. McKinnon

Heriot-Watt University

School of Management Logistics Research

Sustainable Distribution Strategy

'to ensure that the future development of the distribution industry does not compromise the future needs of our society, economy and environment'

UK Department of the Environment, Transport and the Regions, March 1999

Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999

Heriot-Watt University

School of Management Logistics Research

FUEL TAX ESCALATOR

Since 1994: 5% real increase in fuel tax annually

Since 1997: 6% real increase in fuel tax annually

Policy to be continued until at least 2002

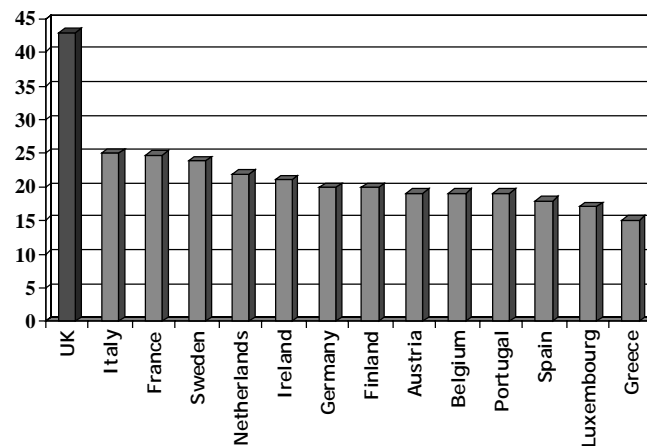
UK CO2 Policy: 20% below 1990 level by 2010

Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999

Heriot-Watt University

School of Management Logistics Research

Diesel Fuel Duty 1998: pence per litre

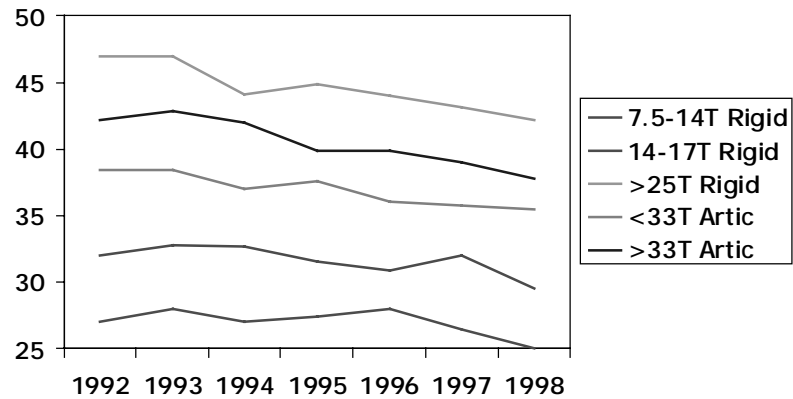


Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999

Heriot-Watt University

School of Management Logistics Research

Truck Fuel Consumption (litres/100km)



Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999

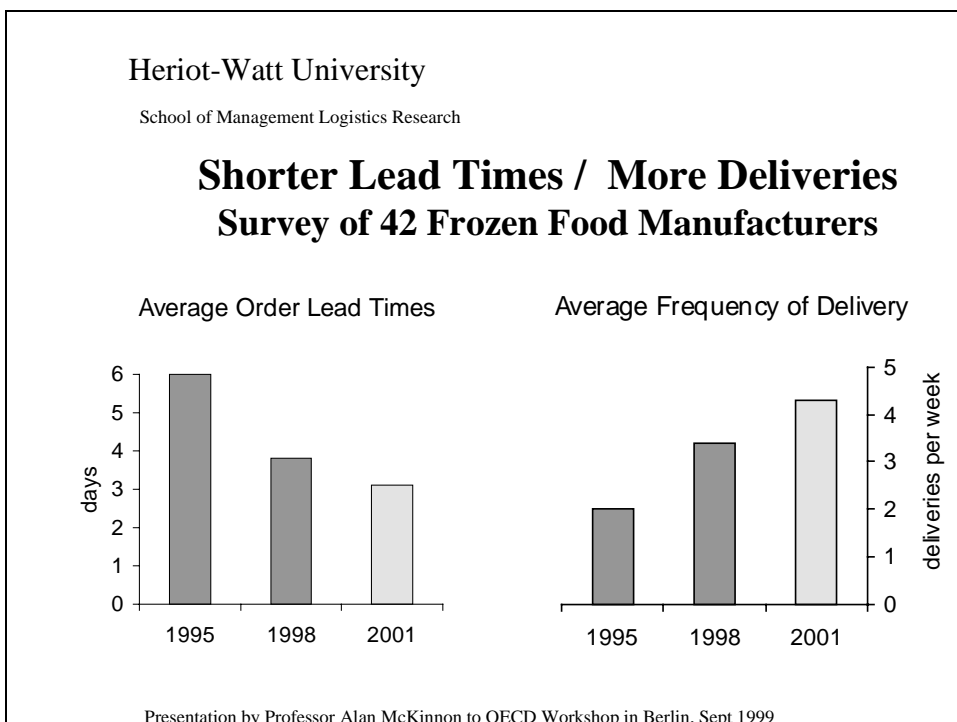
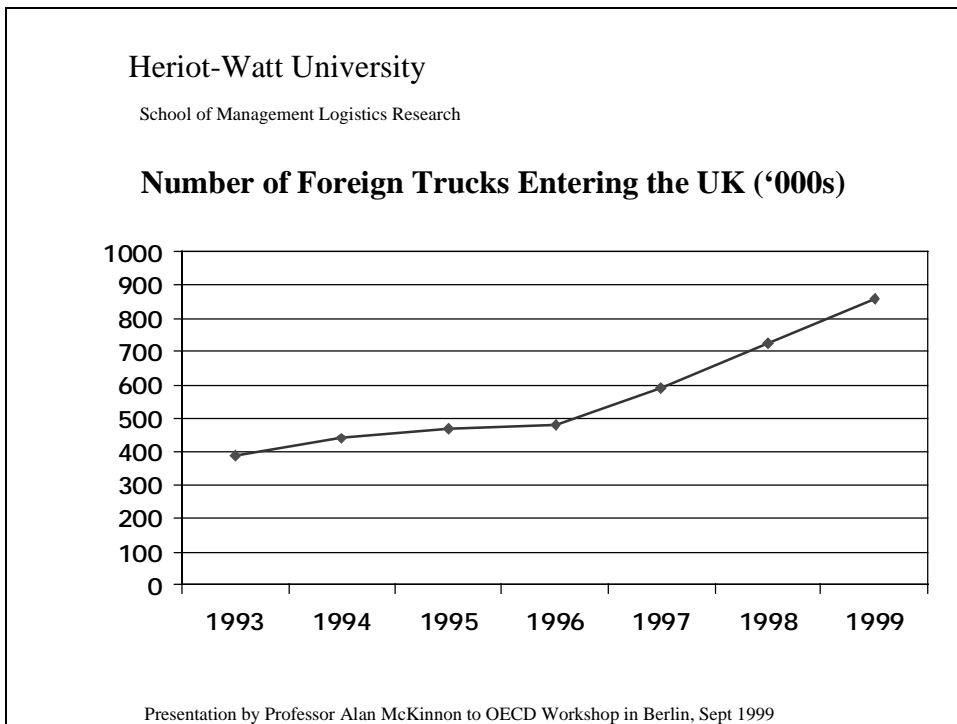
Heriot-Watt University

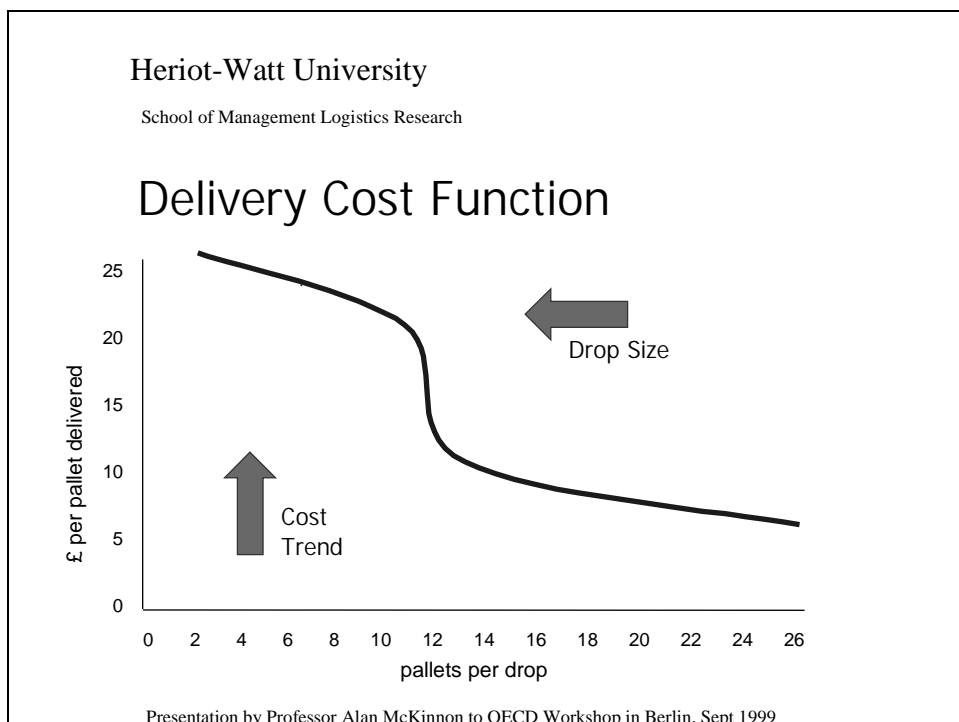
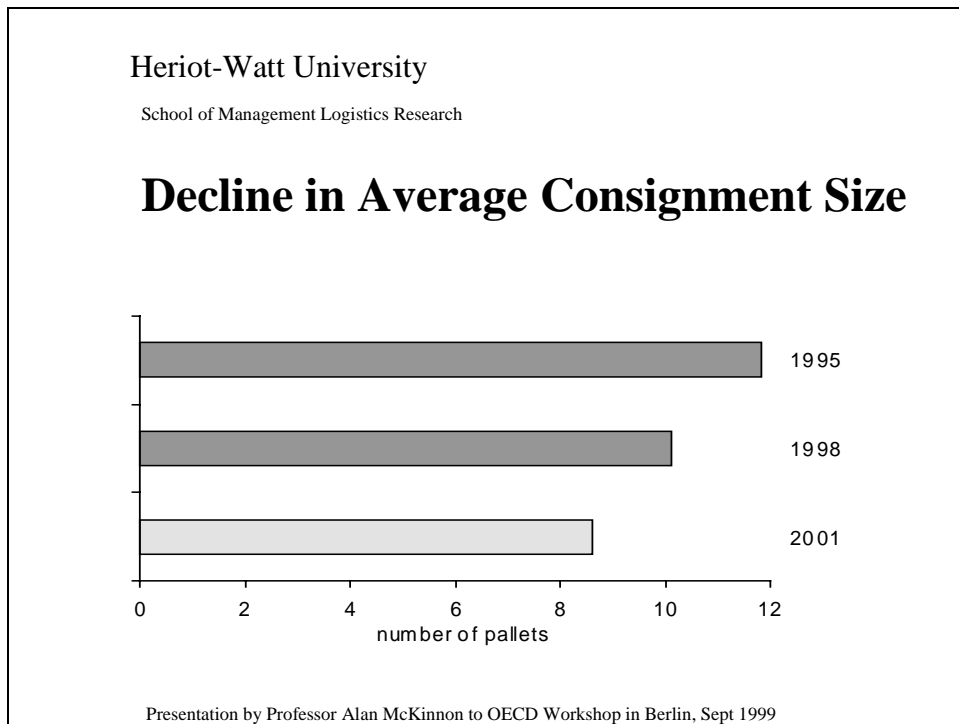
School of Management Logistics Research

Road Fuel Costs in Perspective

- **Logistics costs = 7.5% of sales revenue**
- **Road transport costs = 30% of logistics costs**
- **Fuel = 25-30% of road transport costs**
- **Fuel = 0.6 - 0.7 % of sales revenue**

Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999





Heriot-Watt University

School of Management Logistics Research

Supply Chain Initiative:

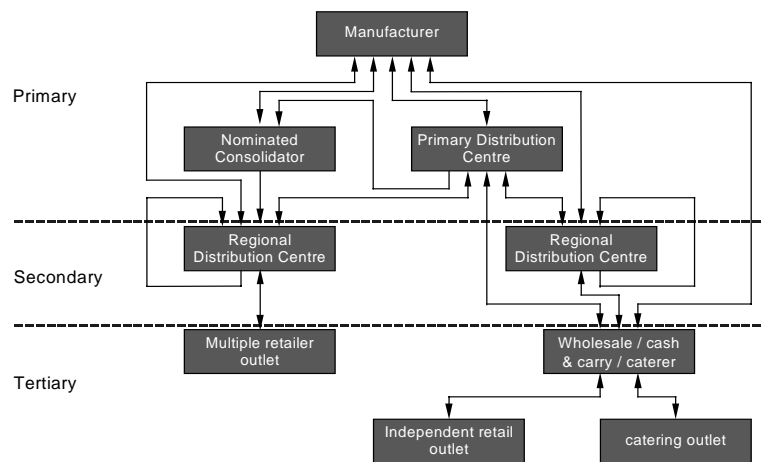
- Cold Storage and Distribution Federation
- UK Government / ETSU
- Heriot-Watt University

Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999

Heriot-Watt University

School of Management Logistics Research

Food Distribution Channels



Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999

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Sample Size: 48 hour audit 22-23 Oct 1998

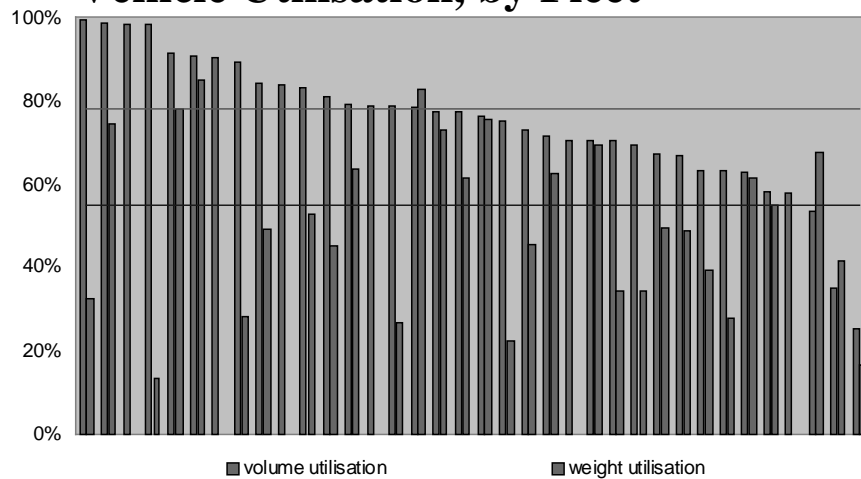
number of fleets	36
tractor units & rigid vehicles	1,625
trailers	2,194
journeys	11,874
pallets moved	206,202
kilometres travelled	1,161,911

Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999

Heriot-Watt University

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Vehicle Utilisation, by Fleet



Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999

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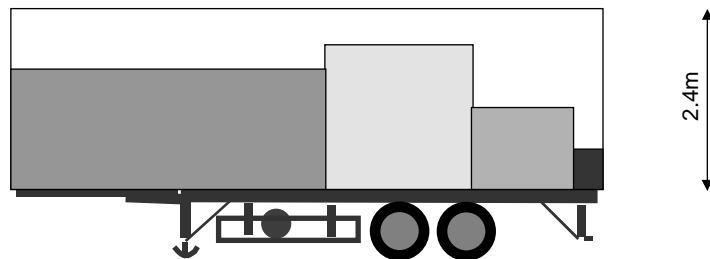
School of Management Logistics Research

Height Utilisation

54% of trips were loaded to between 1.5m and 1.7m

24% of trips to more than 1.7m

17% to between 1.5m and 0.8m and 5% under 0.8m

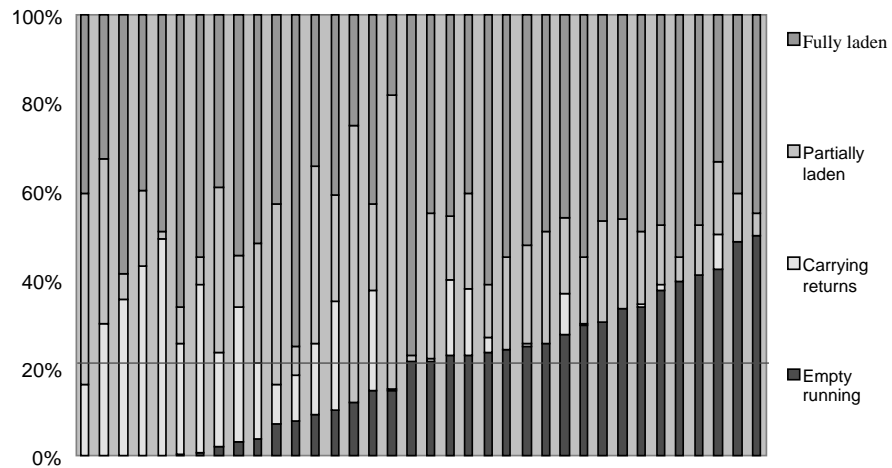


Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999

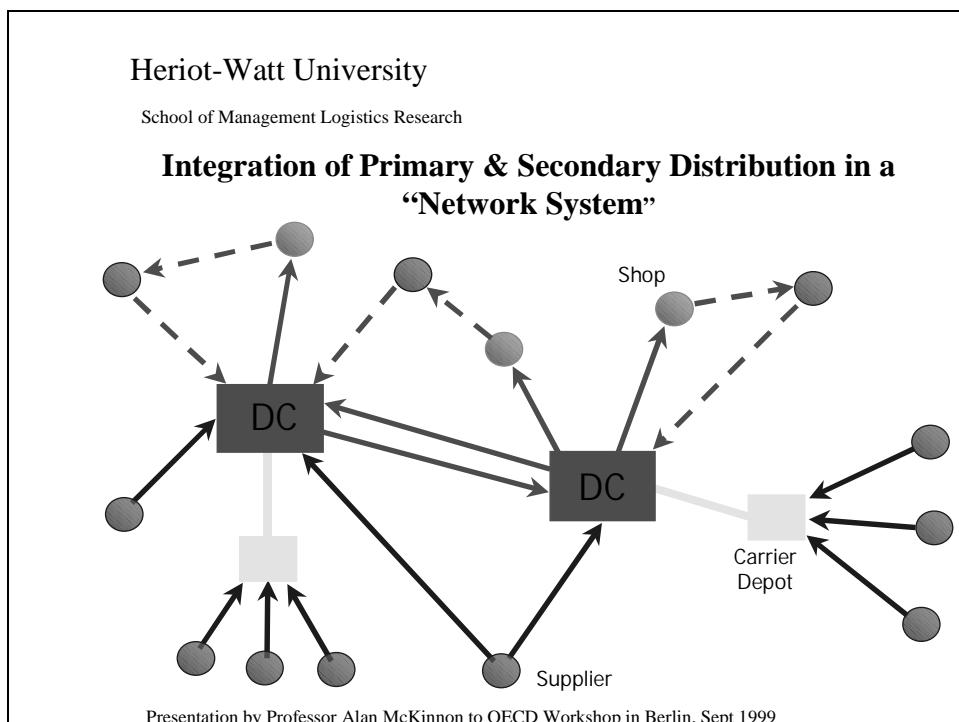
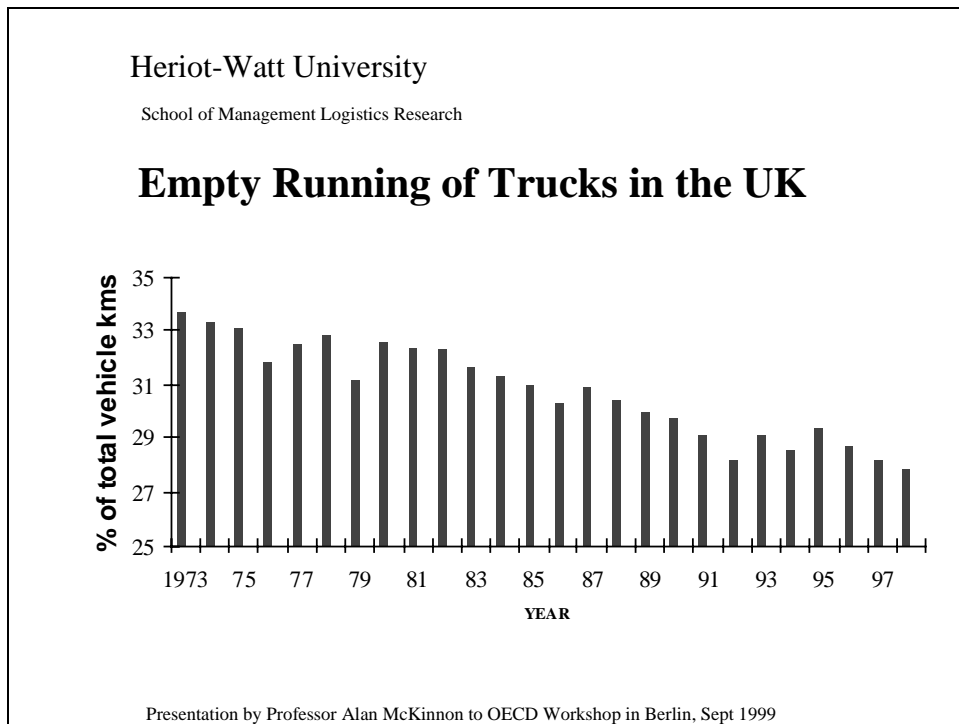
Heriot-Watt University

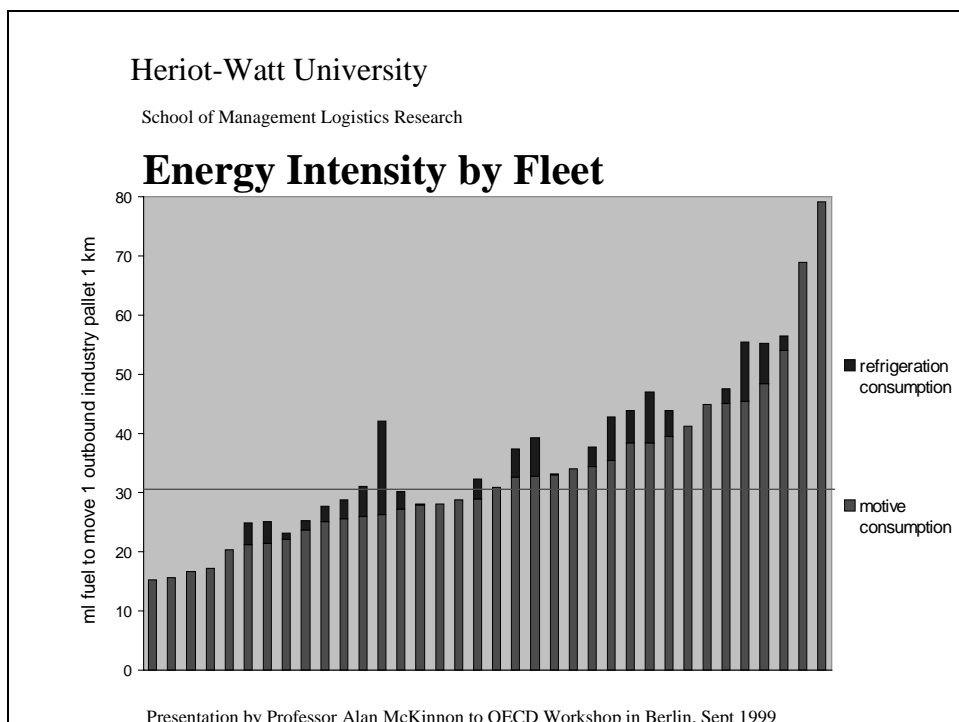
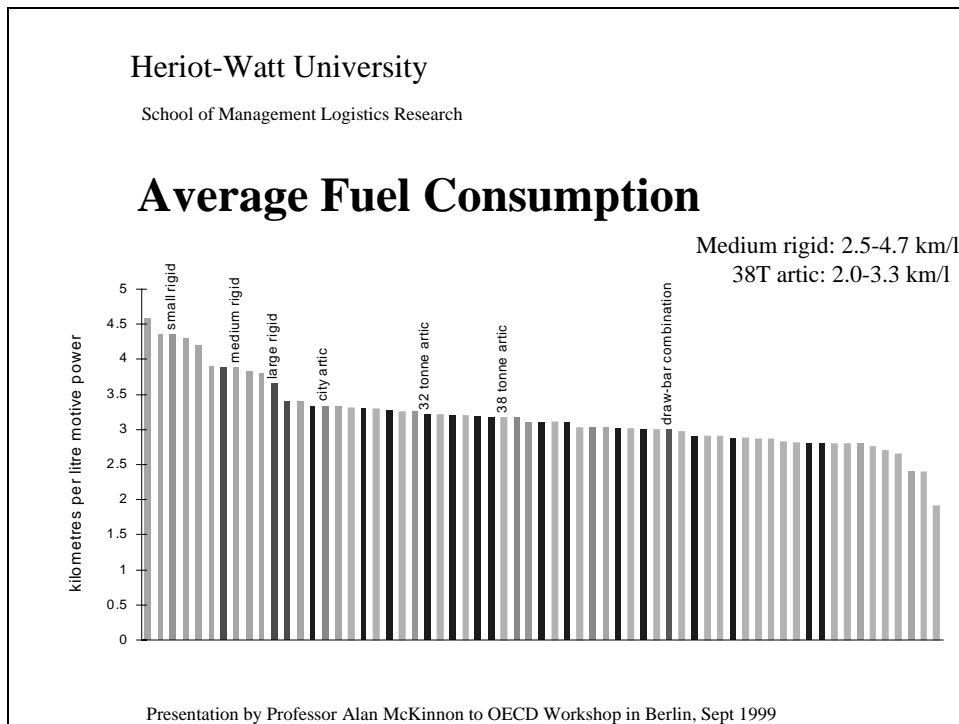
School of Management Logistics Research

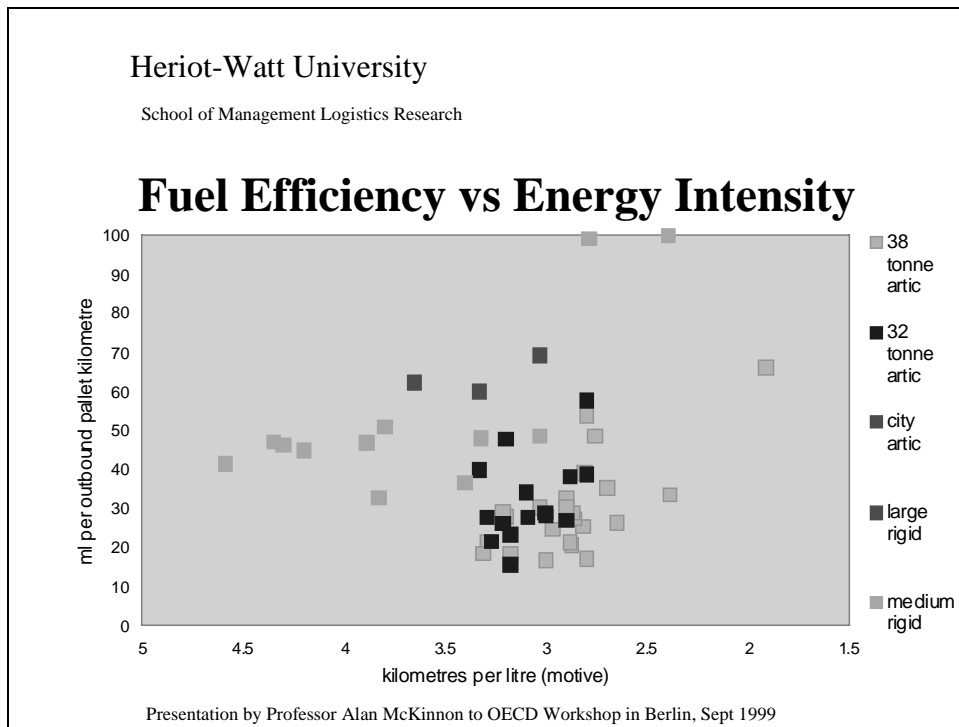
Capacity Utilisation by Fleet (% of Vehicle Kms)



Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999







Heriot-Watt University
School of Management Logistics Research

Potential Fuel Savings


		if fleets below mean performance achieve mean performance	if fleets below mean of top 1/3, achieve mean performance of top 1/3
motive fuel savings	<i>litres</i>	4,670,336	14,726,121
reduction on current level of fuel use	%	9	29
reduction in CO ₂ emissions	<i>tonnes</i>	12,423	39,171
cost saving per vehicle	£	2,255	7,109

Presentation by Professor Alan McKinnon to OECD Workshop in Berlin, Sept 1999

6. THE M.A.N. NATURAL GAS BUS PROJECT

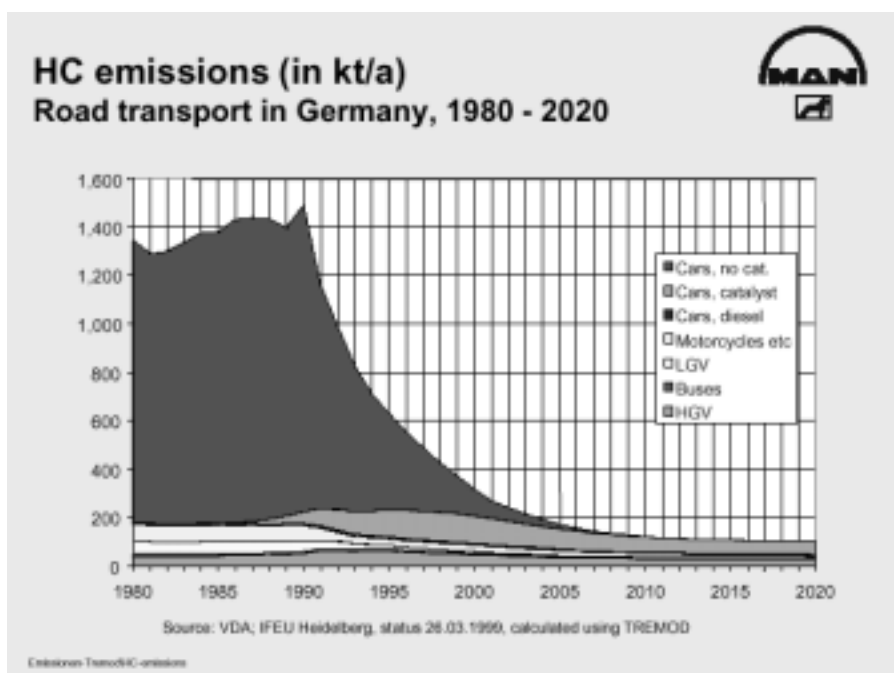
by K-V. Schaller, MAN Commercial Vehicles, München

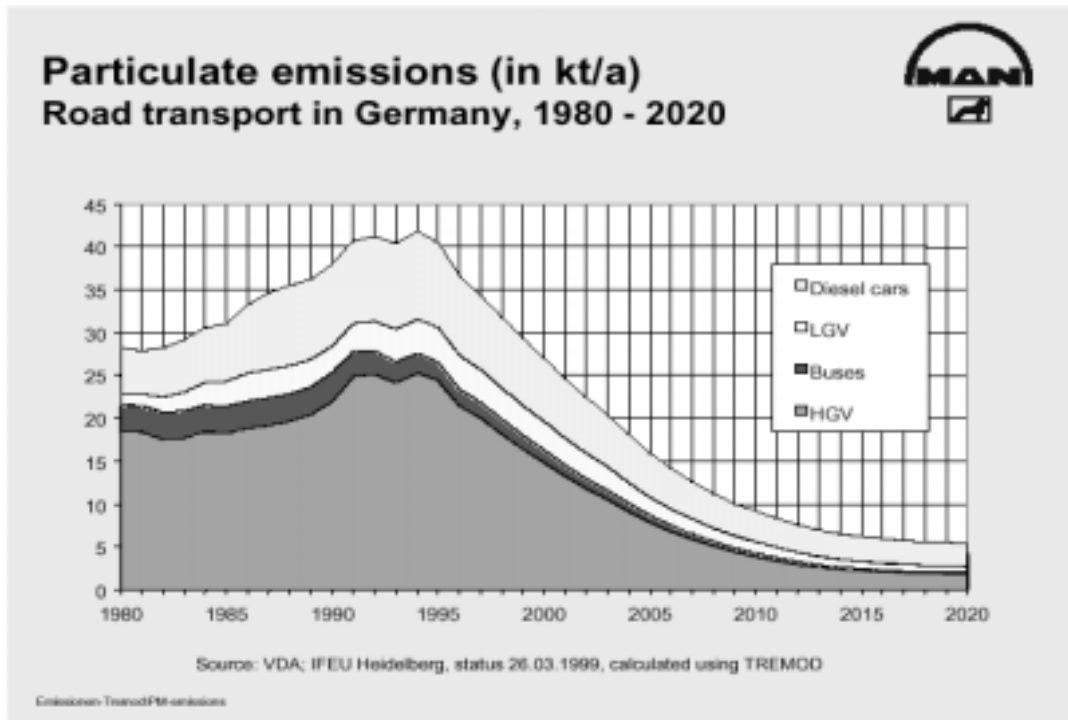
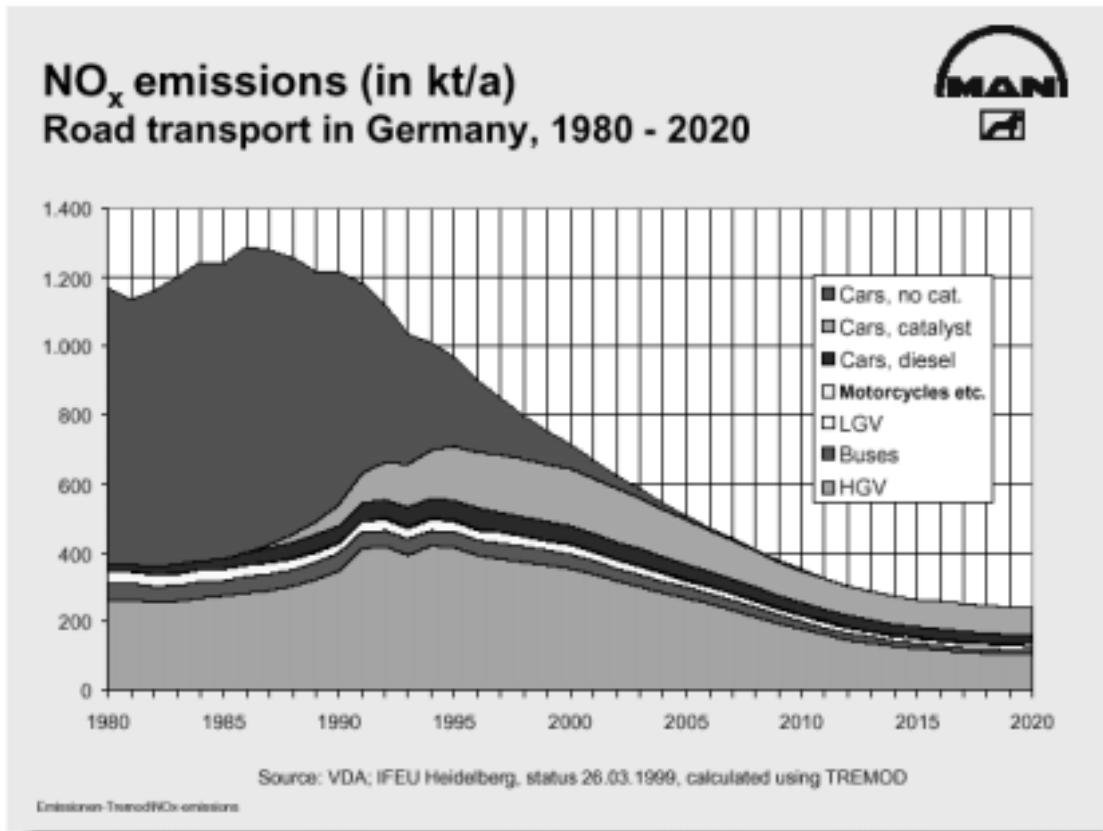
Statements of MAN for UBA/OECD -Conference 27./28.9. Berlin

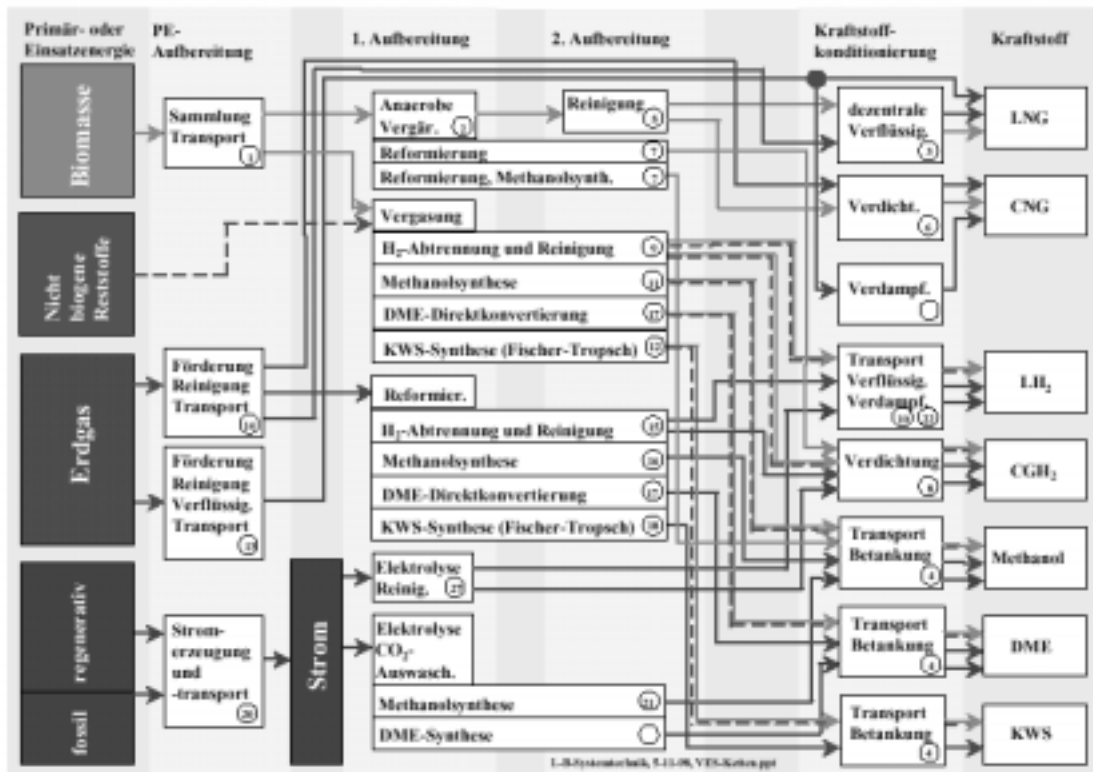


- The tailpipe emissions of commercial vehicles will dramatically reduce up to 2015 for the regulated components NO_x, HC, PM. This is due to exhaust gas treatment by catalytic converters and filters.
- Alternative fuels have specific advantages and disadvantages. The CO₂-emissions in well-to-wheel analysis still show advantages for diesel engines. Hybrid concepts can be combined with any alternative fuel.
- The reduction of CO₂-emissions is, beside vehicle and traffic technology, mainly a question of feedstock for the fuel. All fossile feedstocks show almost the same emissions.
- Hydrogen is an ideal energy carrier for non fossile energy. Fuel cells will be the future solution for propulsion after a co-existence with internal combustion engines.

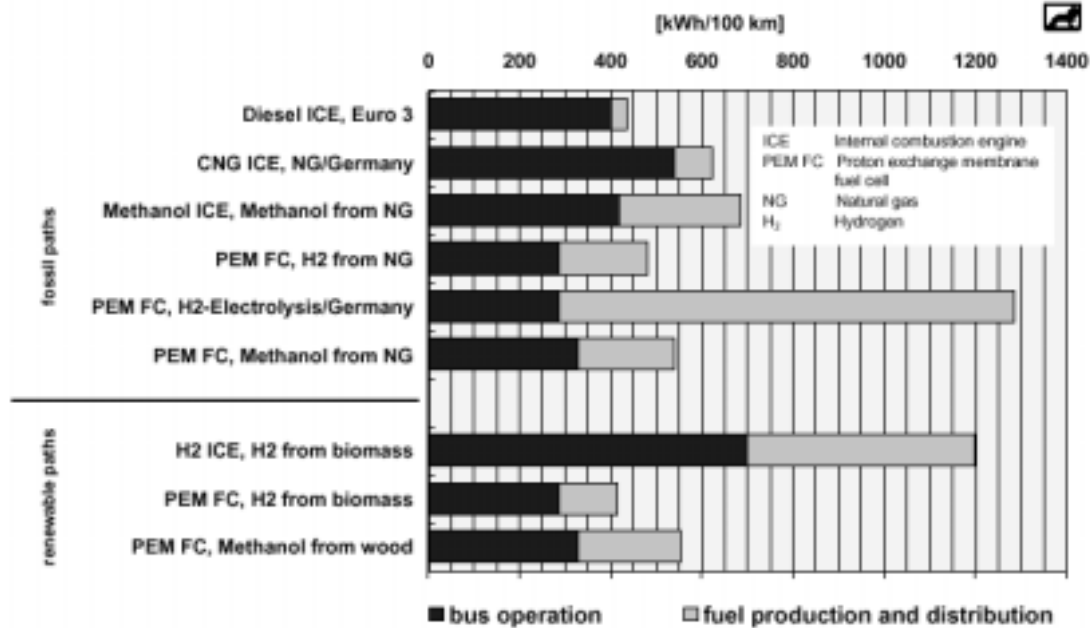
TVGdel 16.9.00



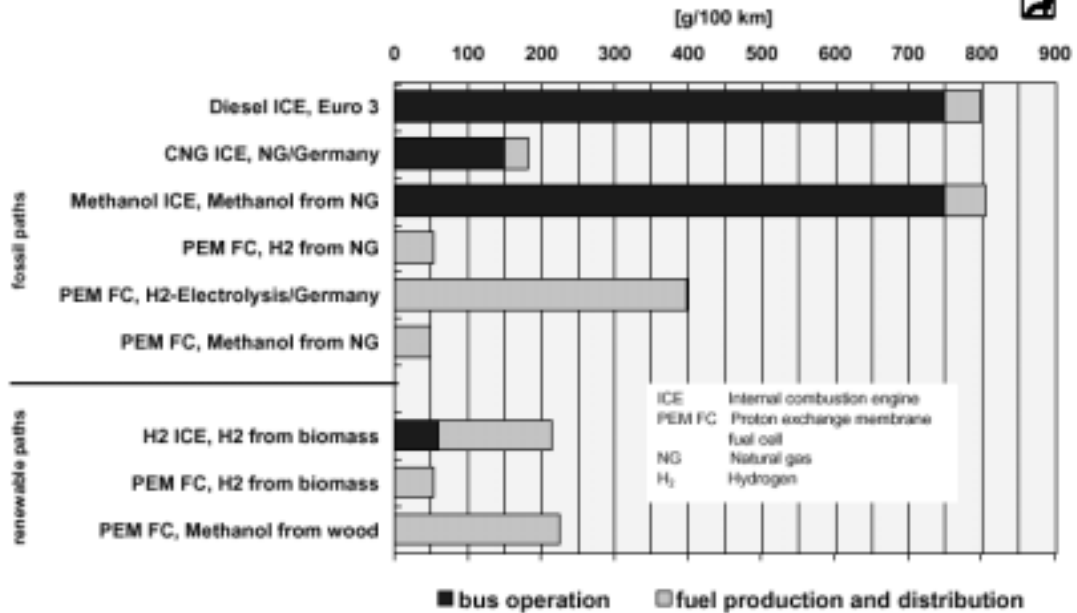




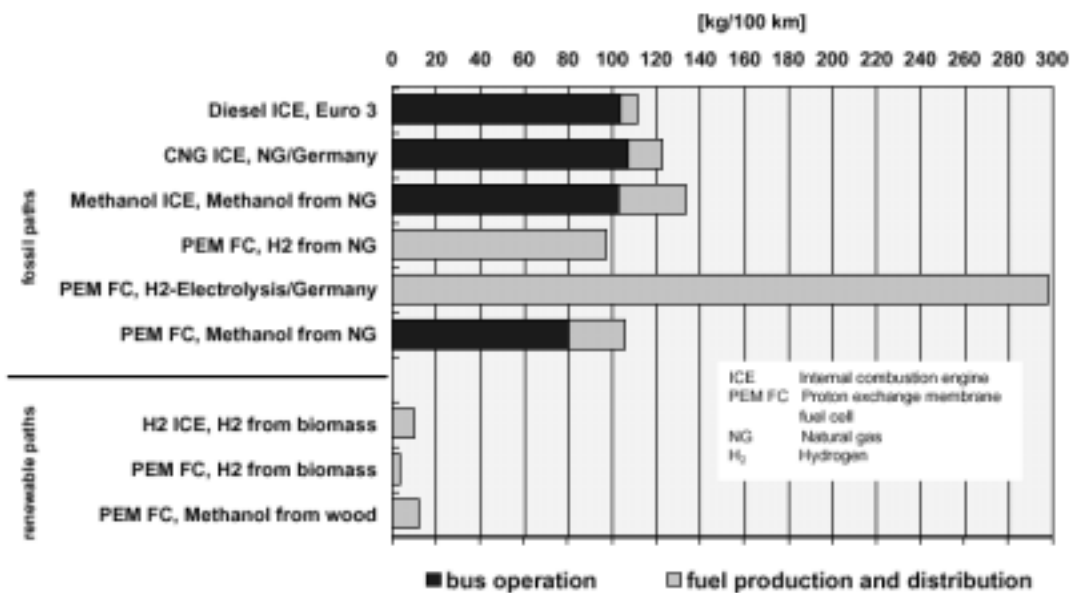
Energy consumption, city bus operation



NO_x emissions, city bus operation



CO₂ emissions, city bus operation



7. ECO-DRIVE™ IN SWITZERLAND – A SUCCESS STORY OF ENERGY 2000: IMPROVING FUEL EFFICIENCY IN ROAD TRANSPORT

by Ernst Reinhardt, Energy 2000

c/o ecoprocess, Zurich, Switzerland

Abstract

“Defensive”, foresightful driving (acceleration and braking), optimised gear shifting and judicious choice of speed are the elements of fuel efficient driving that can bring down fuel consumption by 5-15% on average.

Demonstrating and teaching drivers fuel-efficient driving practices not only results in lower fuel consumption but also reduces stress and accidents – usually with no penalty in terms of delivery time. The Swiss ‘Eco-driving’ scheme demonstrates the potential benefits of a broadly based and standardised programme of driver training and incentives.

Trained drivers usually save much more through fuel savings, reduced accidents etc., than their additional cost. Pay-back is most often less than one year.

In order to improve skills, it is important to win driver acceptance for efficient driving techniques and new technology.

Eco-Drive™ for an intelligent Mobility

- We are mobilising for a responsible mobility. Thanks to Eco-Drive™, the fuel consumption of a vehicle may be reduced by 10 to 20 percent – in keeping with the interests of the environment as well as with those of your purse. The new driving technique is easy to apply, saves energy and renders driving safer and less stressful.
- The Motor Fuels section of Energy 2000 is promoting Eco-Drive™ as an efficient and voluntary action for stabilising energy consumption and CO₂-emissions.

Figure 1

Overview Eco-Drive	Courses			Region			Participants		
			Numbers			Numbers			Number
VSZV: 21599 customers	Eco-Course:		8'621	g-CH:		21'089	Driving instructors:		2'062
TCS: 1963 customers	Simu-Course:		2'605	f-CH:		1'669	Fleet drivers:		7'212
ASTAG: 699 customers	Simu-Demo:		14'299	i-CH:		2'767	Private drivers:		15'713
POST: 1264 customers									
Total: 25525 customers since 1993 as of: 01.06.1999									
	g-CH			f-CH			i-CH		
9930 Courses in g-CH 856 Course in f-CH 440 Courses in i-CH	Eco-Course Courses No.	Simu-Course Courses No.	Simu-Demo Demo No.	Eco-Course Courses No.	imu-Courses Courses No.	Simu-Demo Demo No.	Eco-Courses Courses No.	imu-Courses Courses No.	Simu-Demo Demo No.
	7'718	2'212	11'159	463	393	813	440	-	2'327

Evaluation and Controlling

Effects on Air-Pollution

Eco-Drive™ reduces air-pollution considerably as scientific test have proven. Even under critical driving cycles , e.g. acceleration on flat terrain from full stop effects are important.

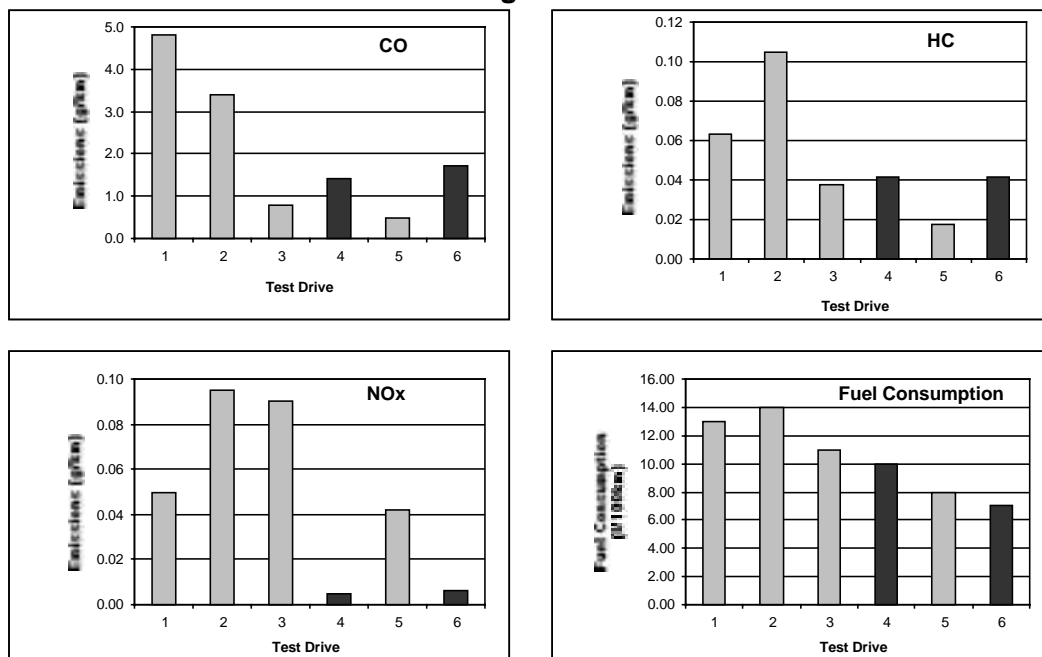
Results of a test, made by EMPA, the Swiss Federal Laboratories for Materials Testing and

Research, showing how much emissions Eco-Drive™ produces and how much fuel it consumes.

test-drive No 4: Eco-Drive™ with **average acceleration**

test-drive No 6: Eco-Drive™ with **low acceleration**.

Figure 2

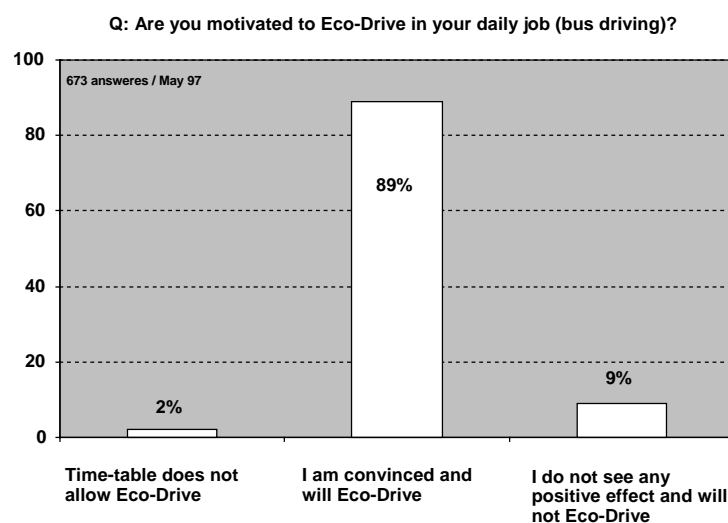


Company reports

More than 7 000 drivers of approx. 150 companies have been trained with the support of Energy 2000 since 1992. All are bound to deliver data on the effects if requested. Rather than to impose compulsory reporting, considering the consistency of effects reported we rely on a few cases. Canon Switzerland and a few more excel in providing their reports. The results are as under:

- fuel savings of > 6%
- cost savings > CHF 46'000 p.a.
- 35 % less accidents
- 22 % higher mileage per accident
- 28 % less Canon driver induced accidents
- less 50 % CO, less 31 % CH, less 23 % NOx
- image gains of the company
- driver motivation.

Figure 3

Eco-Drive: Motivation of drivers of VBZ Zurich**Heading for Quality*****Aims and Process***

Based upon a documented and controlled Quality Management System, the training centres, the training courses and teaching material shall be approved and “certified” by Energy 2000 and the Federal Commission for Road Safety and be eligible for subsidies.

Energy 2000 will establish a Quality Alliance for Eco-Drive™ to which all certified training institutions and interested parties could be members. The initiative is supported by the market leaders in the sector:

- Federal Commission for Road Safety
- Swiss Committee of the driving instructors
- Road Safety Training Centre Veltheim
- SWISS POST
- Swiss Army Transport Unit
- Touring Club Suisse
- Swiss Association of the truckers.

Legalising Eco-Drive

The respective bodies have accepted the integration of Eco-Drive™ Training into the compulsory young drivers training. The Swiss Department for Roads has thus incorporated the contribution of Eco-Drive™ to improve road safety in the catalogue of arguments of the on-going amendment of the Swiss Road Act.

Eco-Drive™ is behaviour– Behaviour is Culture

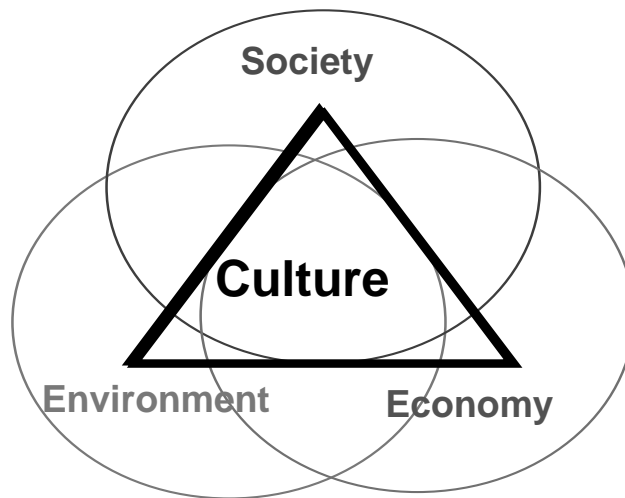
After 20 years of researching, piloting, debating on whether and how to do it, **we should just do it.**

Voluntarily, willingly, because it makes sense.

We should take the road to the customer. Often we can do without a deviation through politics.
It is a matter of instilling a sense of mobility culture in people.

Figure 4

Visions



Market Place

© Reinhardt

Energy 2000 transforms the vision of sustainable transport into the market place

8. MOBILITY CARSHARING SWITZERLAND: A CLEVER MOBILITY SERVICE IS SUCCESSFULLY BACKED BY THE NATIONAL ACTION PROGRAMME ENERGY 2000

by Peter Muheim, Project Leader Evaluation & Synthesis, and Ernst Reinhardt, Energy 2000, Head of the Transport Section / Motor fuels Section

Will be published on www.eltis.org

Summary

The birthplace of modern CarSharing is Switzerland where it has developed extremely successfully since 1987. The world market leader "Mobility CarSharing Switzerland" today provides over 1,200 vehicles in continuous interaction between heavy customer influx, perpetual expansion of range and professionalised services. The most up-to-date technology, CarSharing's extensive network and public transport are expressed in the "Mobility Rail Card", a contact-free chip card which is the country-wide key to "combined mobility".

Abstract

Modern CarSharing was born in Switzerland in 1987 from whence it quickly developed into an ever more customer-friendly and attractive mobility service. At present the world market leader "Mobility CarSharing Switzerland" offers decentralised car rental on an hourly basis in over 700 locations in more than 300 communes. Around 30,000 customers have 1,200 self-service mobility cars available round the clock. Reserve, drive, pay: that's how easy Mobility CarSharing is – a car on call! ¹

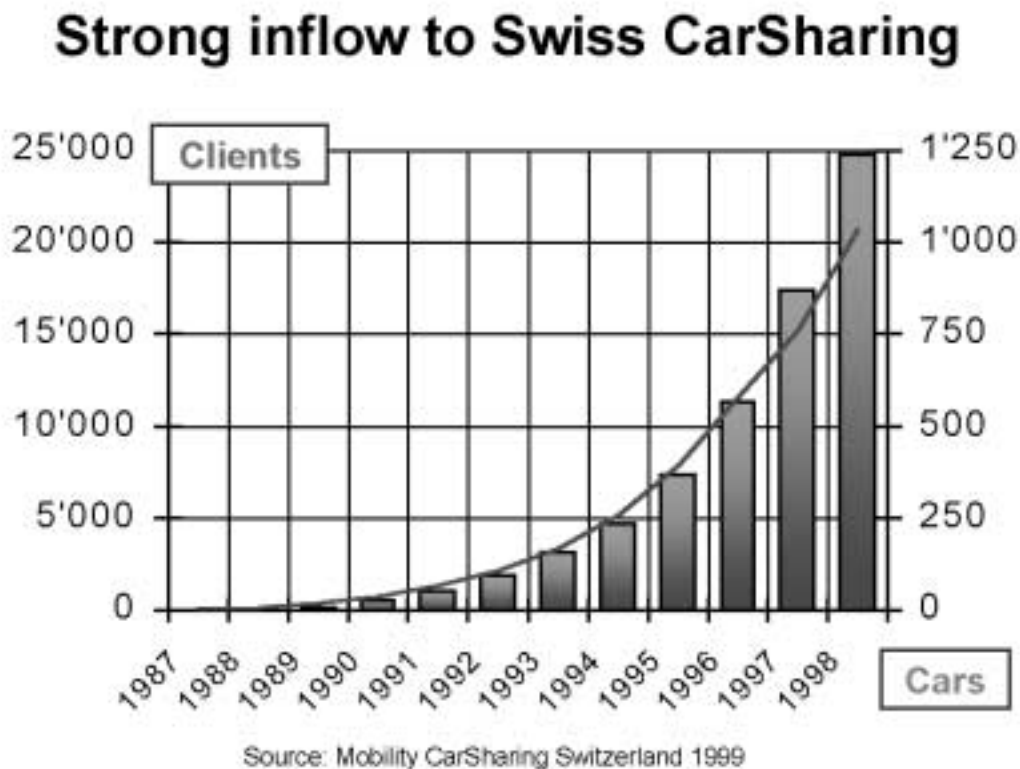
This clever mobility service has been supported by the Motor fuels Section of Energy 2000 since 1992. The projects partially financed have served for the professionalisation of offerers and demand. The customers adjust their choice of transport strongly to the environmental network: public transport is more frequently used and bicycles and going on foot also come into play. By contrast, car usage markedly declines. The energy saved by those giving up use of the car averages 57%.

Background Information

CarSharing – The object of the sponsorship

Organised CarSharing in its modern sense was founded twice in the year 1987: quite independently of one another the two successful firms CarSharing Co-operatives ATG (Central Switzerland) and ShareCom (Zurich) were founded in Switzerland. "Mobility CarSharing Switzerland", which emerged from these two pioneer associations in 1997, is with 30,000 customers and 1,200 cars (as at mid-1999) by far the largest supplier of CarSharing services world-wide. The characteristics of Swiss CarSharing are: strong customer growth, country-wide coverage, standardised and customer-oriented product range, simplest access to the vehicle fleet by means of the most modern communications technology.

Figure 1



Innovative mobility services are provided in close partnership with regional and national transport authorities, in that the facilities of the public transport system are combined with car-related services to the benefit of the customer. Collaboration between the Zurich public transport authority (VBZ) and the Europcar car rental service is provided with the product "züri mobil". At the national level "Mobility CarSharing Switzerland" co-operates with the Swiss Railways (SBB) and the Hertz car rental firm.

Figure 2: The car comes to the train

The "Mobility Rail Card 444", which was jointly launched in 1998 by the Swiss Railways (SBB), Energy 2000 and "Mobility CarSharing Switzerland", opens up for its purchasers, at a price of 444 Swiss francs, access for two years to public transport country-wide, at half price. Simultaneously it provides access to all CarSharing autos. Thus for the first time "Combined mobility" is offered country-wide.

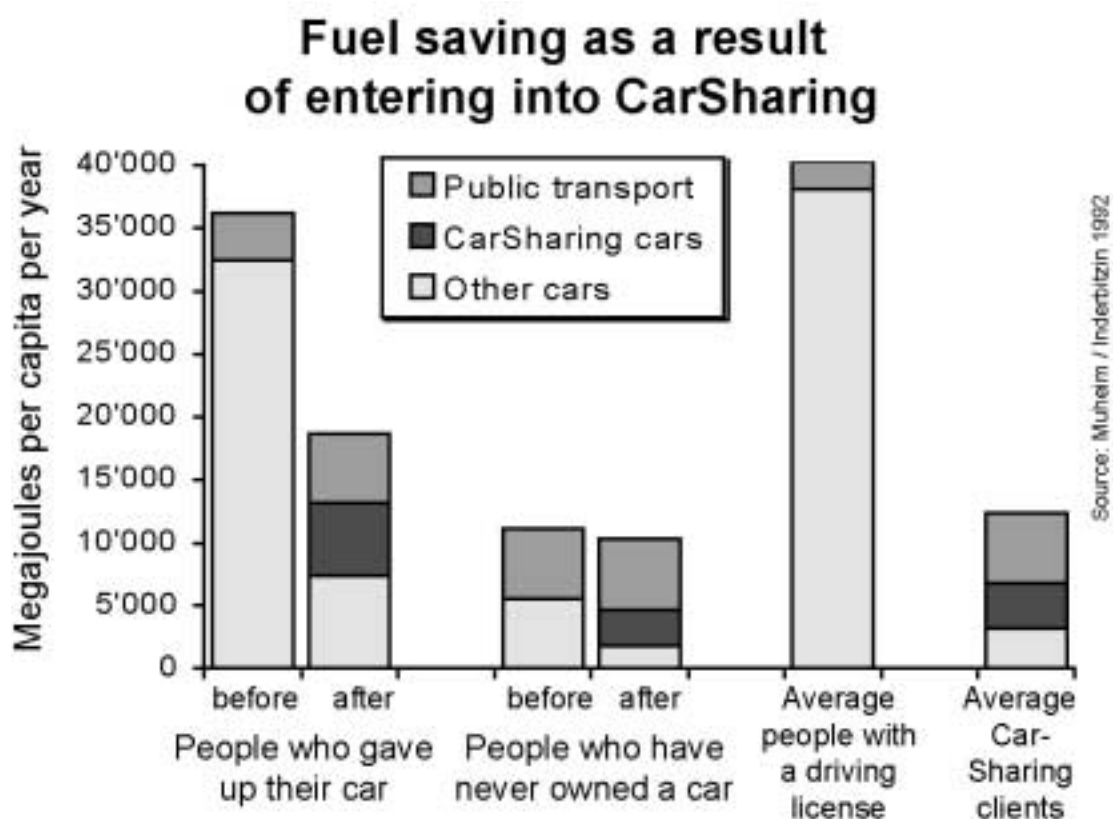
Figure 3: The rail subscription as a car key



Large individual saving of energy and a considerable customer potential

A study² made in 1992 was able to prove that on average CarSharing participants used 70% less energy in traffic than other adults. After giving up their own cars CarSharers save on average about half of their fuel consumption.

Figure 4



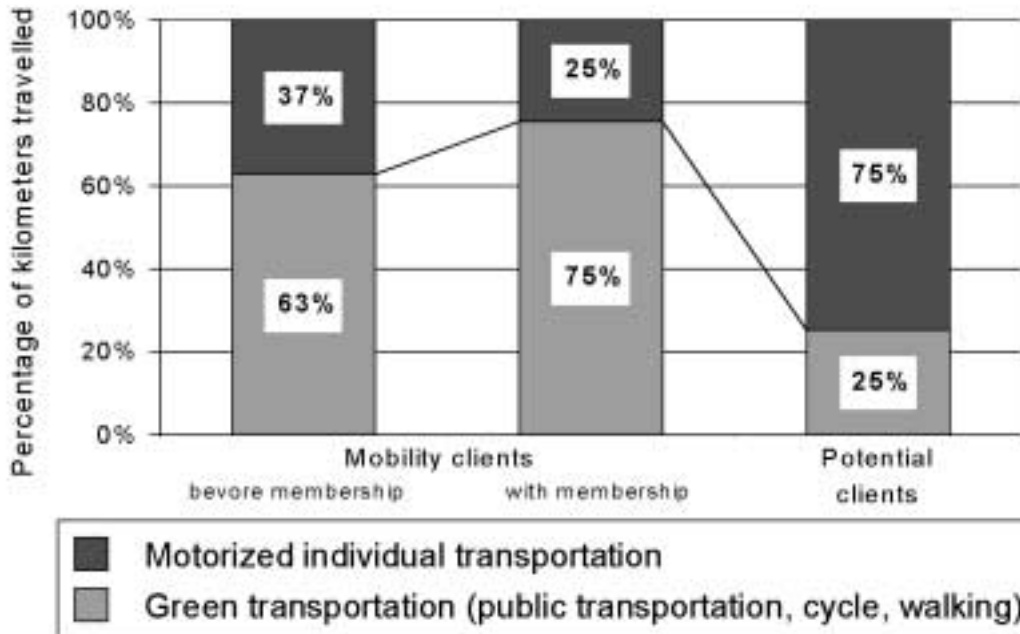
At the same time it was established that CarSharing in Switzerland represented a sensible alternative to the private car for about 600,000 drivers. In the evaluation carried out in 1997/98 the CarSharing development was completely and wholly confirmed not only for the individual effects but also for the customer potential. The large individual energy saving and the considerable customer potential make CarSharing an interesting object of support for the Energy 2000 action programme which has the aim of promoting rational energy use and the renewable energies.

Representative poll confirms positive effects of CarSharing

With CarSharing participation a strong transfer has taken place from individual motor vehicles to the transport means of the environmental network. The market share of public transport, bicycles and footpaths taken together has risen from 63 to 75 per cent. The exact reverse is true of the average driving-licence holder who covers three-quarters of his travelling requirement with individual motor vehicles.

Figure 5

Reciprocal mobility behaviour of the CarSharer



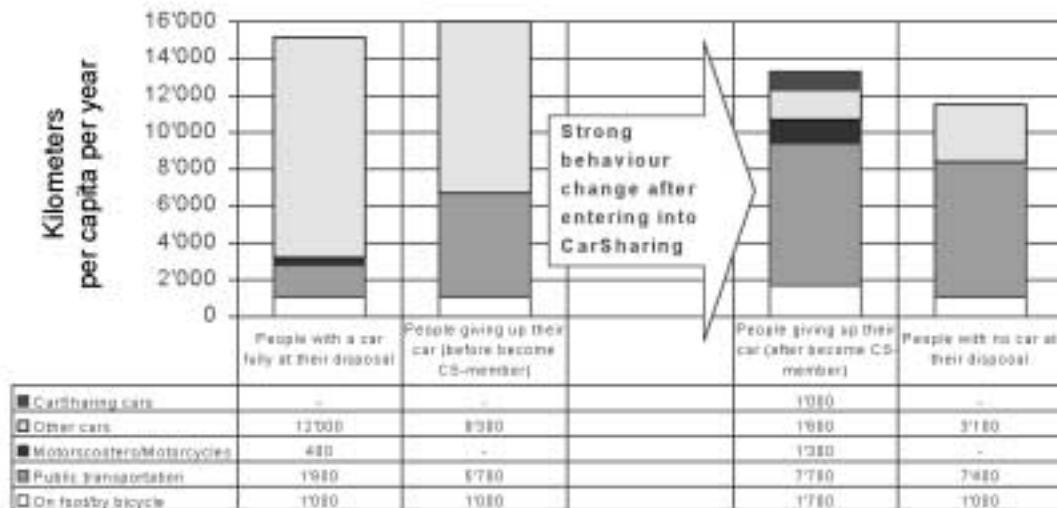
Source: Energie 2000 / Muheim 1998

Whoever as a result of CarSharing gives up his vehicle reduces enormously his car travelling, by 6,700 kilometres or 72 per cent in the year. This is partly compensated for by travelling more with motorised two-wheelers (+1,300 person/kilometres per year) , cycles (+800 pkm/a) and, above all, with public transport (+2,000 pkm/a). As a whole the annual travelling performance of those who give up their vehicles reduces by 2,700 kilometres.

The mobility behaviour of former owners of private cars on entering into CarSharing equates strongly with that of persons not having car availability. Therefore, whereas CarSharing customers and persons without a car facility are very similar in their mobility behaviour, very great differences arise when compared to persons with full car availability.

Figure 6

Strong behaviour change after entering into CarSharing



Source: Energie 2000 / Muheim 1998

For those not owning a car before entry or those who have used CarSharing as a second car the change in behaviour is only marginal. Those not owning cars, especially, replace the previous practice of borrowing a car from the circle of friends by the CarSharing vehicle. Customers with first car in own household often use CarSharing as a business vehicle.

The public transport gains the most from CarSharing

The public transport provides the mobility backbone of CarSharing customers. It is used by them for two-thirds of all distances. In this the increased demand does not fall on the commuting traffic but rather primarily on recreation and business journeys, which are predominantly undertaken outside the rush hours.

Each year the 30,000 mobility customers pay 35 million Swiss francs for public transport season tickets - about 3.9 million Swiss francs more than before their entry. With full exploitation of those interested CarSharing promises public transport alone more than 300 million Swiss francs additional income per year from the increased sale of season tickets.

CarSharing is also an innovative change agent. "züri mobil" not only won distinction in the Swiss Design Competition for service design but also an international award from UITP: „THE FIRST UITP SECRETARIAT GENERAL AWARD FOR INNOVATION IN PUBLIC TRANSPORT.“

Large market potential – large effect

In Switzerland the theoretical market potential for CarSharing amounts to 1.7 million persons (approx. 24% of the entire population). All those people who on the basis of objective criteria could operate CarSharing and benefit from it financially for the first time. According to an extrapolated representative poll carried out in the context of evaluation of CarSharing, more than 600,000 (approx. 9% of the entire population) of these 1.7 million persons are interested in it. In the event of the exploitation of the entire potential of those interested, the energy-saving potential of CarSharing would amount to 3,900 terajoules or 120 million litres of fuel per year.

Thus, according to Ernst Reinhardt, Head of the Motor fuels Section, CarSharing today is the most modern and quantitatively significant pillar of a very customer and environment-friendly, but also economic mobility. The combined mobility in the association of public transport, foot and cycle traffic with CarSharing is the best, most efficient and also best accepted contribution to sustainable and “green” transportation.

Objectives

In 1992 there existed in Switzerland two co-operatives, self-help and by tradition unpaid, which were much influenced by the ecological movement of the 80's, and which were somewhat surprised by their enormous success in growth. Thus in order to master the inflow of customers and also in the longer term to be able to address circles outside the ecology movement, the metamorphosis into customer-oriented services was unavoidable. It was precisely there that the action of CarSharing of the Motor fuels Section of Energy 2000 was applied.

Figure 7

Metamorphosis of CarSharing

	Type 1	Type 2
Self comprehension	Self-help	Service company
Aim	"sharing"	"be profitable"
Target group	Members	Clients
Development	Organic growth	Active marketing
Financing	Self-help	Business

Source: Energie 2000 / IPSO 1998

Energy 2000 set the following strategic goals: the organisation and services of CarSharing must be professionalised. Not only the companies but also their products offered must be adapted to the requirements of the market. An additional target was to intensify the stations network and market penetration in German-speaking Switzerland and the extension of CarSharing services to the French and Italian-speaking Switzerland. The name recognition of CarSharing was to be raised and the 50% annual growth of customers must be maintained throughout the promotional

phase. The exploitation of the system was to take place on a standardised basis nationally.

Implementation

Three packages could be differentiated in the CarSharing promotion undertaken between 1992 and 1997:

1. The "Action CarSharing", to support operations of the two suppliers ATG and ShareCom. These covered management development, development of regional stations, the development of EDP components, electronic reservation system and on-board computers.
2. Establishment of an autonomous CarSharing organisation in French-speaking Switzerland. To this end Energy 2000 met the costs of the person responsible for setting up CarSharing in French-speaking Switzerland.
3. Promotional activities in favour of CarSharing.

The contribution of Energy 2000 consisted of co-financing of the direct project cost to the tune of less than 30%. As a rule Energy 2000 does not finance cost of establishment or overheads. Moreover, a high proportion of own contribution was required of the task performer. At the operational level the Section was deliberately not involved. For the period from 1992 to 1997 the financial commitment of the Section was in the order of only 500,000 Swiss francs.

Evaluation

The principal aim, the professionalisation of the services offered in Swiss CarSharing, has clearly been achieved. Also in the period between 1992 and 1997 the number of car stations in German-speaking Switzerland was increased tenfold.

With CopAuto in French-speaking Switzerland an autonomous CarSharing organisation had been set up which, however, got into financial difficulties in 1996 and had to be taken over by ATG, one of the two suppliers in German-speaking Switzerland. Thus in the French and Italian-speaking parts of the country professional CarSharing is offered also. With this take-over of CopAuto the first CarSharing enterprise operating country-wide was created.

Figure 8: Country-wide station network of Mobility CarSharing Switzerland



According to a representative poll undertaken in the course of the evaluation in 1997/98, "CarSharing" or "AutoTeilen" are today terms which are recognised by 70% and could even be correctly described by 50% of those questioned. And not least, during the entire promotion phase it was possible to hold the customer growth at more than 50%.

Effective mechanism of support

In view of this considerable success it is interesting to discuss what part the government support played. The primary instrument of governmental promotion is financial contributions, therefore in this case the partial financing of practical projects. However, further effects are yielded from this and, moreover, other possibilities of influence open up for the promotional side, e.g. beyond the bounds of project control.

The CarSharing organisation stated that the sheer fact that a government programme, hence an official body had taken an interest in it, had motivated it and had wakened new demands and expectations. Also, an open attitude of the programme was assessed as very important: the receiver was able to determine himself the practical areas of the promotion. No operational interference happened. Errors were possible and triggered learning processes on the part of the promoters and the promoted. In this way in the course of time the support became more and more precisely targeted.

Admittedly, the Swiss German-speaking founder organisation would not have dared to make the jump themselves into the French-speaking part of the country, the associated risks would have seemed too great. Thus in the expansion of CarSharing into French-speaking Switzerland, even if the supplier originally initiated and financially encouraged by Energy 2000 did not succeed, the end result has clearly been the result of the promotion of Energy 2000.

Although only an indirect one, possibly the most important effect of the promotion lies in the legitimisation which the renowned governmental action programme Energy 2000 has given to the new idea. In that the Section head, as co-initiator of "züri mobil", has brought together CarSharing with the Zurich transport authority (VBZ) and Europcar, and has also opened up important doors into the mobility market for CarSharing. Together with the professional appearance of "Mobility CarSharing Switzerland" this formed the prerequisite for "Mobility Rail Card 444" launched jointly with the Swiss Railways (SBB), which opened up to its purchasers, on a single customer card and with preferential conditions, access to CarSharing and to the public transport country-wide, as a world premiere.

Conclusions

In its direct effect the promotion of CarSharing by the Motor fuels Section of Energy 2000 has partly triggered and partly accelerated professionalisation processes. It has created credibility for the clever idea of CarSharing and thus eased entry into combined mobility. This was possible because CarSharing corresponded to a market need and because its suppliers were also willing to adapt the service to the needs of the market. The learning and adaptation capability of the promoters and those promoted and the direct subscription of the promoter to the mobility market and its partners were critical for this successful example of governmental promotion.

Publications:

- 1 www.mobility.ch
- 2 Das Energiesparpotential des gemeinschaftlichen Gebrauchs von Motorfahrzeugen als Alternative zum Besitz eines eigenen Autos
Eine Untersuchung am Modell der ATG • AutoTeilet Genossenschaft.
Peter Muheim, Jürg Inderbitzin. Lucerne 1992.
- 3 CarSharing – der Schlüssel zur kombinierten Mobilität, Bern, September 1998. Publisher: Swiss Federal Office of Energy, Energy 2000. Order by: Eidg. Drucksachen- und Materialzentrale (EDMZ), CH-3000 Bern, Fax ++41 (0)31 992 00 23, www.admin.ch/edmz.
- 4 Synthese, Peter Muheim & Partner, Lucerne. EDMZ-order code 805.501.d, Summary of Synthesis, available in quadri-lingual version (English, German, French, Italian). EDMZ-order code: 805.505.
- 5 CarSharing im Urteil von Experten und Opinionleader Landert Farago Davatz & Partner, Zurich. EDMZ-order code 805.502.d
- 6 Evaluation der Unterstützung des CarSharing durch Energie 2000 IPSO Sozial-, Marketing- und Personalforschung, Dubendorf. EDMZ-order code 805.503.d
- 7 Mobility At Your Convenience / Mobilität wählen / Le choix de la mobilité!
This publications summarizes the main points of the Synthesis in a popular way, available in English, German and French. EDMZ-order codes: 805.504.eng (English), 805.504.d (German), 805.504.f (French).

9. CARSHARING – A HAMMER FOR SUSTAINABLE DEVELOPMENT

by Eric Britton, Ecoplan, Paris

Since there is often some confusion about this term, we need to make the point here at the outset that carsharing, the topic of this report and as it is increasingly used in countries around the world, is **not** "ride-sharing", nor "car pooling". Rather it refers to any of quite a wide variety of arrangements where otherwise unrelated groups of people get together or are otherwise able to access a common pool of cars. Think of it as a highly flexible and convenient form of short term car rental, or alternatively as a driverless taxi. That's about the level of service that they aspire to.

More than that though, carsharing turns out to be one of the best ways that we have thus far identified over the years which can help a city, a neighborhood, or a group of people in their move toward a real sustainable transportation system. Carsharing per se is not a self-contained all-purpose one-stop transportation system or service, an either/ or choice of the sort that most of us automatically think about when we here the words "public transport" or "private cars", but it is really part of a greater whole. Think of it for the moment as what may be the "missing link" is an alternative transportation system which until now has been a utopian dream for some, and an unthinkable non-starter for all of us who have cars and drive them with thinking, literally.

Here is the beauty of carsharing as you will now see it in these pages. It can be made to work in certain situations, it is cost effective, it doesn't cost a lot of public money, and you can start to do it tomorrow morning and in the process make your city and your own life more sustainable.

Are you less than sure about that? Well, perhaps you should read on.

Why Carsharing has not, cannot, and will never work!

Ask most people about "carsharing" and they will look at you with a blank expression. Fair enough. But one is patient. So then, if one can get them to sit still long enough, one explains to them carefully what it means and how it works. And then, almost 100% of the time one hears...

Sounds maybe interesting in principle, but it just can't work.

Or at least it can't work here.

Or... What a terrible, unworkable, crackpot socialist notion!

You have to understand: we (Americans, Germans, Italians, Mexicans... and here you place the nationality of our choice) love our cars and will never give them up.

Relative to all the use and satisfaction I get from it, my car is probably the best performing consumer durable in our family.

In our family each adult needs their own car, because that is the way we have our lives organized.

Because there is no way that any shared car is going to be convenient enough for me to have the easy access I need, when I need it.

I can't afford to be without a 100% guarantee of having a vehicle when I need it.

You see we need a big car like a station wagon and they are probably only going to have small cars or regular sedans.

While we, on the other hand, want to have a very small car that is easy to maneuver in the city, and it seems likely that they will offer only standard sized cars.

Because it's probably going to be a lot more expensive in the long run than owning my own car.

Because I simply can't abide the idea of having anyone else use my car.

How can you trust anybody with something as important as your own car?

How can anyone be proud of a rented car that is not their own?

Anyway, I am sure that they are going to be lousy cars.

+t just doesn't mesh with my life style, my values, and my public image.

Carsharing may be OK for certain marginal types, hippies, Greens and flower people, but it is and will never be a mainline way to live and get around.

Or... it may work in places like Switzerland and Germany where everyone is always so neat and respectful of property and equipment, but here...?

Anyway around here everybody lives and works in places that are so spread out, that there is no way that such a system could work

Because, given the way that people travel, all the cars will eventually end up in one place and so will not be available when and where people want them.

Because the vehicles will be subject to vandalism and mistreatment by people who really don't care about them.

Who'll keep the cars clean?

These schemes are probably uninsurable. At least not at rates that are going to provide competitive transportation.

If it's such a great idea, how come Hertz or Avis don't do it?¹

This is the harsh reality of the context that all those people and groups who have tried to make carsharing work in their towns and cities have had to deal with over these last decades. And if

¹ Did we forget anything? If we did, go to the @Carshare site at www.ecoplan.org/carshare/ and let us all know what we missed.

we list them here with a hint of an indulgent smile, the fact is nonetheless that these are legitimate concerns, that they are widely held, and anyone who wishes to make carsharing work is going to have to be able to deal with them. And, as you can well imagine, there have been plenty of setbacks as this or that project has failed to deal with these realities.

However, there is also a growing number of situations in which organizers are actually beginning to prove to the driving public that they can face and deal with these challenges. This is what the detailed report is all about, as presented in the special edition of the *Journal of World Transport Policy & Practice*, Vol. 5, No. 3, 1999.

Scope and purpose of the book

Advancing the Carsharing Agenda

“Carsharing”? To most of you who will take the time and trouble to work your way through these pages, this term probably already has some meaning.² And perhaps even a certain amount of credibility. However, if our goal here is, as indeed it is, not just to print yet one more wordy report, but to advance an important and useful concept so that people in many places actually begin to do more of it and do it well – all in the interest of decent personal economics, quality of life and sustainability -- then we must not lose sight of the fact that to most people in most places the idea of sharing ones car in some way is a strange and at first glance hardly appealing concept.

Thus, if we wish to advance the carshare agenda for whatever reason, we will do well to bear in mind that this is going to require not only tremendous technical proficiency in order to make these projects and demonstrations work in what is often quite a hostile environment. In addition, it is going to take some first class communications skills to help make it clear to the world why this concept of organizing ones daily life around a mobility arrangement other than the now dominant “own-car” model is not only something that can perhaps work in this or that special situation, but also that it is a concept which has close to universal applicability and, moreover, can be in our own strong personal interest.

The goal of the collection of papers that follows is precisely this: to render the concept of carsharing both more familiar and more credible. But there is more to it than just one more “expert report”. This special edition of The Journal of World Transport Policy & Practice is part of a broader collaborative process involving many people, places, projects and countries about which perhaps you need to know a bit. In fact the present document represents the second stage of a multi-step process which has already been engaged to these ends.

² Since there is often some confusion on this, kindly remember that carsharing as it is increasingly used in countries around the world is **not** “ride-sharing”, nor “car pooling”. Rather it refers to a variety of arrangements where otherwise unrelated groups of people get together or are otherwise able to access a common pool of cars. More than that though, carsharing is one of the best ways that we have thus far identified over the years to begin to move a city, a neighborhood, or a group of people toward a real sustainable transportation system. It can be made to work in certain situations, it is cost effective, it doesn’t cost a lot of public money, and you can start to do it tomorrow morning and in the process make your city and your own life more sustainable. Are you less than sure about that? Well, perhaps you should read on.

The Process Behind the Report

The first stage traces back to early 1997 at which time my colleagues and I were asked by an old friend, Robert Ayres of the Centre for the Management of Environment and Resources of INSEAD, if anything of any importance was going on under the label of “carsharing”. His immediate concern was in identifying new transportation concepts that might somehow help improve energy and resource efficiency in and around cities, and in the process to make substantial reductions in emissions and other negative environmental impacts.

Truth was that I was not able to give him a short answer to his question. As Ayres knew, my colleagues and I have in fact been keeping rough track of carshare developments around the world as part of an ongoing watching brief that we keep on unconventional transportation concepts, but carsharing is only one of several hundred concepts that we try to track and I had not really had a close critical look at the state of play for the better part of a decade. My initial off-the-cuff reaction was somewhat negative: the phenomenon of carsharing had been around for a long time but had always been a very marginal, personal sort of operation which depended above all on the personality and drive of the organizers. Almost all of the operations were small scale, and there was next to no interest in the part of most government and transport circles. On the other hand, there had been a bit of an upturn in both the number and the kinds of new operations in the last few years, so I suggested that we should have a closer look, just to be sure.

To accomplish this we went to work and created a public World Wide Web site under The Commons (a structure that we had set up for just this sort of purpose back in 1994) which would in effect ask this question in public. And then try to answer it via a collective “knowledge building” effort ... and that too in public. Once we had the Web site up and working reasonably well, we contacted several dozen people and groups around the world whom we know to be working in or knowledgeable about this area of transportation innovation, and invited them to come into the Web site to share with whoever might be interested all the materials and insights that this group problem solving exercise might yield. We called the overall cooperative program, the CarShare Consortium, and the site was called “@Carsharing on the Web”, which you can visit today at www.ecoplan.org/carshare/.

@Carsharing describes itself as:

A free, cooperative international information sharing and communications program in support of carsharing projects and programs, world wide. Why are we supporting a concept that may to some appear to be so off-beat and marginal as carsharing? Simple! We think it's a great, sustainable, practical transportation idea whose time has come and whose potential impact stretches far beyond what one might at first suppose.

To make a long story short, the Web site led to an ongoing exchange of information and ideas, which over the last two years has eventually created a forum of about five hundred people and groups, of whom roughly a third have also registered as members of the CarShare Consortium. The first “print” product of this sharing effort appeared in the closing months of 1998, a 200 page cut-and-paste report entitled The Commons Carshare Casebook: Carsharing '99, Present Status, Future Prospects.³

³ The Carshare Casebook was immediately posted on the @Carshare Web site and made freely available to anyone who might be interested. It is freely available at <http://www.ecoplan.org/carshare/>.

Another Kind of Sharing

The Carshare Casebook was widely distributed and in turn set off discussions of the possibility of a joint project between The Commons and The Journal of World Transport Policy & Practice, and eventually others who might wish to come in and add their support to this common public undertaking, to create a balanced and informed overview of carsharing experience and prospects, together with a certain number of what we all thought to be key recommendations. The idea – of which you have the tangible proof in the pages that follow – was to take a sharing approach, much like carsharing at its best, and apply it to the task at hand.

This report has thus been prepared with the help of a spread-out international team of several dozen people on the spot who are best placed to report accurately to the world on what has been achieved thus far in the early work in developing this new concept in a number of leading edge situations, and some of the things that have been learned in the process. It was our hope to that by bringing together these carefully screened hands-on reports of experience, and by creating a means for those at the front of the movement to exchange information and ideas, that we might perhaps also be able to identify a certain number of things that might be usefully done next in order to create more and better carsharing operations. I will leave it to you to read these pages and see for yourself if we have achieved this ambitious objective.

This special edition is not only a cooperative effort involving more than two dozen authors and collaborators from a dozen countries, but also is being supported by two agencies who have come to agree with us that carsharing is a terrific idea whose time has come. The Environment Directorate of the OECD has long been interested in identifying new transportation concepts that can help move people and cities in more sustainable ways and has come in to support this project in several ways. You will find more on this in their introductory note to the report.

Likewise the German Federal Environmental Agency (Abteilung Verkehr und Lärm) has also joined in and is supporting this project in several ways. First, along with the OECD team they have organized a special carsharing session which will use, consider, and comment on this report as part of an international workshop on sustainable transportation innovations which takes place in Berlin from 27-29 September 1999. Also they have been so kind as to help by printing and distributing the present edition.

Furthermore, the OECD/UBA workshop is providing an opportunity to bring together a number of the authors who have contributed to this report. It is our hope that a number of useful things will result from giving them a chance to share some physical space as well as the virtual world that we have commonly occupied and worked with over the last six months of hard work that it has take to get this report out. ⁴

In closing, it is perhaps worth mentioning two aspects of this effort which may not be immediately self evident. The first is that it has been entirely prepared by “distance group work” means, using a combination of email and our dedicated World Wide Web site, both to bring together the basic materials but also to expose them to a process of peer review and comment prior to actual publication. Over all these months of work and interaction, none of us ever were in the same room or even city.

⁴ Extensive materials and follow-up reports on that workshop will be found on both the OECD site at www.oecd.org/env/trans and of course that of the CarShare Consortium at www.ecoplan.org/carshare/

The second is that everyone who has worked on this has done so on a volunteer basis. Each author and reviewer has contributed here in order to advance or shared agenda, and no one has had to be paid money in order to do their part. They have all pitched in just because they thought it was the right thin to do. And is not this too a move to sustainability?

But now that you know the story behind this report, let's turn the page and see what there is to learn about carsharing, its accomplishments, its limitations, and its possibilities, if any.

10. BLUE ANGEL LABEL FOR CARSHARING

- BASIC CRITERIA FOR THE AWARD OF THE ENVIRONMENTAL LABEL¹-
by Federal Environmental Agency, Germany

[Carsharing Environmental Label]



[because of Environmentally Friendly Mobility Service]

1 Preliminary Remarks:

1.1 In co-operation with the Federal Minister for the Environment, Nature Conservation and Nuclear Safety, the Federal Environmental Agency and considering the results of the expert hearings conducted by RAL, the Environmental Label Jury has set up these Basic Criteria for the Award of the Environmental Label.

RAL, reg. assoc., has been entrusted with the award of the Environmental Label. Upon application to RAL and on the basis of a Contract on the Use of the Environmental Label to be concluded with RAL the permission to use the Environmental Label may be granted for all products. provided that they comply with the requirements as specified hereinafter.

1.2 Car Sharing helps to reduce the number of vehicles required and eases the burden on public traffic space -a major concern for cities. According to studies, each car offered for car sharing may, depending on the local conditions, replace 5-8 vehicles which can either be parted with or need not be bought at all.

¹ Edition: June 1999 Price category: 1a

By offering the chance to change the means of transport mobility-enhancing car sharing services can do a lot to ease traffic's burden on the environment, especially by the use of environmentally acceptable vehicles distinguishing themselves by lower fuel consumption. Thanks to the fact that car sharing agencies usually offer state-of-the-art vehicles pollutant emission can be reduced.

Car sharing agencies usually have a pool of different vehicle categories from which the participating customer may choose. Participants in a car sharing service usually can use the vehicles for periods of their choice following a corresponding notice and booking. Taking the participants' wishes into account the vehicles should be kept close to the place of residence in more suburban areas. The costs to be paid by the participants in a car sharing service will -in addition to a monthly basic fee -depend on the period of use and the kilometres driven during that period.

Car sharing agencies being awarded the Environmental Label accept their responsibility for the environment also by meeting the technical requirements for vehicles. Their cars distinguish themselves above all by the lowest possible waste-gas and noise emissions and the lowest possible fuel consumption (and hence the lowest possible CO₂-emission) in their respective category. Formation of rate categories according to size and engine of the vehicle serve as a financial incentive for the participants to use smaller and low-consumption cars.

Car sharing agencies entitled to use the Environmental Label could be conceded privileges by the communities, for example, by establishing car sharing stations on public roads. These would make environmentally acceptable car sharing even more attractive and at the same time help to ease the burden on parking space.

Car sharing is a useful complement to public transport and other mobility services (taxi, rental car, etc.). Co-operation between the car sharing services and with other mobility services (e.g. by common tickets, attractive rates, sales and booking co-operation, co-ordination of the areas covered by the individual services) could produce considerable synergy effects.

Target groups for car sharing are singles, families, carpools, public administration as well as private and public enterprises.

2 Scope

These Basic Criteria apply to car sharing agencies offering organized car sharing as a service.

3 Requirements

The Environmental Label shown on page 1 may be used for marking car sharing agencies under para. 2 provided that they fulfil the following requirements.

3.1 Car sharing agencies under paragraph 2 must give a permit to each participating person. This shall not affect a check of the driver's driving experience as well as a solvency standing test according to their business terms.

3.2 Car sharing agencies shall have at least 10 participants per vehicle.

3.3 Car sharing agencies shall give their participants following minimum guarantees: -24h-car booking, 24h-car receipt and 24h-car return.

- Short-time use for one hour or more must be possible. The rate per hour must not be more than 15% of the daily rate.
- Charging on the basis of time and kilometrage. Free kilometrage shall be inadmissible. At least the running costs per km must be charged.
- Regular care and maintenance of the vehicles in accordance with the manufacturer's recommendations.

3.4 The vehicles made available by the car sharing agencies must comply with all legal requirements for road traffic safety and operational safety.

3.4.1 Car Sharing Fleet

Upon application for the Environmental Label the vehicles of a car sharing agency must at least observe the EURO II limits for passenger cars and those of Directive 96/69/EC for light commercial vehicles.

The agencies must see to it that all passenger cars and light commercial vehicles of the fleet belonging to the M1 and N1 classes also comply with the following requirements two years after signing the Contract on the Use of the Environmental Label at the latest:

3.4.2 New Vehicles

3.4.2.1 Passenger Cars and Light Commercial Cars of Class I

All passenger cars and light commercial cars belonging to the M1 or N1 class bought by the car sharing agencies following the award of the Environmental Label must comply with the requirements listed in the following table. The additional criteria listed below shall make decisions on offers otherwise looking identical easier.

Requirements		
Average CO2 emission of the Car Sharing Fleet (according to RL 93/116/EEC)		165 g/km
Registration according to Directive 98/69/EC, para. 5.3.1.4 Table Line B (2005) M, Column: Gasoline'	Pollutants CO HC NOx	Limits 1.0 g/km 0.1 g/km 0.08 g/km
Average Noise Emission (Driving Noise-Type Approval Value) maximum		71 dB (A)

By December 31,2002, new Diesel-engine vehicles must observe the exhaust-gas limits according to EURO III.

3.4.2.2 Noise of the Tires

When buying a vehicle care should be taken that is equipped with approved original equipment tires not exceeding an average noise emission of 71 dB(A) or, by way of substitution, with tires according to RAL-UZ 89.

The applicant undertakes to display the Environmental Label only in connection with the logo of the car sharing agency at the stations, on publications, advertising material (for the mobility services) and on the vehicles.

Observation of the following additional criteria is recommended:

- Recycling concept (recycling potential) with a minimum recycling share of 85%, - Environmentally acceptable use of materials during the production of the vehicle, -An "eco-audit" is performed by the manufacturer.

4. Compliance Verifications

4.1 The applicant shall declare compliance with the requirements under paragraph 3 as a whole. To prove compliance with the requirements under para. 3.4, the applicant shall additionally present a list of all cars (fleets of more than 10 cars may be presented on electronic data media) indicating manufacturer, car type, date of acquisition as well as the respective carbon-dioxide emission values, exhaust-gas approval standards and noise values (driving noise type approval value) and send copies of the relevant vehicle title or certificate of registration, respectively.

4.2 The applicant shall prove compliance with the requirements under paras. 3.1, 3.3 and 3.5 by presenting the terms of contract, rates and the logo.

4.3 Data regarding participants and the number of vehicles as per December 31 of each year shall be submitted by April 30 of the following year.

To prove compliance with the requirements under para. 3.4 the applicant shall present the list mentioned under para. 4.1 and updated with regard to new purchases along with the vehicle titles or certificates of registration of these new purchases.

4.4 The applicant shall take notice of the additional criteria and present corresponding papers. Information on these additional criteria can be seen from the list published by the VCD (Verkehrsclub Deutschlands e. V.), as amended.

5 Applicants and the Parties Involved

5.1 Car sharing agencies shall be eligible for application.

5.2 The following parties are involved in the award procedure:

RAL, Umweltbundesamt [Federal Environmental Agency] and the federal state where the place of business is located that manufactures the products to be marked with the Environmental Label.

6 Use of the Environmental Label

6.1 The terms governing applicant's use of the Environmental Label are stipulated by a Contract on the Use of the Environmental Label to be concluded with RAL.

6.2 Within the scope of such contract the applicant undertakes to comply with the requirements under paragraph 3 as long as he makes use of the Environmental Label.

6.3 For the marking of products according to para. 2 Contracts on the Use of the Environmental Label are concluded.. These contracts run until December 31,2002.

They shall be extended by periods of one year each, unless the contract is terminated in writing by March 31, 2002 or by March 31 of the respective year of extension.

After the expiry of the contract the Environmental Label may neither be used for labelling nor for advertising purposes. This regulation shall not affect products being still in the market.

6.4 The Contract on the Use of the Environmental Label shall give the following particulars:

6.4.1 Applicant.

Annex 1 to the contract pursuant to RAL-UZ 100

APPLICATION FORM

Environmental Label for Car Sharing

Car Sharing Agency (Applicant)

Applicant's Statement:

It is hereby stated that:

every person will be allowed to participate (this does not affect a check of the driver's driving experience as well as a solvency standing test according to the business terms),

there are 10 participants per car,

cars can be booked, received or returned around the clock (24-h service),

cars can be used for short periods of 1 hour or more and the rate per hour is not more than 15% of the daily rate,

charging is done on the basis of time and kilometrage (free kilometrage is inadmissible). At least the running costs per km are charged.

regular care and maintenance work will be performed in accordance with the manufacturer's recommendations,

the cars made available by the car sharing agencies comply with all legal requirements for road traffic safety and operational safety,

two years after the signing of a Contract on the Use of the Environmental Label at the latest compliance with para. 3.4.2.1 is verified for all passenger cars and light commercial vehicles of the fleet belonging to the classes M1 and N1,

when purchasing a vehicle it is seen to it that it is equipped with approved original equipment tires not exceeding an average noise emission of 71 dB(A) or, by way of substitution, with tires according to RAL-UZ 89,

the Environmental Label will be displayed only in connection with the logo of the car sharing agency at the stations, on publications, advertising material (for the mobility services) and on the vehicles,

the recommendations with regard to the following criteria will be taken into consideration:

recycling concept (recycling potential) with a minimum recycling share of 85%. - environmentally acceptable use of materials during the production of the vehicle

an "eco-audit" is performed by the manufacturer,

data regarding participants and the number of vehicles (as per December 31 of the preceding year) and new purchases, including vehicle titles/certificates of registration will be presented by April 30 of each year.

Annexes

Vehicle title or certificate of registration, including a list of all vehicles together with the data according to para. 4.1

Contract terms, rates, copy of the logo according to para. 4.2

Documents according to para. 4.4

The Bundesamt für Wehrtechnik und Beschaffung (Federal Office for Defence Technology and Procurement) has registered the system under Supply Reg. No.....²)

Place:

Applicant:

Date:

(signature by authorised representative and corporate seal)

² Products equipped with a Supply Reg.No. are reported by the Federal Environmental Agency to the Bundesmaterialkatalogisierungszentrale (Central Federal Office for Material Registration). Its information system kept for various procurement offices of the Federal Government lists these products with a special mark indicating that they have been awarded the Environmental Label. The Environmental Label has no influence on the issuance of a Supply Reg. No.

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